



PROCEEDINGS

of the

International Conference on Inventive Computing Systems and Applications (ICICSA 2018)

January 29-30, 2018

Organized by

Inventive Research Organization

Venue: Hotel Ibis, Pattaya, Thailand.



ICICSA 2018

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Universal Vehicle Identification and Classification System (UVICS) Using Image Processing

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Abstract

In this new era, the use of vehicles has become very important for human prosperity and development. However, the use of vehicles in various crimes, kidnapping, terrorist activities also have become an unwanted evil for the humanity. The use of vehicle in suicide bombing, vehicle ramming on innocents by the psychopaths and terrorists has been increased drastically. Therefore, there is an urgent requirement of a reliable system that can track and further neutralize the attempt of the vehicles ramming onto the crowd, important building like schools, universities, banks, government institutions and high security zones like military establishments. Thus, we have devised a very simple mechanism to identify and classify the vehicles entering or leaving into any establishments as authenticated military and civil vehicles. Our proposed research basically uses the simple image processing method to detect vehicle number plate from a live video captured by a camera installed at the entrance of such buildings or restricted zones. This research could also provide a great assistance to identify the authenticity of a civil vehicle from the database of state or country traffic department.

Keywords: License Plate Recognition, Character Segmentation, Template Matching, Military and Non-Military Vehicle Categorization

1. Introduction

Modern technology has blessed us with many new inventions and one of the most promising inventions is the license plate recognition system by digital image processing. A license plate is used for uniquely identifying a vehicle [1]. In recent years, security has become a major issue worldwide. Vehicle ramming, suicide bombing attacks, terrorist attacks and other illegal activities have become a daily scenario. According to [14], a license plate recognition (LPR) system plays an important role in numerous applications, such as parking accounting systems, traffic law enforcement, road monitoring and security systems. Priti Rajvanshi [13] mentioned that Automated Number Plate Recognition System would greatly enhance the ability of police to detect criminal activity that involves the use of motor vehicles. Thus recognizing license plate can be a vital key to ensure proper security of vehicles, to prevent unauthorized vehicle entry in restricted areas, to identify the traffic rule breakers as well as reduce crimes.

The Azor attack by Palestinian terrorists in 2001 was considered to be the earliest ramming attacks and a new militant tactic which proved to be more difficult to prevent than suicide bombings [15]. Many similar incidents took place such as the Jerusalem truck attack, Edmonton Attack and the Barcelona attack in which a 22 year old drove a van over pedestrians killing 13 people and injuring 130 people. That is why vehicle identification has become a necessity. The proposed system takes an image as an input, converts color image to grayscale image, binarizes the image and applies Unwanted Line Elimination Algorithm (ULEA) to remove noise and enhance the binarized image. Binarization is performed mainly to highlight characters and to suppress background [2]. Then it separates the vehicle from the background through Vertical Edge Detection Algorithm (VEDA), and afterwards it applies Highlight Desired Details (HDD) to highlight license plate, Candidate Region Extraction (CRE) and finally applies Plate Region Selection (PRS) to extract the actual region of interest.

Various countries use various formats in categorizing civil and military vehicles, for example Bangladesh uses an arrow at the beginning and Bengali numerals after that to identify a military vehicle and Bengali alphabets followed by Bengali numerals for civil vehicles. India and Pakistan use special symbols at the beginning of the number plate of their military vehicles and English alphabets and numerals for civil vehicles, Thailand uses a special symbol followed by four to five Thai numerals for military vehicles and Thai civil vehicles use Thai alphabets followed by English numerals [16]. Thus the level of complexity of license plate recognition system is different worldwide [1]. The main purpose of Universal Vehicle Identification and Classification System (UVICS) is not only to identify license plate to prevent terrorism but also to find a common way through which military and non-military vehicles of various South Asian countries such as Bangladesh, India, Pakistan, Thailand can be categorized.

We organize the rest of our paper as follows. A brief description of related work is given in section 2. The proposed method is given in section 3, in section 4 we have shown the experimental data and results. Finally, section 5 concludes the paper.

2. Related Works

There are many researches done in the field of license plate recognition system using image processing. This section briefly mentions some of the related studies in order to provide a clear concept of how the system actually works. The great impact of license plate recognition and vehicle classification has been discussed by various studies. In 2001, Remus Brad [12] discussed about the endless possibilities that lies in this field. He mentioned that this technology has a wide range of application starting from parking management, traffic control as well as public security. According to Nikolaos and Ioannis [3] extraction, segmentation and recognition of characters are three main steps of any license plate recognition algorithm. They mentioned these tasks to be very challenging as various vehicles have various license plate formats. These tasks become more complex when license plate images are from various angles and the images consist of noise. Thus they suggested that an accurate and fast processing system is required. [4] used three techniques which are morphological operation, histogram manipulation and edge detection. All these three techniques help in license plate localization and segmentation of characters. In this paper they used Artificial Neural Network for recognizing and classifying the characters. The limitation of this paper is that it works with standard Egyptian license plates only.

Robert F.K and Surendra Gupte [5] used segmentation, region tracking, vehicle identification, vehicle tracking and vehicle classification. Region is tracked by observing multiple images of the vehicle. Various parameters like height, width, length are obtained by applying 2D projection. [6] and [7] followed the similar approach like [4]. The first paper modified the morphological operation by modification of Hough Transformation. They used feed-forward back propagation Artificial Neural Network. The second paper printed the extracted characters in a text file with the help of MATLAB. They also proposed an algorithm for Parking Management System besides the license plate recognition. Ragini and Bijender [8] used Sobel Edge Detection and Morphological operation. They used bounding box method for segmentation. The paper [9] developed algorithm for vehicle color detection and trademark (logo). They did color classification using fuzzy sets and morphological operation was used for logo segmentation. The results for correct color classification for this system are just 32.71 percent.

[10] conducted experiments using image data collected in Thailand. Histogram of Oriented Gradient (HOG-based BOF) and linear support vector machine (SVM) were adopted for a detector. They mentioned that robustness against illumination or environmental change can be achieved with HOG, and robustness against various types of fonts can be achieved with BOF. There are certain limitations in this system. In some cases the license plate is not detected from vehicle image. With the help of this literature review, we can find that though several studies have been done in the field of license plate recognition but there is no paper that has done successful classification of vehicles that are of various formats and languages all together.

2. Proposed work

The overall scenario of how the system works is represented with the flowchart in the Figure 1 and the block diagram in the Figure 2.

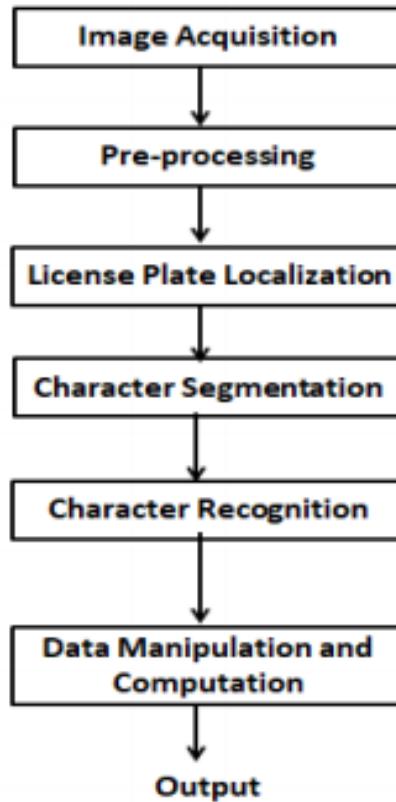


Fig. 1. License Plate Recognition System Flowchart

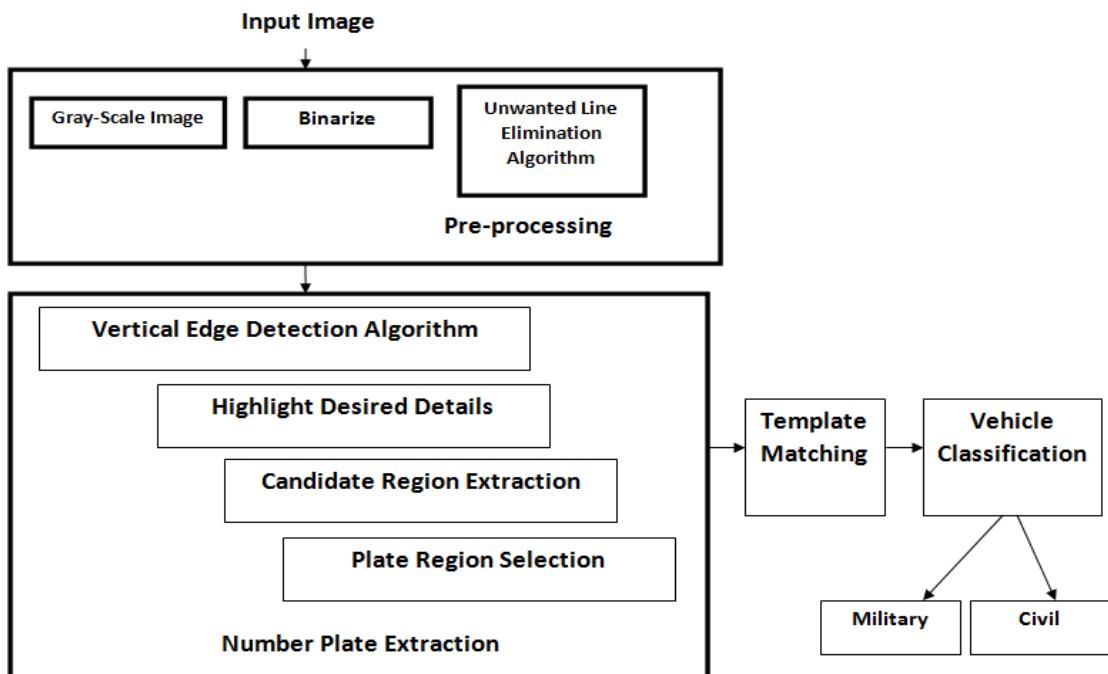


Fig. 2. License Plate Recognition System Block Diagram

3.1 Pre-processing

At first, a color image of a vehicle, captured from the camera installed at the entrance of any building or establishment, is taken as input. Color images can be represented by three or four components for each pixel such as red, green, blue, cyan, magenta, etc. This color image is converted to grey-scale image which is shown in Figure 3.



Fig. 3. Color Image to Gray-scale Image

In the grey-scale image the intensity of a pixel is represented as a range starting from 0 for black to 1 for white. Then the picture is binarized so that it contains only two values that are 0s and 1s. The unwanted line elimination algorithm then enhances the binarized image. The entire process starting from color image input to ULEA image is known as Pre-processing stage.

3.2 Edge Detection

The edge information is quite helpful to obtain shape information. At first the edges are detected and after that the sharpness is increased to make the image clearer. The process of classifying and placing sharp discontinuities in an image is called the edge detection [11]. The Vertical Edge Detection Algorithm differentiates the number plate details from the background. It basically reduces the amount of data to be manipulated and thus makes the further process faster. Each character has two edges, one is the starting edge consisting of two pixels and another is the ending edge which is of one pixel.

3.3 Highlight Desired Details

It takes the VEDA output and highlights the desired details such as the number plate.

3.4 Highlight Desired Details

There are multiple candidate regions. This method gives regions that have larger darkness ratio. The candidate regions are separated from each other with upper and lower lines. Morphological filtering is used as a tool for extracting image components and so representing and describing region shapes such as boundaries. Candidate region is extracted in this method.

3.5 Plate Region Selection

It extracts the actual region of interest such as the license plate region. It relies on the output of candidate region extraction. The region with maximum black pixel is considered to be the desired license plate region. The process described is shown in the figures 4 and 5.



Fig. 4. Input Image and Dilated Image

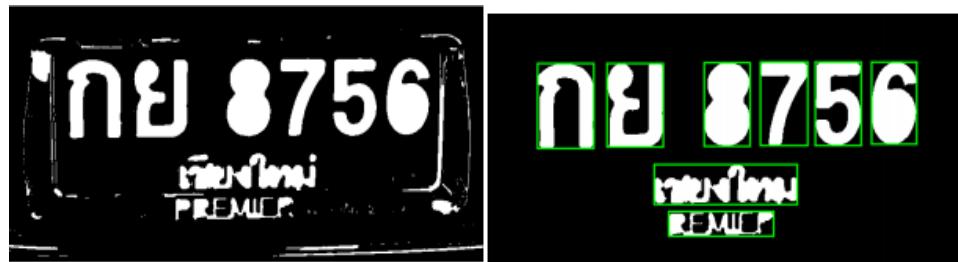


Fig. 5. Plate Region Selection and Segmented Image.

3.6 Template Matching

Template Matching is a technique through which image is compared with predefined images that might be stored in database. Optical Character Recognition system is a widely used approach of template matching. Template Matching could be a methodology in digital image processing to identify little components of a figure which match a template image [11]. The template data for our system is shown in the Figure 6.



Fig. 6. Template Data

4. Experiments and Results

The experiment takes an image of military and non-military vehicles of Bangladesh, India, Pakistan and Thailand and applies all the required steps that are mentioned in the figures 1 and 2 to get segmented image and matches the image with the template images. Various logical conditions are applied to differentiate between the military and non-military vehicles of the different countries. Bangladeshi civil vehicles consist of Bengali alphabets followed by Bengali numerals and military vehicles have up arrow before Bengali numerals. Indian and Pakistani civil vehicles consist of English alphabets and numerals but military vehicles consist of special symbol such as an up arrow and only English numerals. So, if the segmented image has special symbol then it the output is a military vehicle otherwise non-military.

Country	Original Image	Segmented Image	Output
Bangladesh	ঢাকা মেট্রো-গ ২০-২৬২৭		 Command Window New to MATLAB? See resources for Getting Started . C(1) = [] Civil vehicle f1 >>
Bangladesh			 Command Window New to MATLAB? See resources for Getting Started . C(1) = [] Military vehicle f1 >>

Fig. 7. Results for Military and Non-military vehicles of Bangladesh

Country	Original Image	Segmented Image	Vehicle Type
India			 Command Window New to MATLAB? See resources for Getting Started . C(1) = [] Civil vehicle f1 >>
India			 Command Window New to MATLAB? See resources for Getting Started . C(1) = [] Military vehicle f1 >>

Fig. 8. Results for Military and Non-military vehicles of India

Country	Original Image	Segmented Image	Output
Pakistan			 Command Window New to MATLAB? See resources for Getting Started . C(1) = [] Civil vehicle f1 >>
Pakistan			 Command Window New to MATLAB? See resources for Getting Started . C(1) = [] Military vehicle f1 >>

Fig. 9. Results for Military and Non-military vehicles of Pakistan

The military vehicles of Thailand consist of special symbols followed by 4 to 5 Thai numerals. On the other hand, Thai non-military vehicles have Thai symbols followed by English numerals. Thus logic is applied that if the number plate consists of English numerals then it is a non-military vehicle and if it consists of Thai numerals then it is a military vehicle. The result of the following experiment is shown in the figures 7, 8, 9 and 10 for military and non-military vehicles of Bangladesh, India, Pakistan and Thailand respectively.

Country	Original Image	Segmented Image	Output
Thailand			
Thailand			

Fig. 10. Results for Military and Non-military vehicles of Thailand

5. Discussion and Conclusion

The entire system is implemented in MATLAB. The images of military vehicle have been taken from public domain (INTERNET) due to unavailability and no direct access of the armed forces vehicles from India, Pakistan and Thailand in Bangladesh. However, the pattern and number format of the read images of the military vehicles used in experiments are correct as actual. The images and number plates of military vehicles used in this project are unclassified in nature. However, UVICS can also be added with a module which can identify the vehicles of specific target group form military domain. Furthermore, UVICS can also be a very useful tool at UN Missions where vehicles from different countries generally get involved together for a combined goal of human safety and progress. In future UVICS can be attributed to identify the civil vehicles' authenticity and ownership up to the hierarchy of particular countries' state, division and district level by connecting the system with the national database of traffic department of the target country. This will allow the security agencies or guards deployed at various important places to identify the vehicle well in advance and can avoid or stop any ramming or suicide bombing situation. The method is devised for universal acceptance across the nations. This research will further be introduced to identify and classify vehicles from USA, Europe and South-East Asian countries. UVICS can also be used to track down the stolen vehicles on road. Moreover it can play a vital role in ensuring security of individuals by preventing vehicle suicide bombing and vehicle ramming situations.

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Authors Biography



Ishraq Haider Chowdhury was born in 1993 at Dhaka, Bangladesh. He is a final year student of Military Institute of Science and Technology (MIST) in Department of Computer Science and Engineering. He has research Interest in Image Processing, Computer Interfacing and Artificial Intelligence. He has done a project named “A Smart Way to Control the Intensity of Light” in the field of Artificial Intelligence. He has also done a project named “Automatic Vehicle Parking Management System” in Computer Interfacing. He has received a Certification on “Mobile Apps Development Course”.



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E-Commerce System Design to Expand Indonesian Eels Processed Product for International Market

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Abstract

Limited marketing is the reasons why several industries cannot develop well. Besar kecilnya mobilitas dan liberalisasi jual beli, membuat pihak manajemen harus melakukan inovasi perluasan pasar. E-Commerce application is the objective of this research in order to generate a system that facilitates the effort to introduce Indonesian Sidat processed product worldwide; to expand the potential market and as an effort to increase the sales volume by establishing an interactive communication with customers (buyers). *Waterfall* is used as the method for E-Commerce system design with object orientation approach. The result of E-Commerce system design is expected to be able to display all information on the products which are the processed product of Indonesian Sidat. The marketing system is no longer focus on local community as the target, but also on the community abroad. E-Commerce system provides comfort to the visitors, in this case, E-Commerce is designed to contribute in problem solving to ensure a customer's friendly information services, it displays specific messages to guide the visitors, potential buyers may initiate the buying process, and the payment can be made by several methods such as bank transfer, cash on delivery and PayPal, and then the product payment confirmation is made through email. These facts not only broaden the target market, but also create global competition because the marketing system is not limited to a certain territory.

Key Words: *E-Commerce, Transfer, Cash on Delivery, Paypal, Waterfall*

1. Foreword

The use of information technology in marketing sector has been expanding very fast with various significant changes in the digital format, mobilization of the capital and liberation of information [1] (Laudon & Traver, 2013). Customers (buyers) can make the order and purchase without time and space limitation, aware of information update [2](Xiaohui et all, 2014). Business expansion becomes more flexible, reaching more target market, less expensive and interactive promotion media, transparency in the operations cost, digitizing of products/services, simplifying distribution system, providing easy commercial transaction across cultures and countries with relatively more effective costs, facilitating establishment of business network with different patterns of differentiation as needed with specific product / service specification [3](Li & Hong, 2013).

The success of an E-Commerce is mainly due to the product's speciality with distinct specification. Business of a unique and specific product has higher opportunity and comparative level due to its specification and distinctive from other business, for example Sidat cultivation business in marketing the processed products. The growth of cultivation business is not too significant because it is not easy to sell the product to domestic market since the local community does not consume Sidat processed products. The limited marketing has caused several businesses in Sidat Cultivation canot develop well due to limited buyers. One of the business is PT Luhur Kasih Sakti, because the marketing has not well developed and

tends to be stagnant, the business owner is seeking to a new approach to expand its business opportunity by marketing the product online with E-Commerce system.

The limited mobility and liberalization of the market has caused the Management to try ne innovation to expand the target market by designing and using E-Commerce. E-Commerce technology is a business mechanism which funtions electronically by focusing on the online business transactions, and it has the possibility of developing a friendly and personalized relations with customer beyond time and space [4](Li & Yang, 2014). This fact creates a global competition because the marketing system is not longer limited to a certain area. Currently, the marketing system is still depend on direct interaction with customer (buyer) and focus on a special location in Indonesia, which makes it hard for the Management to increase the selling and to expand the marketing outside Indonesia.

The objective of this research is to create a system that provides conveniency to introduce and sell Sidal processed product globally. Expanding target market area and increasing selling volume by developing an interactive communication with customer (buyer) through providing an online interface alternative as a media to promote Sidat processed product from PT Luhur Kasih Sakti.

2. Literatures

E-Commerce is part of e-business. In general, a customer who plans to shop online through internet shall need a technology and internet infrastructure to search for online shop or webstrore. From the seller or provider's prospective, E-Commerce can be used to gather information, such as customer's data, since customer usually has to register as a member before their can proceed with the transaction (Laudon & Traver, 2013). At first, a customer needs information on which online shops that sell the product that he wants to buy by using any available search engine technology [5](Lee, 2014). When the online shop is identified, the customer may directly look for the items that he wants to buy through web catalog facilities provided by the E-Commerce site. The web catalog also functions as promotion media (including special price and discount) of the Seller.

Several E-Commerce sites provides services for the customers to negotiate the pice, and several sites only apply un-negotiable fixed price [6](Li, et all, 2011). Online catalog or web based catalog is a display in form of application to promote items to be sold. In an online catalog or web catalog, usually there are several categories of the sale items, including the price list or other promotion, and a shopping cart or other terms for online shopping cart. [7](Schneider, 2012).

The technology behind the online catalog is actually the E-Commerce site or portal itself supporting by web or internet infrastructure. Whereas it is the business process that describes how a customer accesses the online catalog, purchases any item and completes a transaction in an E-Commerce site (Li & Yang, 2014). E-Commerce system on digital transaction for various organization or personal (individual) may reach broad customers and communities, therefore they have the opportunity to boost their target market growth [8](Schneider, 2012). This transaction model gives possibility to conduct commercial transaction across countries and culture in a more convenience way and more effective costs, compared to traditional type of transaction. This mechanism technology can be operated everywhere for any countries worldwide since it has a universal standard [9](Kwahk, 2012).

With E-Commerce system, all micro, small or middle level businesses can participate in global market easily, and even in real time mode. All businessmen can establish a business network, and create a direct connection with customer (Li & Hong, 2013). E-Commerce system as an advanced information technology has create several changes, such as reducing interaction costs between seller and buyer, simplifying interactions beyond time and place, providing more alternatives and promotions, expanding target market opportunity without depending on huge capital and investment, providing business transparency and friendly services to customer or buyer [10](Bernadi, 2013).

One of the researchs on E-Commerce in Indonesia which is relevant to this research in "*Pemanfaatan Teknologi Ecommerce Merupakan Sarana Penting dalam Menerapkan Strategi dan Promosi secara Online Sehingga dapat Memperluas Pangsa Pasar.*" The use of Ecommerce Technology is an Important Media in Implementing Online Strategy and Promotion to Expand Market Target

[11](Antika, et all. 2014). There are many simplicity in the transaction process and information update which are very helpful in making managerial decision. [12](Anwar et all., 2014). Information distribution has become faster and adaptive toward the changes of the community needs without limitation of time and place [13](Astuti et all., 2013). Reduction to the operations cost and achievement of corporate profitability as well as opportunities to improve the competitiveness of the company [14](Julisar dkk., 2013). The retailing and marketing system become more effective, dynamic and simple in increasing the product distribution [15](Kosasi, 2014).

Marketing digitalization provides several operational advantages such as the processing of ordering data is easier to track, the supply and payment systems are more accurate, and it creates a better relation with customer [16](Kosasi, 2015). E-Commerce system makes possible to reach and access global market (56%), supports product promotions (63%), creates product branding (56%), establishes close connection with customers (74%), simplifies prompt communication (63%), gains customer's satisfaction memberikan kepuasan kepada pelanggan (56%), owning E-Commerce system can derive and improve customer's satisfaction (74%) and competitive advantage (81%).

This research applies System Development Life Cycle (SDLC) method with Waterfall approach, therefore the approach is not identical with the previous researches. This method has several phases namely planning, designing, unit testing, system testing and maintenance [17](Sommerville, 2011). For designing, E-Commerce designer applies base components, and PHP programming language of framework CodeIgniter. Further, E-Commerce system designing applies NetBeans IDE version 7.2., and applies MySQL application in designing the whole database.

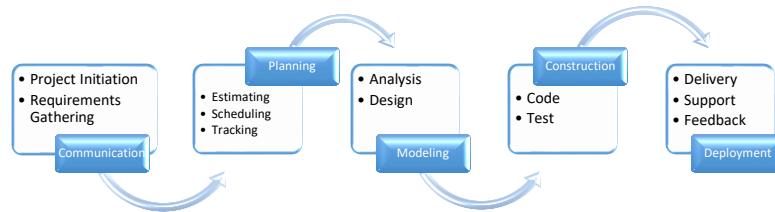
3. Research Method

Case study research is through approach of market expansion needs by using target analysis, business model design, customer interface, market communication and implementation design. The research instrument is through interview and observation technique, and for the sampling is through purposive sampling technique. Research data is from primary data and secondary data.

Primary data is data that directly acquired from the company through interview with and observation to the company's representative. Secondary data are daily business transaction data, company's daily and monthly data, and reports published to public. All acquired data will be reprocessed as needed for the research.

Application design is using Waterfall approach (Shelly & Rosenblatt, 2012). This approach is classic and systematic thus it will be easy to understand because all the processes work simultaneously in certain sequences to create a software (Figure 1).

Figure 1 Waterfall Approach



This method starts from planning, developing and will be continuously evaluated to determine if this information system is still suitable to be applied, if not, it will be changed with a new system and it will start with the planning again. System planning begins after receiving a proposal either internally or externally, followed by management decision. After management approval, the plan will be made in a complete work plan structure, and includes the whole system. The development phase will be conducted through survey, analysis, designing, developing, implementation, and maintenance. The purpose of the survey is to identify the scope of work. The analysis phase is to understand the available system, to identify the problems, and to look for the solution. The designing phase is to design a new system to resolve

company's problems. The developing phase is to create a new system through computerizing system coding. The objective of implementation phase is that the system created can resolve the company's problems. Its application will be in sequential (waterfall), in which each phase has to be completed before it continues to next phase, in order to avoid repetition of a phase. The purpose of maintenance phase is for the system to run properly and can be operated optimally. The evaluation phase is conducted to ensure that the implementation of system development is in line with the planning, from the timing, cost or technical aspects.

Evaluation team includes user/management, and it starts during the system development, during the hand-over and during the operations. Then, the process of designing a prototype E-Commerce system is using basic component with application of CSS (Cascading Style Sheet), PHP (Personal Home Page), javascript framework, jQuery, CI (CodeIgniter), by utilizing MVC (Model View Controller). The system testing will use data that is easy to be checked (easy values), simple and easy to calculate data (typical realistic values), extreme data (extreme values) and prohibited data (illegal values). The structure of the testing is important because the data recording has to be accurate and precise. The validation of input process shall determine the overall output qualification of the system making it easier to make managerial decisions. The needs for opportunity analysis of target market expansion begins by identifying a number of similar competitors, where in this business not many has used the internet media as online marketing model so it is a good opportunity. Limitation of technical factors are such as access speed, server capability and ease of access. Providing easy information access that has become a problem. A dynamic promotion media may boost the number of transactions and customers. However, not all has constant and normal interner infrastructure networks. The products has special specific factor that requires product's digitalized media in virtual market. The design of interface is using 7C approach (Context, Content, Community, Customization, Communication, Connection, and Commerce). As for market communication can use search engirne, online commercial, print media and magazine [18](Mohapatra, 2013).

4. Result and Analysis

The needs for designing business process of E-Commerce system starts off through searching, identifying and analyzing processes to complete all information needed related to the contents and features attributed to the dimension of Sidat processed products. This process is intended to dig up all requirements of the information of each business process, so that the application model and the marketing sites procedure align with conventional business process. This will offer new opportunity as well as a solution to some limitation that a company has by considering the operations procedure and standardization.

Marketing digitization system enables seller and buyer to meet online through E-Commerce sites with no restriction to location and time in conducting the business transaction. Business process analysis scope of the information request process shall be up to validation receive process from customer (buyer). The specification requirement of E-Commerce system shall be differentiated into two important parts, functional and non-functional. The functional requirement is part of the requirement that consists of processes to run E-Commerce system. While the non-functional requirement is focusing on elements of system behavior properties. The interaction and ability to manage the stimulus of all elements of the system can be the most important support for successful relationships with customers and prospects.

The design of E-Commerce system architecture has two main parts, namely front-end and back-end pages. Each section has its own features and content. Front-end is a page that displays the front of Ecommerce site that serves the user with features that have been arranged in such a way to facilitate the process of spending knowledge and searching product information quickly and accurately. Front-end is a user page doing the online shopping process, searching price and product information and interacting with the company. While Back-end is the page that is displayed for the admin and setting the contents of the data in the front-end site. Admin can add, edit, delete existing data, such as product data, administration data, and order data; and on back-end pages admin can also access other useful information. The admin page can not be accessed directly through the menu in index.php, but must by typing a certain address on the browser so that the security level is higher.

One of the principles in designing a site is ensuring that each page has a good navigation system and links that are able to take visitors to the main page. E-Commerce site has a menu section header, in which the Catalog menu will always be updated according to visited links, My Account menu, Trolley menu, Checkout menu. In addition to using the header section menu, this site also uses other alternative navigation links on the left and right sides like Categories, New Products, Search, Shopping Cart, Bestseller, Viewed Product, and Bookmark. In the Footer, there is a trademark of the site and company. E-Commerce system uses client server technology architecture centrally, because it can overcome the problem of duplication of interference. The purpose is that if one customer has a disruption in accessing data from the server then the interference does not affect other customers in doing data access. In addition, it does not require a large amount of costs because the server only serves to store all customer data, transaction data, and product information, therefore all existing data can be used by the client in accordance with the function and purpose. Server provides data in accordance with the needs of the client so that it can directly operate through the available network. This connectivity provides an effective network to ensure and ensure a smooth acquisition of information so that all transaction data and feedback from customers can perform the process more effectively and efficiently.

E-Commerce architecture has a business process management mechanism starts from the customer accessing the site, then the customer purchasing an item by adding the item to the shopping cart. After the shopping is complete, the buyer can enter billing information into credit card or buyer who already has a PayPal account can login to make payment. Before making a payment, the buyer confirms the details of the transaction, next the buyer checks and prints the payment confirmation. The final step is that buyer receives payment notifications via email. The payment method architecture with PayPal starts from a customer shops by stuffing items into the shopping cart. After shopping, the next step is the customer must log in. After successful login, customer can check the shipping data and billing information, then makes payment. After making the payment, the customer can view the order in detail and then the customer sees the confirmation of the ordered item.

The architecture of how payment of invoices work online starts from invoice delivery. The customer then clicks the payment link on the invoice to make a payment. After the payment process is done, the customer's funds are transferred from the customer's bank to the bank with the payment network. After all payment processes are completed, then the final step is the customer matches it with the original invoice.

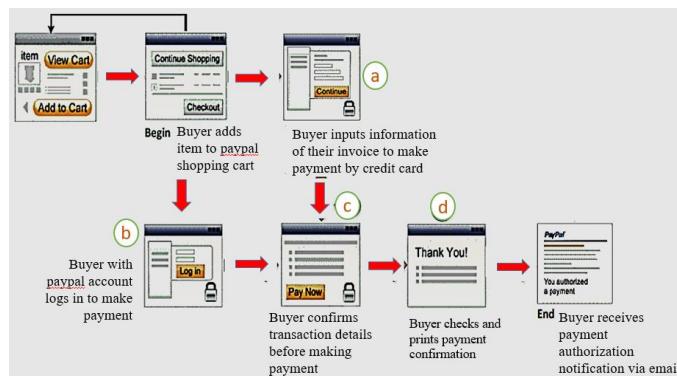


Figure 2 E-Commerce System Architecture

Strategy in the designing stage of E-Commerce site refers to object-based design. *Use-case* diagrams explain the benefits of the system when viewed from the perspective of people outside the system or actor. The Admin's function in the site is when successfully login to the administrator page, the admin can manage the purchasing activities that contains the explanation of how to make transactions, change password, manage product management such as adding, deleting and changing product data and product categories, manage admin module which contains bank data, manage comments and incoming transaction

menus. The Visitor's function in this case the consumer (buyer) is the product ordering activities through the registration process (Figure 3)

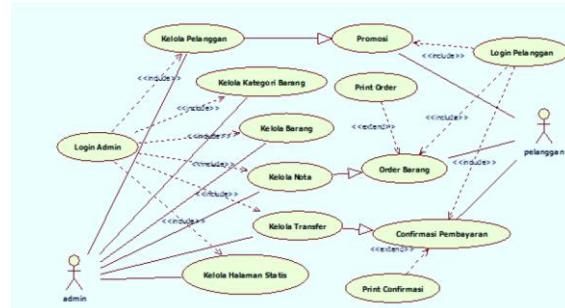


Figure 3 *Use Case Diagram of E-Commerce System*

The data structures design is using MVC framework (Model View Controller). The MVC framework generates a data structure that assigns tasks to each functions so that it is more controllable. CodeIgniter is a framework that enforces the MVC file structure in its structure. The MVC structure in the CodeIgniter framework uses component diagrams. The work unit that manages all the components in the CodeIgniter framework is the core component which is integrated in the system package. The core component oversees or manages the dependent model and controller in which the controller sends the data request and the receiving model retrieves the data that the controller wants from the database. The result of data request will be shown to the view by the controller. The MVC file structure in the CodeIgniter framework is usually placed in the application folders which have been grouped according to their respective functions. Here is a file structure display of each MVC folder in PT Luhur Kasih Sakti's E-Commerce site design.

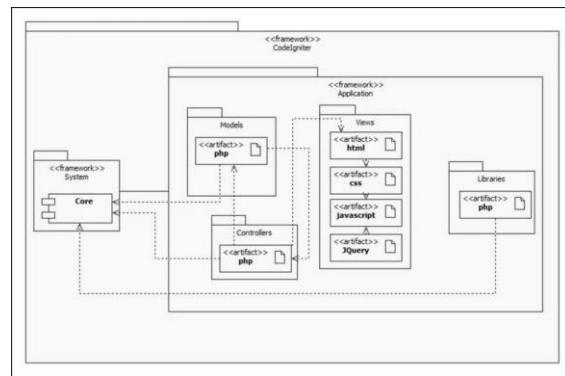


Figure 4 Component Diagram of E-Commerce System

Furthermore, class diagrams can display some classes and packages that exist in the system/software used and the connections therein. The class diagram describes the types of objects in the system and the various existing static connections. The class diagram shows the properties and operations of a class and the restrictions contained in the connection of those object.

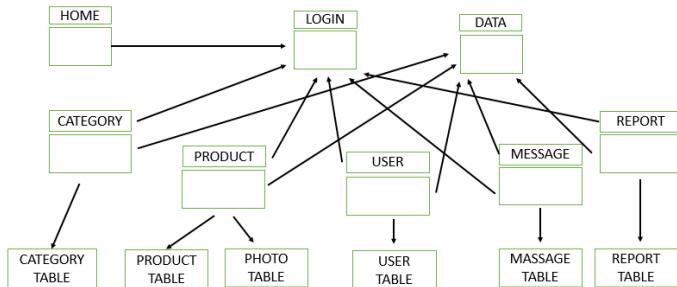


Figure 5 Class Diagram of E-Commerce System

Here is the main page design to manage all contents on **E-Commerce system of cosmetic products**. The design page of the seller/supplier menu format has a function to log all records so it will be easy to find a particular seller/supplier's ID. This information is very important considering all transactions will be interconnected with other items of choice menu. All the options in this menu have permanent inner links. The interface for public pages of this homepage is the default page when the display is first accessed with the base address. This page will display some sections that help users to find the required products through the E-Commerce system's site search engine, categories with parent and child. In addition, there is an automatic slide banner at the top, this is to provide announcements about the policy or information to be conveyed to visitors (consumers / customers)

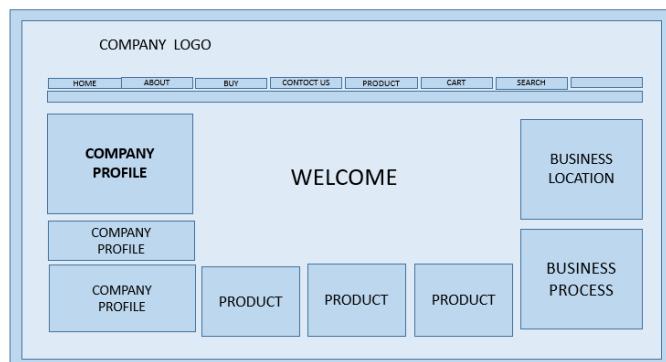


Figure 6 Mockup Design Main Page of E-Commerce System

Having a shopping cart page display on the visitor page. If a visitor makes a transaction by clicking the buy button, the item will go into the consumer's shopping cart. On that page, the data of purchased products and total payments to be paid by consumers will appear. (Figure 7).

For information showing order data such as member's data i.e. name, address, phone number and email as well as the name of the ordered product, the shipping cost, and the total price of the items ordered by e-mail. The system will send the destination account number for the payment through the email of the member ordering the product. If the data has been sent via email and within three days the payment confirmation is not received, then the admin will cancel the order by changing the member's booking status according to the established procedure and the delivery process will not be done or not performed.

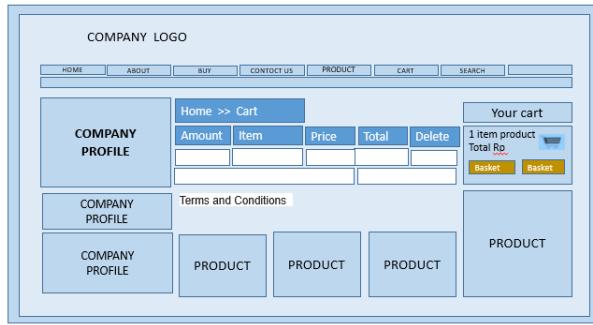


Figure 7 Mockup Design Shopping Cart Page of E-Commerce System

For information showing order data such as member's data i.e. name, address, phone number and email as well as the name of the ordered product, the shipping cost, and the total price of the items ordered by e-mail. The system will send the destination account number for the payment through the email of the member ordering the product. If the data has been sent via email and within three days the payment confirmation is not received, then the admin will cancel the order by changing the member's booking status according to the established procedure and the delivery process will not be done or not performed.

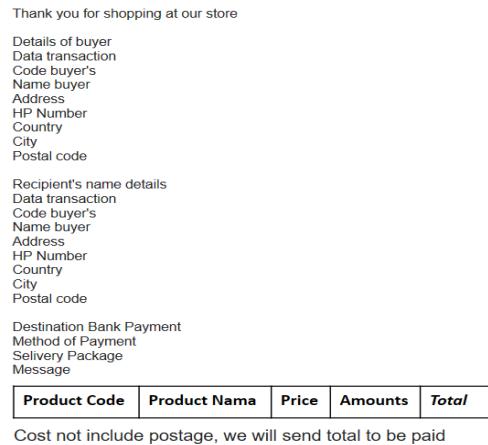


Figure 8 Order Confirmation Email of E-Commerce System

The system has a content to verify and validate. It is important considering all the item's data that have been entered into the shopping cart can not be used as data of the items to be paid. This is because the data has not been entered into the admin's bill of sale. To continue this process, the consumer must click the process button. After the process button is clicked then the the item's data in the shopping cart will proceed to the admin invoice. Below is a display that shows that the existing data in the cart is proceeded into admin's bill of sale. To make payment to the ordered items, the consumer must fill in the data on the confirmation payment form. But before filling in the data, the most important thing that cosumer must know is the invoice number. To get information about the invoice number, the consumer can click on the Invoices menu that is grouped into the shopping cart at the right of the site (Figure 9).



Figure 9. Payment Confirmation in E-Commerce System

This E-Commerce system provides a number of operational advantages, such as data processing is easier to track, payment systems become more accurate with no accounts receivable, inventory information is more accurate, develops personalized relationships with customers to become closer, and it is one of the company's competitiveness aspects. Also, the ability to identify customer needs that has not been met, eliminate time constraints for customers to obtain information about the products offered or the ongoing promotions, communicate with customers in a more clear manner and directly solve their immediate needs. All sidat processed products sold are no longer focusing to the domestic market only.

E-Commerce system has a navigation feature that provides convenience for visitors, in this case either consumers or buyers, while visiting the site's page. It contributes to problem solving as a guarantee for a customer's friendly information services and switch to the sales digitization of sidat processed products. Displaying certain messages in directing visitors, the prospective buyers can start the process of ordering goods online at anytime and anywhere as well as to get the most up to date information about sidat processed products.

The ability of the E-Commerce system offers many new opportunities, especially the opportunity to expand market target with low operating costs because all transactions can take place regardless of the time and place of business transactions.

5. Conclusion

E-Commerce system design for special sidat processed products has the facilities to store personal data members (members) with complete username and password to anticipate being misused by irresponsible people. E-Commerce System also provides payment facilities through bank transfer and Cash-On-Delivery. In addition, this application provides interesting features for members, such as the invite friends program, and gift of discount shopping vouchers when the member is having birthday. The architecture of this application can also be used to enter new data and change existing data as well as provide information about purchases made by the member to the shop owner. Provides information to members about the delivery status of the goods they purchased and the status of payment via e-mail. In order for E-commerce implementation to run well, especially on the client's side, it requires a hosting server that has a large capacity and fast access speed.

For further development, this E-Commerce system site can be added with news facilities on the development of information and technology so that the users and visitors can keep up with the latest developments. Complete with electronic payment system using credit card or other electronic payment system like PayPal. Provide several languages option to provide convenience to customers who are foreigners, and domiciled in Indonesia to place orders or make transactions.

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Automated Mobile Robot with RFID Scanner and Self Obstacle Avoiding System

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Abstract

An Automated Mobile Robot can navigate on a floor freely by avoiding obstacles and walking on the shortest path between two points. It uses a vector map of the floor and Dijkstra's shortest path algorithm for calculating shortest path. For obstacle avoidance, it uses ultrasonic sensor modules and pre-loaded intelligence. The RFID scanner is used for identification and verification of destination and re-calibrating position of the robot on a path by detecting other locations on the path. This system requires 195 RPM and 1.75 seconds duration for the robot to successfully read the RFID tag.

Keywords: Mobile Robot; Obstacle Avoiding System; RFID; Delivery Robot; Dijkstra's Algorithm;

1. Introduction

1.1 Background

Robotics is a growing field around the world, including Bangladesh. Over the past few years, there has been a significant increase in the number of Robotics competition among universities. [1] Most of these competitions are about constructing “Line Following Robots”. Recently, a restaurant has opened where food is served by a “Line Following Robot” [2]. It is rare to see robots in Bangladesh that are autonomous and capable of making complex decisions. An autonomous intelligent robot that can go from one place to another within a building while avoiding the obstacle is quite formidable to build. It comes with many challenges solving which will take the robotics sector of Bangladesh another step forward [3].

1.2 Problem Formulation

Automating delivery of items between rooms using an “Automated Mobile Robot” that can find its path from one point to another while avoiding obstacles, without any lines to follow. Also, it can identify the source and destination by RFID scanning. After delivering the items, the robot will backtrack its path to return to its source.

1.3 Overview of Automated Delivery Robot

The robot is called “Automated” because it is able to run without manual control of a user. The user simply needs to input which rooms the delivery needs to go and the robot will carry the item there. The ADR uses the shortest path between source and destination. It calculates this path using Dijkstra's Shortest Path Algorithm [4].

While traveling between source and destination, the robot can avoid obstacles. Once it reaches the destination, it verifies the destination by scanning an RFID tag with the unique code on the door. Once it is verified, it will wait there for a fixed amount of time (so that someone can pick the item from the robot) and then backtrack to a source. If the verification is failed, it will still return to the source.

2. Related Works

Robotics is a growing field and there are plenty of works which are related to ours. Below are some of the works which relate to ours. This robot uses “Obstacle Avoidance” techniques to reach a destination from the source. Obstacle Avoider Robot using ultrasonic sensor HC-SR04 can sense the obstacle in its path and by identifying the object, it avoids the path [5] In Bangladesh, popular trends in robotics have been regarding line follower robots and recently restaurants using line follower robots for delivery. Yet there a scarcity of obstacle avoiding robot systems like ours and we can say that ours is the first of its kind in Bangladesh. Also from Worcestershire Polytechnic Institute have developed an obstacle avoiding robotic system [6] but it lacks the idea of delivering goods from one room to another that can help disabled people and also small and big business ventures.

3. Proposed work

3.1 Basic Design of Robot

In our proposed design, the robot has 30 cm length, 20 cm width, and 15cm height. The body is built of PVC cardboard. The whole system is controlled by Arduino Mega 2560 R3 which has 16 MHz oscillators and ICSP header. It has 4 DC motors (12 volts, 400 RPM). These motors are controlled by two L298N Dual Motor Driver for PWM control. The motors use positive polar to indicate forward move and negative polar to move on backward direction. Sensors and modules are also corporate with the circuits to control the system. Ultrasonic Sensor HC-SR04 for observing obstacles, RFID RC522 for RFID Reader and Scanner, Buzzer to emulate sound.

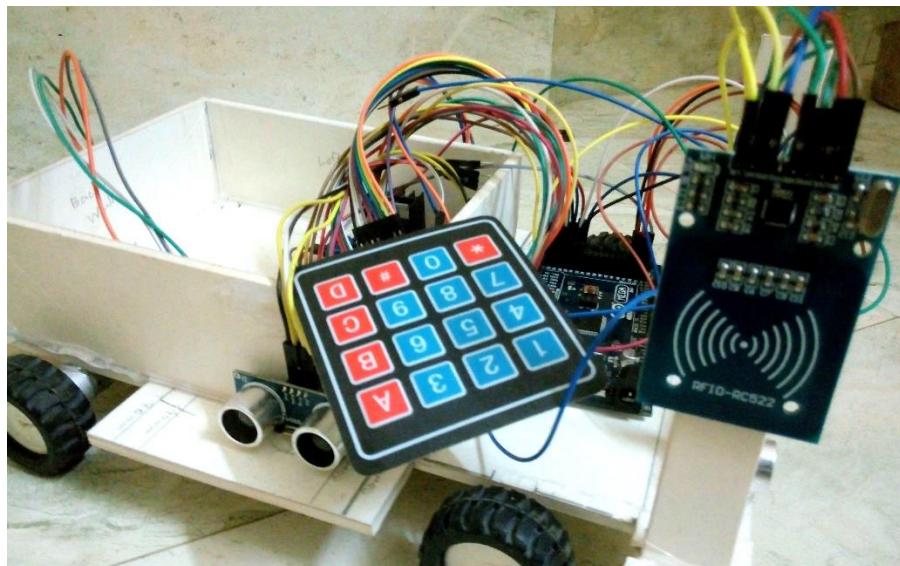


Figure 1: Automated Mobile Robot with RFID Scanner and Self Obstacle Avoiding

3.2 Algorithm

The floor on which the robot will work on is first modeled into a graph. Each room is a node. In order to travel from one node to another, the floor is further divided into a mesh of nodes [13]. There are edges between a pair of nodes whose weights are the distance between that pair of nodes. These all nodes are considered as row and column of a 2-D matrix.

We have modified the Dijkstra's shortest path algorithm to find the shortest distance between two nodes [12]. First, the robots need the distance between source and destination. Suppose the Source is U and the destination is V. The robot will calculate the shortest distance by Vector Mapping (VecSLAM) [7] using the following algorithm.

```
{  
    measure_source ();  
    measure_destination ();  
    motor_reading ();  
    shortest_path ();  
    if (sonar_reading() == true) {  
        avoid_obstacle ();  
    } else {  
        motor_reading ();  
    }  
}
```

Shortest Path Calculation:

For each node distance, n, in the graph:

n.destination_distance = Infinity (Keypad Reading)

Create an possible path list

start.source_distance = 0, (motor off)

While path list not empty:

current_source = node in the list with the smallest distance from destination, remove current from list

For each node from source, n that is adjacent to current distance:

if source.distance > current.distance + length of edge from n to current destination

destination.distance = current.distance + length of edge from n to current source (distance measuring for RPM of robot, motor starts)

Mainly, the robot calculates the vector mapping source and destination distance from the user input [8]. If the node distance is 10 cm, each node from the source will be calculated with pre-loaded vector mapping. 2-D grip will define the row and column between source and distance. The robot will calculate row to row and column to column distance to measure actual path.

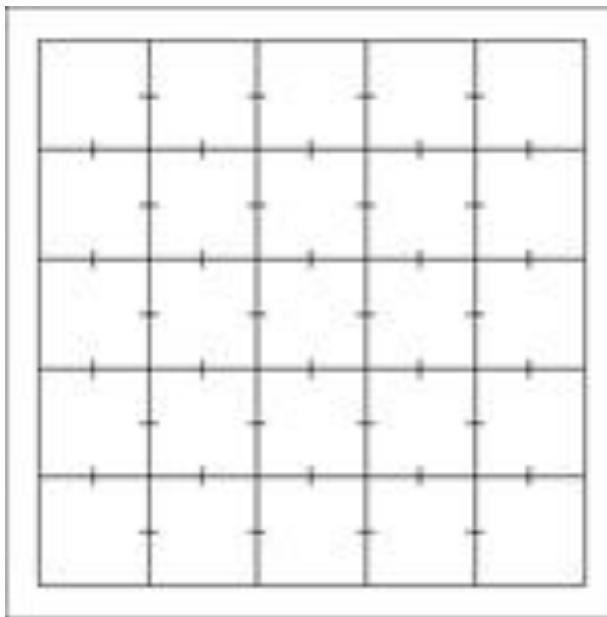


Figure 2: Row-Column divination for path measurement

3.3 System Design

3.3.1 Equipment list:

One of the main specialties of this robot is, it is cost and power efficient. Very few Drivers and Sensors have been used and all of them are operable in a very low Power supply. All the equipment's are listed with power capacity.

Arduino Mega 2560 R3: Arduino mega 2560 has integrated as the main development board in this robot where Input Voltage (limits) : 6-20V and Operating Voltage: 5V [9].

Motor Driver: L298N motor driver has been used to control the PWM of the Robot where Operating Voltage: up to 46V and Total DC Current: up to 4A [9]

Motor: 4 DC Motors with 400 RPM controls the movement and speed where Voltage: 12V and Voltage Range: 6-12V [9]

Wheels: 42x19mm pololu is associated with the DC Motors where Diameter: 1.65 inches (42 mm) and Width of tire: 0.75 inch (19mm) [9]

Sensors: Ultrasonic Sensor HC-SR04 is used to sense the obstacle for the robot. 4 of them has been used in Front, Rear, Left and Right where Voltage: DC5V and Current: less 2mA [9]

RFID Reader: Mifare RC522 Module RFID Reader Scans the RFID tags and recirculates the result to the robot where Frequency: 13.56MHz [9]

Keypad: Flexible 4*4 Matrix Keypad has been used to take the input of Room Number from the User.

Buzzer: 5V Continuous Tone Beeper Creates the sound when the robot successfully scans the RFID tag while Roaming where Voltage Range: 2 ~ 5VDC and Sound Pressure Level: 82 dB [9]

Mini Breadboard: Mini breadboard of 170 Points have been used to regulate the whole circuit.

Power Source: LIPO 2200mAh 11.1V battery is the power source for the whole robot and circuits.

3.4 Assemble and System Principle:

DC Motor Connection with Motor Drivers- DC motors are connected to the L298N dual motor. 2 L298N motor controls 4 motors. Positive polar of the DC motor will work as the Forward movement and Negative polar will be the Backward Movement.

Ultrasonic Sensor connection: Trig and Echo Pin of Ultrasonic Sensor are connected to Arduino Mega (Digital Pin 33-41) and VCC GND shorted in Breadboard.

RFID RC522 connection: RC522 is placed on Right Side of the Robot and GND VCC is shorted in Breadboard. RST/Reset - D5, SPI SS - D53, SPI MOSI - D51, SPI MISO - D50, SPI SCK- D52

Keypad: 4*4 Matrix Keypad is the input source to define source and destination for the Robot. All the input Pins are connected on Digital Pin of Mega. Here, Row Pins = {23, 25, 27, 29} and Col Pins= {28, 26, 24, 22}

LIPO: Lipo is the power source for both Bread Board and Arduino Mega. So the positive terminal is connected to the VCC and 9V terminal is connected in the GND phase.

3.5 Implementations:

After the assembly we have to test or implement the system. For testing following steps are followed- 1. We have tested the polarity of the motors if they are rotating in the same direction also their rotation speed. 2. Ultrasonic Sensor reading will provide the actual distance between objects, which has illustrated in figure 3(a). 3. Test the RFID Tag serial number if they are being able to read correctly, this test confirms the range and tag id of RFID. Figure 3(b) shows the result of this test.

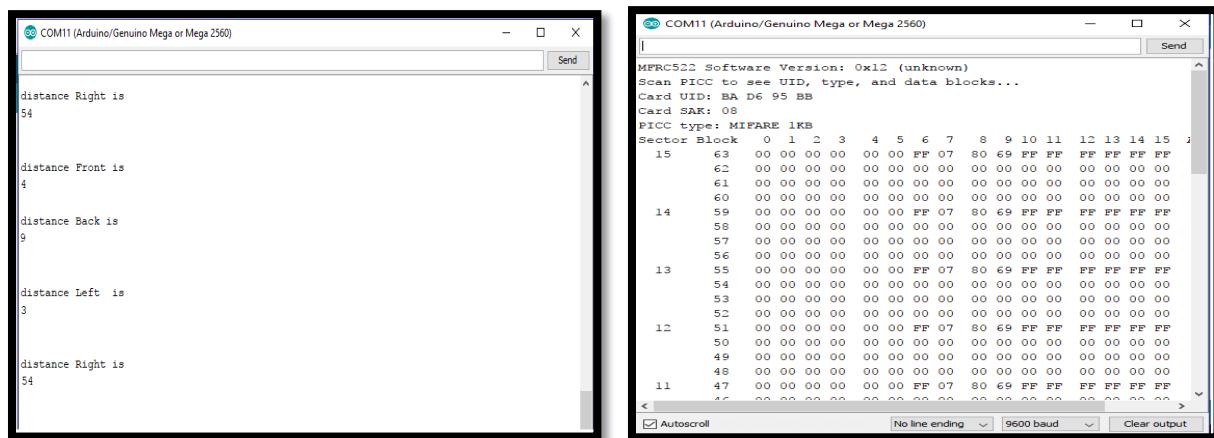


Figure 3: (a) Ultrasonic Sensor reading from Arduino Serial Monitor, (b) RFID Scanner Result from Arduino Serial Monitor

3.6 System Principle: RFID and Ultrasonic Sensors are quite complex to handle on a Robotics System. To handle both sensors and modules, the construction of the robot is shown in Figure 4.

3.7 Circuit: Sample Circuit has been generated by Fritzing [10]. In figure-4 illustrates the whole circuit that are implemented in the Robot (digital pin numbers of Arduino mega are changed in the figure).

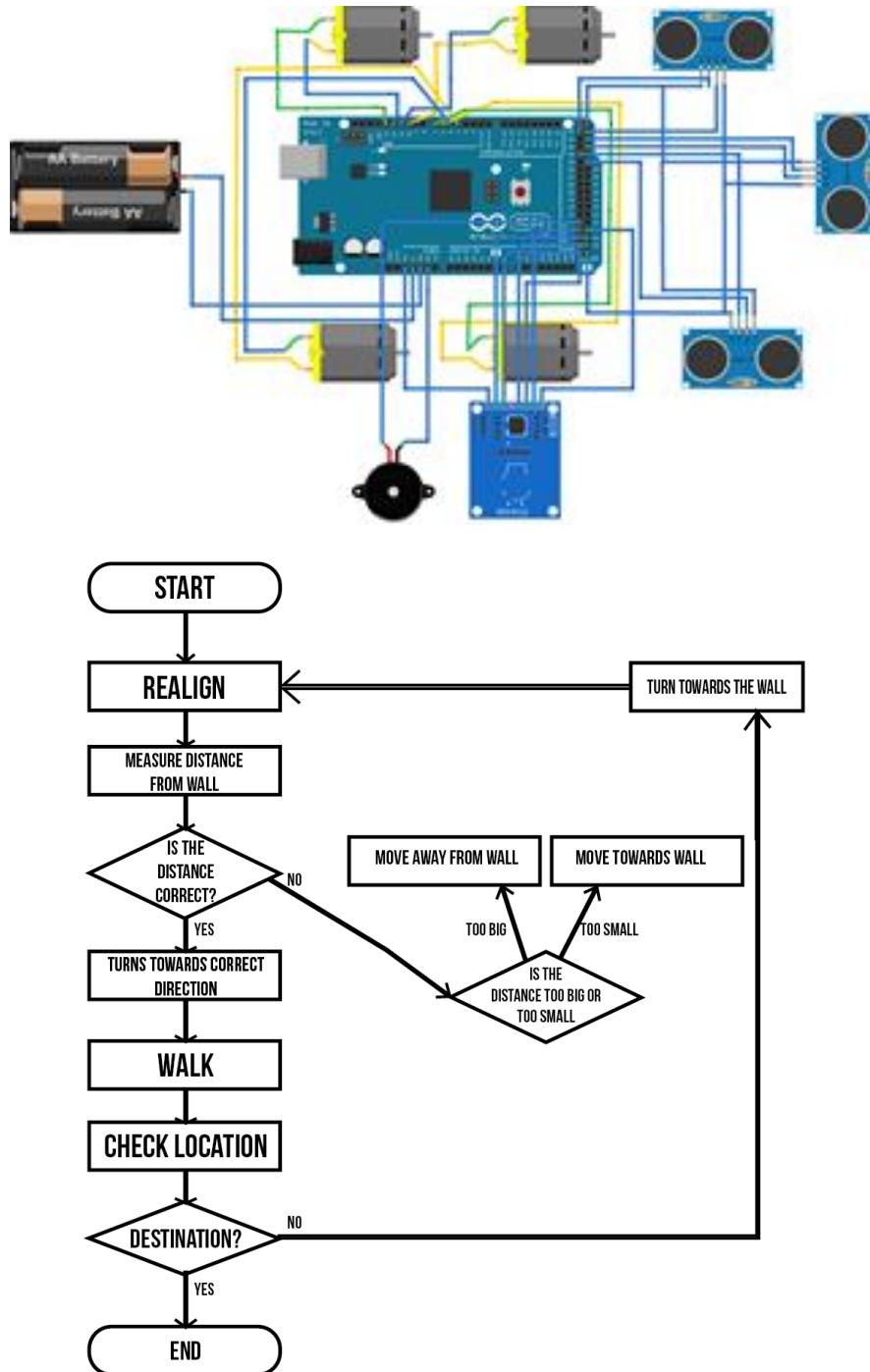


Figure 4: (a) Circuit Diagram, (b) Work Process

3.7 Result and Discussion:

This intelligent robot is capable of moving from one node to another, but only when certain conditions are met. The robot is able to neutralize some of the errors by regularly scanning rooms across its pathway using RFID.

The sonar module used for detecting obstacles is pretty accurate, but they still have their limitations. Experiments have been run to determine the distance of obstacle that sonar modules can accurately read. An object is placed at a distance of D from the sensor and reading are taken for a cross check. The distance D is then gradually decreased until 0 while readings are continuously monitored. A chart (Figure-6) has been generated from the experiment readings using an online tool Meta-Chart [11]. Black Straight lines of Figure 5 are the error that observed during taking sensor values of HC-SR04. These values obtained from 20 experiments.

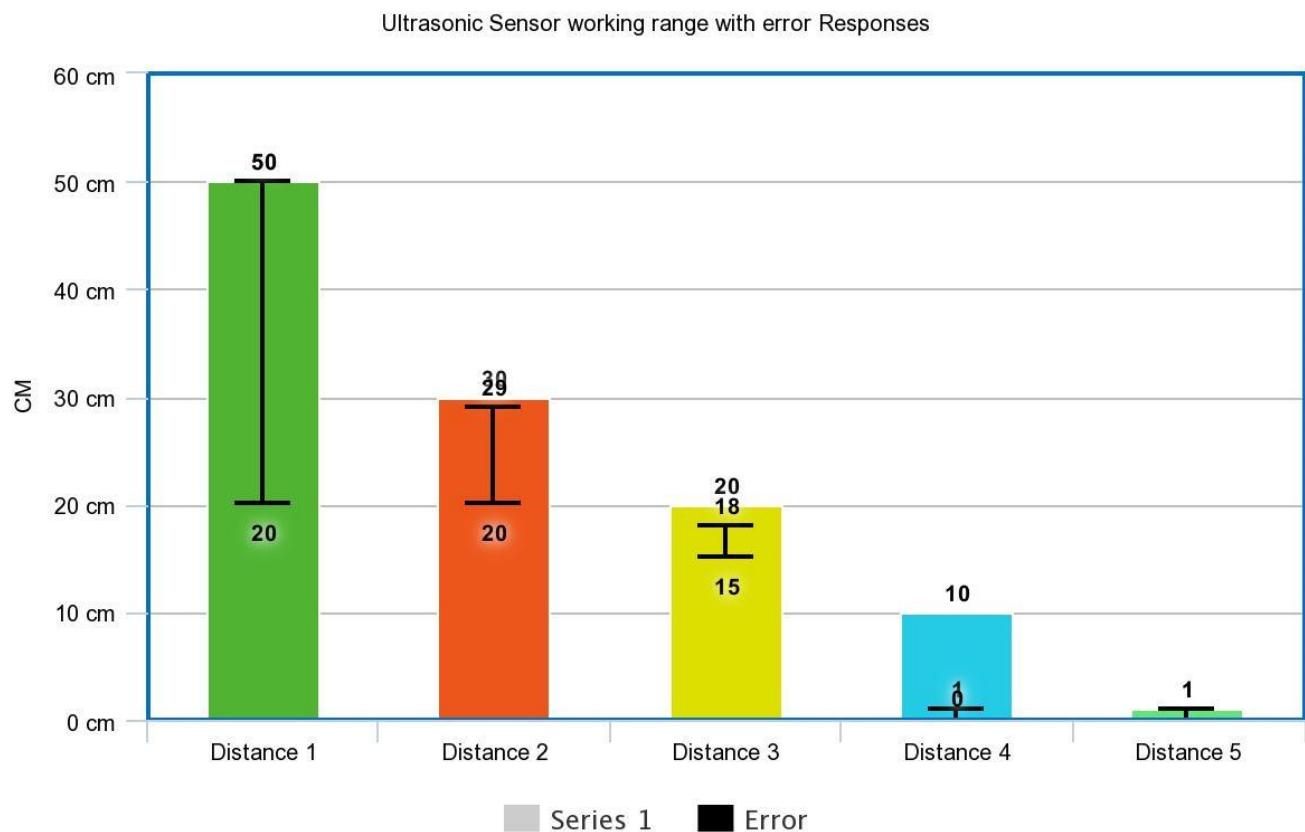


Figure 5: Error range of Ultrasonic Sensor

RPM (MAX 255)	Time Duration (Second)	Reading Status
255	1.5	NO
255	2	NO
240	1.5	NO
240	2	NO
220	1.5	NO
220	2	NO
200	1.5	NO
200	2	YES
190	1.5	YES
190	2	YES
180	1.5	YES
180	2	YES

On Average, it takes $((200+190) \%2) = 195$ RPM with $((2+1.5) \%2) = 1.75$ Second MAX to Read the RFID Tag.

Table 1: RFID Tag Reading time comparing to Speed Generated by Meta-Chart

Another experiment has been run on reading capabilities of RFID scanner under motion, using Arduino Serial Monitor. The experiment has been run to determine the optimal speed of the robot such that it does not skip over the target.

Here, RPM refers to “Revolutions per Minute” of the wheel (speed of the robot) “Time Duration” refers the amount of time RFID scanner takes two processes reading. As the speed of robot increases, the RFID scanner finds it difficult to make a proper reading. From this trial and error experiment (Arduino Serial Monitor), it has been decided to use 195 RPM and 1.75 seconds duration for the robot to successfully read the RFID tag.

4. Conclusion

The robot can navigate on the floor as long as the detailed map is provided to it beforehand. A smart robot that can navigate without any line to follow can open doors to further innovation of the robot industry in Bangladesh. The robot has to room further improvements such as using indoor positioning system to accurately track position on the floor, voice control for ease of use and more structural supports to avoid a wider range of obstacles.

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An Amalgamated Prediction Model for Breast Cancer Detection using Fuzzy Features

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Abstract—Machine learning techniques for cancer prognosis are being widely researched and applied. Supervised learning in conjunction with other computational techniques are paving the way forward for predictive health analytics. The step of input feature processing is very important in order to obtain meaningful results from a data analytics problem. In this paper, the Extended Kalman Filter (EKF) and Fuzzy K-Means clustering algorithms have been combined and a hybrid algorithm is proposed with improved functionality compared to either of the two separately. The proposed hybrid algorithm implements a fuzzy K-means algorithm with Support Vector Machine (SVM)coupled with an EKF for data filtering. From the filtering and prediction consecutive cycles, the result of Kalman filters is obtained and fuzzy membership functions are calculated in order to form a relationship between the labels and attributes. K-means utilizes this relationship to create a new modified set of attributes, which are given to the SVM classifier, with lesser number of support vectors. The number of clusters is added into the training process as the input parameter except the kernel parameters and the SVM penalty factor. The approach was tested for various publicly available data sets like UCL,SEER and a real data set compiled by the authors. After performing statistical analysis, the accuracy, precision, recall and F-score value of the algorithm have been found and compared against those obtained from the traditional algorithms.

Keywords—Cancer, Clustering, Extended Kalman Filter, Fuzzy K-Means.

I. INTRODUCTION

Detecting cancer within the appropriate time-frame is critical given the usual nature of late diagnosis associated with most of the cancer types. Quite pertinently, the predictive-detection problem [1] assumes an immediately utmost importance. Research being carried across the world has not yet been able to comprehensively infer the prognostic approach since it is challenged by a multitude of concerns. Accurately appraising the risk of cancer for individuals with high degree of accuracy and thus enabling cancer prognosis for patients are important to control the morbidity and deaths caused due to cancer. Predictive Cancer models [2] additionally provide modern advancements in determining risk and identifying high-risk individuals [3] thus facilitating the planning and design of clinical cancer trials, promoting the development and analysis of risk-benefit indices, and also estimating the cancer

burden and cost associated with this condition. Models may also help in the evaluation of the treatments and management.

Cancer, also called as malignant tumor or malignant neoplasm, involves unusual cell growth with metastasis. However, all tumors need not be cancerous; benign tumors are immobile. The signs and symptoms that are characteristics of different types of cancers include:lump formation,abnormal bleeds, persistence of cough for a long period, sudden weight loss ($>10\%$) and bowel movements irregularity etc. Humans are affected by more than 100 different types of cancers. In a cancerous condition, the orderly process of cell growth and production goes wrong and cells begin to show an uncontrollable growth. Data has shown tobacco to have caused about 22% of all cancer related deaths. 10% deaths may be attributed to a unbalanced diet, obesity, sedentary lifestyle and consumption of alcohol [4]. Among the less common factors are things like infections, ionizing radiation and environmental pollutants. The same WHO report [4] brings out the fact that in the developing countries, about 20% of cancers are caused due to infections like Hepatitis B, Hepatitis C, and Human Papilloma Virus (HPV).These factors may be responsible for partially mutating the genes in a cell,however a lot of genetic changes may be required for the development of cancer. Approximately 5%- 10% of cancers are known to be due to genetic defects inherited from one or both parents.

Signs and symptoms may show the presence of cancer but certain tests like medical imaging and biopsy may be necessary to confirm its presence. Unfortunately, even after diagnosis and several stages of treatment, there remains a silent risk of regeneration of the cancerous form, which needs to be appropriately detected and predicted in appropriate time. Having considered all these facts, the learning and intelligence based predictive models developed on the foundations of machine learning theory will prove to be highly beneficial.

Even when the same data mining approach is applied to the same data set, the results may be different since different researchers use different feature extraction and selection methods. It is important that the data is pre-processed before data mining is applied so that redundant information can be eliminated or the unstructured data can be quantified by data transformation. Theoretical guidelines for choosing

appropriate patterns and features vary for various problems and methodologies. Indeed, the data collection and pattern generation processes are usually not controllable directly. Therefore, utilizing feature extraction and selection is the key to simplifying the training part of the data mining process and improving the performance without changing the main body of data mining algorithms [5]. Feature extraction, also called data transformation, is the process of transforming the feature data into a quantitative data structure for training convenience.

The proposed hybrid algorithm, called fuzzy K-means SVM, reduces support vectors by combining the fuzzy K-means clustering technique and SVM. Since the K-means clustering technique can almost preserve the underlying structure and distribution of the original data, the testing accuracy of such hybridized classifiers can be put under control to some degree even though reducing support vectors could incur a degradation of testing accuracy. In the proposed approach, the number of clusters is added into the training process as the input parameter except the kernel parameters and the penalty factor in SVM. In unsupervised learning (clustering), usually the number of clusters is subjectively determined by users by applying domain knowledge. However, when the K-means clustering technique is combined with SVM to solve the problems in supervised learning i.e. classification, some objective criteria independent of applications can be adopted to determine these input parameters.

This paper is organized as follows. Section II provides the mathematical preliminaries of the constituent algorithms that make the hybrid algorithm. The data sources on which the proposed algorithm has been tested are described in section III. Section IV details the proposed hybrid algorithm with the results obtained given in section 5. Section 6 concludes the paper.

II. CONSTITUENT ALGORITHMS

The proposed approach is an amalgamation of supervised, unsupervised learning techniques along with a powerful data filtering method. Fuzzy set theory has also been used for achieving effective feature reduction. The various constituent algorithms have been discussed in this section.

A. Extended Kalman Filter

Kalman filter is a discrete time, linear time varying and finite dimensional system by which the mean-square error minimization state is estimated. Kalman filters are a form of predictor-corrector algorithm used extensively in the control systems engineering for the estimation of a process unmeasured states. For the control law design, the estimated states might be used then as a part of the required strategy [6]. In order to get an approximate filter, the Extended Kalman Filter is obtained as an extension of the Kalman Filter to the non-linear system model domain. This is done by applying the Kalman Filter to the error system that is linear [7]. In the sense of mean squared error, no optimality guarantee is offered by the EKF since it is obtained with the use of a non-linear

systems linear approximation. However, for getting the good estimates of accuracy rates from the system, the method of EKF has proven to be useful for a number of systems. This could be understood in other terms like the process where the previous value is recurred back so as to compute the value at present.

B. Fuzzy K-means

An extension of the famous technique of clustering, K-means is Fuzzy k-means that is also termed as Fuzzy C-means [8]. While hard clusters are discovered by K-means, a method that is formalized more statistically is Fuzzy K-Means by which soft clusters are discovered where with certain probability, to more than one cluster, a fuzzy point can belong to [9]. Fuzzy K-means, like K-means, works on the objects whose representation is possible in the vector space that is n-dimensional and has a defined distance measure. The Algorithm is described in algorithm 1:

Algorithm 1 Fuzzy k-means

- 1: Begin the k clusters
 - 2: Until united
 - 3: **for** every pair **do**
 - 4: Compute probability of point belonging to the cluster
 - 5: Assign the values of probability membership of the points to the clusters given above
 - 6: Re-compute the centers of the clusters
 - 7: **end for**
-

C. Implementation of the design

One of the simplest learning algorithms that is unsupervised is the k-means using which a clustering problem that is well known and whose solutions are available. In order to classify the given set of data, an easy and simple way is followed by the procedure through definite number of clusters set a priori. To define the k centers is the main idea, one for every cluster. Since different results are obtained for different locations therefore in a sly way, these centers must be positioned [10]. Placing them as far as possible from each other is a better choice. Each point that belongs to a given set of data is taken in the next step and then is associated to the nearest center. Step first is completed when no point is awaiting and then the early group age is done. From the previous step, the resulted clusters centroid are required to be re-calculated at this point as k new centroids. Between the new center that is nearest and the same points of data set, a new binding is to be done after obtaining these new k centroids. Generation of a loop takes place. Due to this loop, we can notice that there is no movement in the centers or in other words, till no further changes are done, the location is changed by the k centers step by step. Similar to K-means mentioned above, an input file is accepted by the Fuzzy K-means that contains the vector points. The input directories here, similar to K-means, are not modified by the program. The output of the cluster, for every iteration, is stored

in the directory that is cluster-N. In the cluster-N directory, the files are created. The mapper/ driver/ reducer/combiner are used by the code as follows: Fuzzy K-Means driver: This is comparable to K-Means driver. Till it is converged or for the number of iterations specified, it iterates over the cluster points and input points. A new directory cluster-i is created during every iteration containing cluster centers that are modified and obtained during the iteration of Fuzzy K-Means. In the next iteration, this is fed as the input clusters [11]. Fuzzy K-Means Mapper: During the method configure(), it reads the input cluster and then of a point of each of the cluster, the probability of cluster membership is computed. There is an inverse relationship between distance and cluster membership. By making use of the distance measure supplied by the user, the distance is computed. The encoded clustered is the output key [11]. The cluster observations that contain the observation statistics are the output values. Fuzzy K-Means combiner: From the mapper, all the pairs of key value are received by this and then the cluster membership probabilitys partial sums times each clusters input vectors are produced. The encoded cluster identifier is the output key. The cluster observations having the statistics of the observation ate the output values. Fuzzy K-Means reducer: Certain keys are received by multiple receivers along with the values that are associated with the keys. For the cluster, a new centroid is produced by the reducer by summing up the values and this is the output. The encoded cluster identifier is the output key. The clusters that are not converged are encoded by the reducer with the cluster Id ‘Cn and with cluster Id ‘Vn, the converged clusters are encoded.

D. Support Vector Machine

Classification techniques like Support Vector Machines (SVMs) [12] and [13] have been applied recently for breast cancer research. Since this is a powerful technique based on the optimal separating hyperplane theory, an SVM based classifier model can accurately divide the data related to cancer (obtained either in digits or as images) into suitable classes to detect cancer in advance or estimate the survivability of a patient possessing an advanced stage. The use of the separating hyperplane theory for a breast cancer prediction problem, as regards to the applicability of an SVM based on maximum margin classifier approach, has been shown in Fig. 1.

III. DATA SOURCES

A. Collection of Data: Real and Digital Sources

Cancer-related information sources, available from reputed institutes like the American Cancer Society, National Cancer Institute, WHO, Breast Cancer India, NCBI, Regional Cancer Centre, Bikaner (India) were referred to for this study. Efforts were also made to infer knowledge from real field experiences. Accordingly, patients suspected or diagnosed with cancer, including those attending the Out Patients Department (OPD) and those admitted with diagnosis of breast cancer, inside the wards of the Regional Cancer Centre Bikaner, Rajasthan were interacted with to gain deeper insights. Another set of patients who were suspected or diagnosed with cancer and

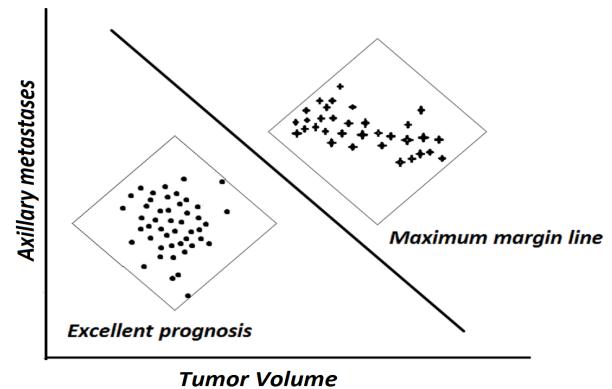


Fig. 1. Applicability of an SVM Based Technique for Breast Cancer Prediction

attending the OPD at the Rajiv Gandhi Cancer Institute, New Delhi were also spoken to for valuable information. Relevant data and fairly recent technical content was searched from online portals like IEEE Xplore Digital Library, ACM digital library, Elsevier and PubMed. Some other journals with good impact factors were thoroughly referred to and some noteworthy points were also taken from relevant papers published in highly acclaimed conference proceedings.

B. Real Data Set

This data is from diagnosis of breast cancer, inside the wards of the Regional Cancer Centre Bikaner, Rajasthan. Number of instances: 569, Class distribution: 357 benign, 212 malignant, Number of attributes: 32 (ID, diagnosis, 30 real-valued input features). Attribute information are (ID number, Diagnosis (M = malignant, B = benign) Ten real-valued features are computed for each cell nucleus:

1. Radius (mean of distances from center to points on the perimeter)
2. Texture (standard deviation of gray-scale values)
3. Perimeter
4. Area
5. Smoothness (local variation in radius lengths)
6. Compactness
7. Concavity
8. Concave points
9. Symmetry
10. Fractal dimension

Out of a total 569 samples, 357 are benign and 212 are malignant cases. There are no Missing attribute value in data set.

C. UCI Repository

The original Wisconsin breast cancer dataset was utilized in this study and it was downloaded from the University of California, UCI Machine learning repository. Recordings are made from biopsies of real patients in the hospitals of Wisconsin, USA. The dataset has 699 instances or samples characterized by 9 attributes or features although there are 11 columns in total. The 1st column is for identifying each

instance with an ID while column 11 stands for the class label for describing the severity of the tumor, the labels being benign = 2 or malignant = 4. The 9 attributes of the data (excluding the class label) represent bio-physical characteristics of the tumor biopsy and are expressed as integral values. The information of the 9 attributes can be reproduced from the relevant web page of the UCI repository website as:

1. Clump Thickness
2. Uniformity of Cell Size
3. Uniformity of Cell Shape
4. Marginal Adhesion
5. Single Epithelial Cell Size
6. Bare Nuclei
7. Bland Chromatin
8. Normal Nucleoli
9. Mitoses

Out of a total 699 samples, 241 are malignant and 485 are benign cases [14]. The next section discusses how the training data set obtained after random sampling of the 699 observations has been used for performing feature processing using hybrid Algorithm.

IV. HYBRID ALGORITHM DESCRIPTION

Since different selection methods and feature extraction are used by different researchers therefore different results might be there even when on the same set of data, same approach of data mining is applied. Before the mining is applied, it is necessary that pre-processed data is there so that by data transformation, quantification could be done of the unstructured data or elimination of the redundant information could be done. For the different methodologies and different problems, the theoretical guidelines for the selection of proper features and patterns differ. In fact, the processes of the pattern generation and collection of data are not directly handy often. To simplify the data mining processs training part and improve the performance without changing the data mining algorithms main body, the key is utilization of the feature selection and extraction. For the convenience of training, the process of transformation of feature data into the quantitative data is termed as Feature extraction that is also known as data transformation.

The approach is to implement an EKF optimized hybrid fuzzy K-means algorithm with Support Vector Machines for Breast Cancer detection. The Fuzzy membership functions will be calculated in order to create a relationship between the attributes and the labels. The likelihood of each point in the clusters is calculated and is considered as state vectors. The apriori state is updated using the Kalman Gain and the relationship is utilized by K-means and it will create a new modified set of attributes, which will be given to the SVM classifier. Although SVM can build classifiers with high testing accuracy, the response time of SVM classifiers still needs to improve when applied into real-time BI systems. Two elements affecting the response time of SVM classifiers are the number of input variables and that of the support vectors. The traditional k-means clustering algorithm suffers

Algorithm 2 Hybrid Algorithm

- 1: Initialize Data set and Separate
 - 2: **for** each point i **do**
 - 3: Calculate apriori state as probability of point
 - 4: Update apriori probability as posteriori probability of each point in the cluster using fuzzy likelihood
 - 5: For each point for each cluster calculate new centroid and update Kalman Gain
 - 6: If centroid movement > threshold?
 - 7: Update covariance and apriori state
 - 8: **for** each selected cluster **do**
 - 9: Check if cluster quality is good
 - 10: **IF** no then reject feature
 - 11: **ELSE** Select feature and load sum to initialize hyperplane
 - 12: Calculate distance of hyperplane with each point and for maximun width of street update weights
 - 13: Classify as Benign or Malignant
 - 14: Stop
 - 15: **end for**
 - 16: **end for**
-

from serious drawbacks like difficulty in finding the correct method for the cluster initialization, making a correct choice of number of clusters (k). Moreover k-means is not efficient for overlapped data set. There have been many methods and techniques proposed to address these drawbacks of k-means. Fuzzy k-means is one of the algorithms, which provide better result than k-means for overlapped dataset. The number of features is very important to the accuracy and prediction time of the algorithm. Some features might be redundant having the same information while others might also deviate the classifier. To address this problem, proposed novel scheme of features selection is implemented, which would extract the meaningful features out of the large dimensional dataset. Although K-means is a well-known technique for clustering data without any labels and hence it is called unsupervised learning. Traditional K-means generates crisp partitions and assignment of each object is done only to one cluster. But this fails when the objects are located between clusters. The fuzzy k-means clustering algorithm partitions data points into k clusters $S_l (l = 1, 2, \dots, k)$ and clusters S_l are associated with representatives (cluster center) C_l . The relationship between a data point and cluster representative is fuzzy. That is, a membership $u_{i,j} [0, 1]$ is used to represent the degree of belongingness of data point X_i and cluster center C_j . Fuzzy clustering becomes more relevant in such situations for extracting meaningful information out of these data structures. Also uncertainty handling is another challenge to crisp clustering techniques. And thus only partial knowledge is extracted during the crisp clustering approach. This paper utilizes fuzzy clusters so that any object is represented by membership in a cluster rather than a crisp value. Although the developed EKF optimized fuzzy-Kmeans algorithm is a clustering algorithm, it is utilized in this paper as an aid to

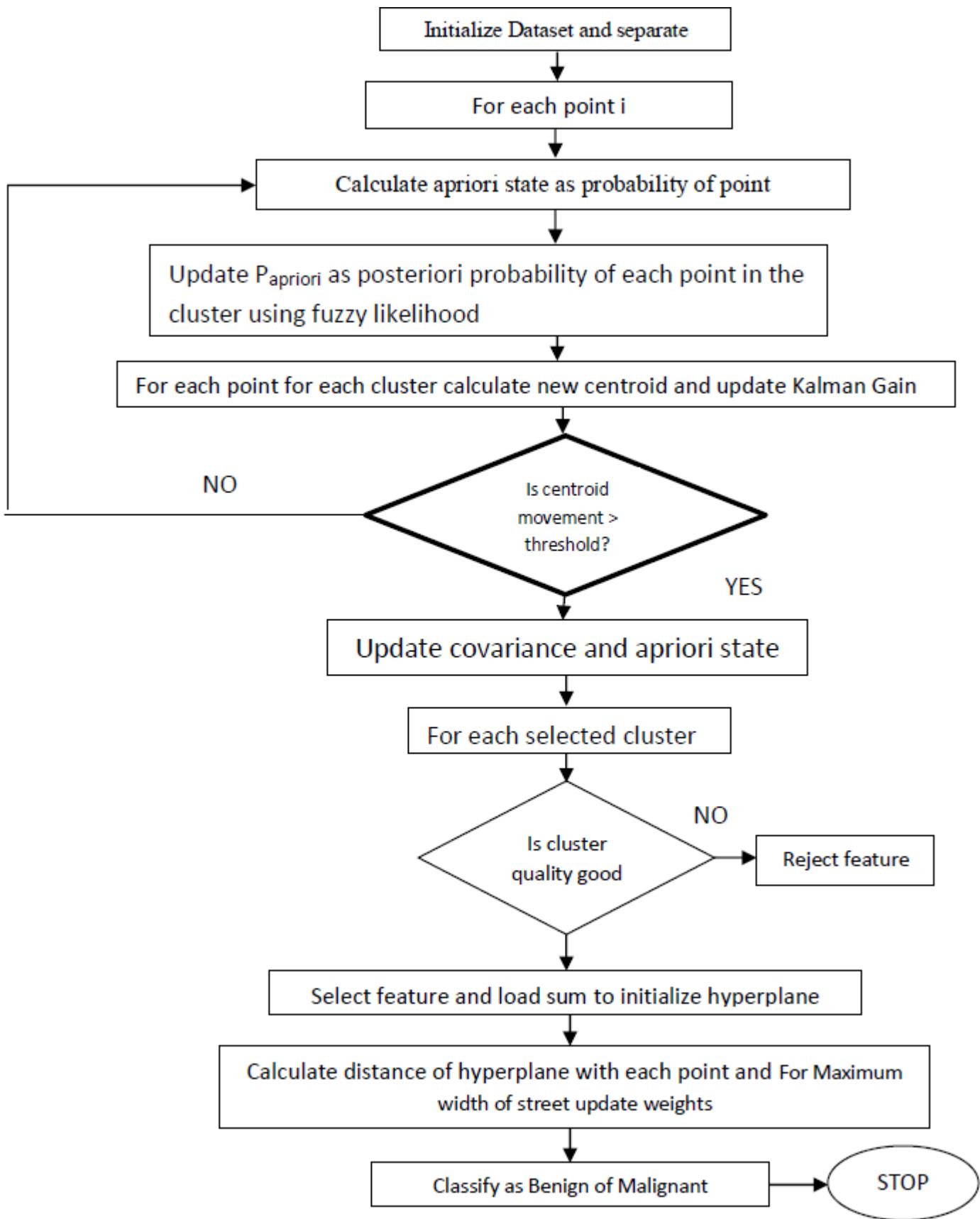


Fig. 2. Proposed Hybrid Algorithm

the classification of breast cancer. Only few features out of the input support vectors in a particular clusters are selected. The hybrid algorithm reduces support vectors by combining the fuzzy K-means clustering technique and SVM. Since the K-means clustering technique can almost preserve the underlying structure and distribution of the original data, the testing accuracy of hybrid classifiers can be under control to some degree even though reducing support vectors could incur a degradation of testing accuracy. In the hybrid algorithm, the number of clusters is added into the training process as the input parameter except the kernel parameters and the penalty factor in SVM. The approach has been shown as a schematic in Fig. 2 above.

A learning method that is supervised is SVM. For the data classification and analysis, it is a good tool. Even for the data that is large, the SVM classifier has a quick learning speed. For the two or more problems of class classification, SVM is used. SVM is based on the notion of the optimal decision planes. The one that separates among the items set that have a different membership of class is the decision plane. With the use of the technique of the Support Vector Machine, the detection and classification of the brain tumor was done. With the Support Vector algorithm, a hybrid fuzzy K-means algorithm has been attempted to be implemented. In order to create a relationship among the labels and attributes, calculation of the functions of the Fuzzy membership will be done. By K-means, the relationship would be utilized and a new modified set will be created by this of the attributes that are then given to the SVM classifier. By combining the SVM and fuzzy K-means clustering technique, the support vectors are reduced by the proposed algorithm. Since the original datas distribution and the underlying structures maintenance is almost done by the technique of K-means clustering, to some extent, the hybrid classifiers testing accuracy can be under control even though the degradation of testing accuracy could be incurred by reducing the support vectors. In the training process, the number of clusters is added in the proposed algorithm as the parameter of input except the kernel parameters and in SVM, the penalty factor. With the help of domain knowledge, the number of clusters is usually determined subjectively in unsupervised learning. However, in supervised learning e.g. classification, to solve the problem, when the technique of K-means clustering is combined with the SVM, for the determination of these input parameters, some objective criteria could be adopted that is independent of the applications.

V. RESULT AND DISCUSSION

The proposed algorithm was tested for two different data sets: The UCI (Wisconsin) data set, which is publicly available and a dataset compiled from real patients in Rajasthan, India (referred to here as the ‘real’ dataset).

Since the possible classes are ‘benign’ and ‘malignant’ only, the classification output was either ‘0’ or ‘1’ respectively. Table I shows the confusion matrix found for classification test done on the UCI dataset:

TABLE I
CONFUSION MATRIX FOR UCI

	Class 0	class 1
Class 0	68	1
Class 1	4	225

TABLE II
CONFUSION MATRIX FOR ‘REAL’ DATASET

	Class 0	class 1
Class 0	38	1
Class 1	2	128

When used on the ‘real’ dataset, the confusion matrix was found to be as shown in Table II:

The results obtained for individual data sets have been summarized in Table III, in terms of classification accuracy.

TABLE III
ACCURACY RATES OF HYBRID PREDICTIVE ALGORITHM

Data Set and Number of Attributes	Accuracy
UCI (10)	98.32%
Real (31)	98.22%

VI. CONCLUSION

A hybrid algorithm combining fuzzy feature processing and enhanced Kalman filter with a Support vector machine based classifier has been proposed. The amalgamated algorithm was used for prognosis of breast cancer by identifying a sample to be belonging to either ‘benign’ or ‘malignant’ class. Three types of datasets were used for testing the algorithm. Apart from the publicly available datasets of the UCI and WDBC, efforts were put in collecting data from actual patients in the state of Rajasthan, India. The satisfactory results obtained with the proposed hybrid algorithm provide encouragement for the adoption of machine learning based approaches for cancer prognosis.

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The Analysis of Fruit Ripening Level from Diffusion of Gases by using Data Mining Techniques

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Abstract

The purpose of this research aims to analyze fruit ripening level from diffusion of gas by data mining techniques. Due to the fact that Ethylene is associated with fruit ripening level. A tool, Arduino board connected with MQ3, MQ6 and MQ8 detection sensors, has been developed for the assessment. These sensors are substituted for Ethylene one which is quite expensive. After collecting 160 data by this tool, data mining procedures are mainly used for data clustering and classification. The experimental result demonstrates that K-Means clustering algorithm classify durian ripening level into 4 types; 1) unripe, 2) pre-ripe, 3) ripe, 4) overripe. When it comes to classification, various types of algorithm, for instance, Decision Tree, K Nearest Neighbors (KNN), Neural Network, Naive Bayes and Support Vector Machine (SVM), have been compared by accuracy rate of their performance through cross validation procedure. It has been found that Support Vector Machine and Neural Network algorithm are similarly the most accurate. However, the accuracy of all algorithm in this experimental closely to 100%, these algorithms can be further developed to analyze fruit ripening level from diffusion of gas analysis.

Keywords: Ethylene; Ripening; Gas Sensor; Data Mining; Clustering; Classification

1. Introduction

Thailand locates in tropical climates area; therefore, there are various different kinds of fruit, which can be categorized in many ways according to chosen classification factors. This research emphasizes on the analysis of fruit ripening level, which it is divided into 2 types by fruit respiration rate [1]. Fruit which respiration rates change after full grown harvest, so called climacteric fruit, such as banana, mango, papaya and durian. On the other way, one which respiration rates is unchanged or has minimal change after full grown harvest, non-climacteric fruit, such as orange, pineapple, lemon and rambutan.

Problems related to fruit collection, transportation and trade, always come along with climacteric fruit. Whenever farmer, entrepreneur or distributor is fail to manage in harvesting and transporting fruit so it is not to meet consumers' requirement. It also wastes cost and time to store additional goods. Several researches study in ripening level of fruit control during harvesting and transporting procedure [2], [3], [4]. However, this research indicates that climacteric fruit and non-scientific identifical color change of fruit are able to be classified by its ripening level. Farmers and distributors is still able to specify how much of fruit ripening level though their experiences and its color observation. Even though, it is difficult to observe non-climacteric fruit, such as durian and jackfruit, which its color is unchanged or has minimal change. Farmers and distributors must have much more experiences on observation. This study conceives to analyze fruit ripening level from diffusion of gases by using data mining techniques. Durian is used for the experiment as non-climacteric fruit samples which cannot be apparently notice its ripening level. As

its fame known as “King of fruit”, durian bring Thailand reputation to around the world [5]. Each consumer always picks different ripening level of durian. As per further study on other research, ripening level of durian can be classified into 3 levels; unripe, ripe and overripe [6]. In fact, portion of Thai people consume different level of ripening which is pre-ripe durian. Refer to the research which study on papaya’s physical change, it is indicated that unripe level appeared to be apparently changed on its skin color to be yellow around 10 - 20% [7]. As well as other kinds of fruit, their skins turn from green to partial yellow. Due to these facts, this research chose to classify ripening level of durian into 4 levels; unripe, pre-ripe, ripe and overripe. Unripe one can be fried as crispy durian chips. Overripe one would go through a process to be preserved durians. On the other way, most of pre-ripe and ripe ones are distributed to consumers without any processing. Vendors mostly recognize durians ripening level by using wooden stick to tap it or observing its thorn color. Nonetheless, this method cannot be accurate so that they have to chop apart of it and let consumer press their finger on its pulp to re-examine whether its ripening level meet their requirements. Hence, these procedures are still inaccurate and unreliable for consumers. Furthermore, durian need to be partly chopped so that they can examine its ripening level. After studying climacteric fruit ripening process, it can be implied that continuously ripening of the fruit or leaving it in properly condition will let it have numerous change on flavor, color and savor. If fruit ripening process is considered through scientific change, it involves with ethylene. Ethylene appears to be low diffusion in Unripe durians, but high in ripe ones. Assuming that it is significant factor of fruit ripening process [8], [9]. In case that ethylene can be measured so fruit ripening level can be done in the same way. The research purposes to analyze fruit ripening level from diffusion of gases by using data mining techniques to synthesize and classify data. This study would help farmers, entrepreneurs and distributors to devise plan to spend less time for delivery and cost less money on stocking, including to efficiently select durian and measure its ripening level to sell consumers.

2. The Proposed Method for Analysis of Fruit Ripening Level and Implementation

Arduino, microcontroller board, can be used as diffusion of gases detection for benefit on analysis. It can be connected with numerous kinds of sensor, including gas sensor. Providing that ethylene gas sensor connect with Arduino board, then it would detect ethylene gas to collect data for further analysis. Due to the fact that this sensor type is hard to find in general store in Thailand and price is higher than other ones as hydrogen gas sensor or alcohol gas sensor, so that this research detect gas by using MQ3, MQ6 and MQ8 gas sensors instead. As chemical formula analysis of ethylene, C_2H_4 [10] refer to 2 carbon atoms and 4 hydrogen atoms. MQ3 gas sensor is used for detection of alcohol and ethanal (Ethanol; C_2H_5OH) which its elements are ethylene (C_2H_4) and water (H_2O) [11]. Then, MQ6 gas sensor is used for detecting hydrogen gas. Nevertheless, it is no sensor tool to detect carbon gas (C) so this experiment provides MQ8 gas detection sensor for LPG, consisting of propane and butane, which carbon is main element of it [12]. During Arduino board is processing, MQ Gas Sensors will transfer Norazlan amount of gas volume data to collect and display the result before it is evaluated by using data mining techniques. On the experiment, plastic box has developed for fruit ripening level assessment which finish installing Arduino board and relevant gas sensors, along with ventilation fan to pull out durian’s diffusion gases to be processed in figure 1.

Furnished plastic box in figure 1 is used for measuring alcohol, hydrogen and carbon gases level. When durian is put into this tool, amount of diffusion gases data will be displayed in diagram and figure. The researchers start collecting data when the number in diagram go to the highest and saturation point and then gather amount of durian’s gas data.



Figure 1: Display the plastic box for fruit ripening level measurement.

After gathering required data, it was analyzed by using clustering data mining technique to preliminary examine how many groups it can be classified. Classification technique was used for creating model to inspect fruit ripening level. To initiate, 160 attributes of data are collected and processed by cross validation technique [13]. In this experiment, various algorithms; Decision Tree, K Nearest Neighbors (KNN), Neural Network, Naïve Bayes and Support vector machine (SVM), were used to create models. After that, comparison has been made to find which one has the most accuracy rate. This research has been designed experiment into 3 steps; 1) create tools for gathering various gases amount data, 2) evaluate fruit ripening level by people and collect data from each type of sensors, 3) bring all gathered data for data mining.

3. Experimental Result

After developing tools to collect gases amount from durian, the study found that unripe one which cut from its tree would have high respiration rate (ethylene) that is similar to ripe durian at peak rate. It can be demonstrated from gases amount on durian. Data is collected and processed in data mining progress after specialists have been invited to evaluate fruit ripening level. The result of this experiment is as following:

K-means clustering has been used for classification group of fruit ripening level. As per relevant studies, it is found that K-Means is efficient for accurate group number classification [14], [15] by assigning mean or centroid of each cluster, finding distance from data to each mean and then grouping data with nearest neighbor mean of each cluster. After calculating distance, mean would be changed and classification group goes on until data group in each cluster is stable. There is no initializing label in this experiment so as to using K-Mean clustering technique to classify 3 gas data group. Primarily, the theory of this research divide fruit ripening level into 4 types as Thai people commonly get used to. Nonetheless, number of clustering group, K value, is assigned to be 2 to 6 for the purpose of what the result of K-means clustering shall be. The result displays as following table 1.

As per table 1, k=2 can be classified as 1) unripe or overripe, 2) pre-ripe or ripe. However, the result is not efficient due to their extremely different on how it has been chosen in the market. If k=3, it will be separated to 3 cluster group; 1) unripe, 2) pre-ripe, 3) ripe or overripe that are full of errors, for examples; unripe (2) in cluster_0, overripe (3) in cluster_1 and ripe (6) in cluster_2. When it comes to k=4, it can be classified into 4 groups; 1) unripe, 2) pre-ripe, 3) ripe, 4) overripe which small error include unripe (2) in cluster_0 and overripe (2) in cluster_3. However, numerous data in column k=5 and k=6, which are much different from each other such as unripe or overripe, appear in wrong clustering group. In conclusion, the most perfect k variable, or numbers of clusters, for durian ripening level classification by 3 type of gases detecting, is k= 4.

Table 1: Display k variable in K-means clustering algorithm.

k cluster \	k=2	k=3	k=4	k=5	k=6
cluster_0	unripe(40), ripe(1) overripe (39)	unripe(2), ripe(34) overripe(37)	unripe(2), ripe(38)	unripe(25), overripe(2)	unripe(13), overripe(8)
cluster_1	unripe(40), ripe(39) overripe(1)	unripe(38), overripe(3)	ripe(40)	ripe(40)	unripe(23), overripe(1)
cluster_2		pre-ripe(40), ripe(6)	pre-ripe(40)	overripe(26)	ripe(38)
cluster_3			unripe(38), overripe(2)	unripe(15), overripe(12)	unripe(4), ripe(1), overripe(19)
cluster_4				pre-ripe(40)	pre-ripe(40)
cluster_5					ripe(1), overripe (12)

Durian ripening level classification needs significant constituent element, gas amount detected by sensors. Due to this, properly algorithm has been chosen for the assessment. Decision Tree, K-Nearest Neighbor (KNN), Neural Network, Naive Bayes and Support vector machine (SVM) algorithm has been used for this research and compare which one is the best.

Firstly, default parameter set had been assigned in every algorithm to create model, and to compare each other for finding the most efficient and accurate one. Experiments with optimize parameter set was later performed and reiterated. The result is shown in Table 2.

Table 2: Display efficiency of algorithm in comparison.

Algorithm		Unripe accuracy	Pre-ripe accuracy	Ripe accuracy	Overripe accuracy	Average accuracy
Decision Tree	Default Parameter Set	100%	97.50%	97.50%	97.50%	98.12%
	Optimize Parameter Set	100%	100%	100%	97.50%	99.38%
K Nearest Neighbors (KNN)	Default Parameter Set	100%	100%	100%	97.50%	99.37%
	Optimize Parameter Set	100%	100%	100%	97.50%	99.38%
Neural Network	Default Parameter Set	100%	100%	99.99%	99.99%	99.998%
	Optimize Parameter Set	100%	100%	100%	99.99%	99.999%
Naive Bayes	Default Parameter Set	100%	97.50%	97.50%	100%	98.75%
	Optimize Parameter Set	100%	97.50%	100%	100%	99.38%
Support vector machine (SVM)	Default Parameter Set	100%	100%	97.50%	100%	99.38 %
	Optimize Parameter Set	100%	100%	100%	100%	100%

Refer to Table 2, default parameter set has been assigned to each type of algorithm. It is found that Neural Network, Support vector machine and K Nearest Neighbors (KNN) algorithm are subsequently accurate than other ones. During the default parameter set assignment, Naive Bayes and Decision Tree are less accurate. However, optimized parameter has been adjusted and accuracy rate is raise to more than 99%.

4. Conclusion

Gas detection sensors, MQ3, MQ6 and MQ8, are developed as tools for measuring durian's gas amount to collect data from 160 durian samples. According to the data, it has been analyzed by clustering data mining process for group data classification. K-means algorithm used for categorizing group in this

experiment. It reveals that fruit ripening level from diffusion of gases can be separated into 4 group of data; unripe, pre-ripe, ripe and overripe, which the result is similar to studies method and match with the types of durian level for consumer purchase.

Furthermore, the reason why the chosen models inaccurately categorize group, is durian's unstable respiration rate which raises when durian is unripe, and decrease when it is ripe. Later, it comes up to peak rate once it is overripe. Due to the fact that the respiration rate and diffusion gases at different ripening level are almost the same, the algorithms conduct and display inaccurate results.

Classification technique has been used on durian ripening level from diffusion of gases analysis. Initially, model was created to measure ripening level. This study applies all of 5 algorithms; Decision Tree, K Nearest Neighbors (KNN), Neural Network, Naïve Bayes and Support vector machine (SVM). As a result of rapid miner default parameter, Neural Network, following with Support vector machine and K Nearest Neighbors, are the most accuracy algorithm. On the other hand, Naive Bayes and Decision Tree are lower at accuracy rate. Parameter is later modified in Rapid miner. This experiment refers that the most accurate classification algorithm model is Support Vector Machines (SVM) consisted with relevant studies, a Comparative Efficiency of Neural Network Classification for the Diagnosis of Heatstroke [16], Developing and Effective Automatic Thai Document Categorization [17] and Thai Social Media Alert System for Business by Support Vector Machine [18]. Hence, SVM is the most appropriate and accurate method to assess fruit ripening level. In future research, tools will be developed for durian ripening level measurement by Arduino board. Algorithm would be considered other facts further than accuracy rate, for instance, difficulty of using models for developing and data processing speed.

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Mixed Facial Emotion Recognition using Active Appearance Model and Hidden Conditional Random Fields

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Abstract

Automatic emotion recognition through facial expression analysis is an emerging topic on affective computing and social signal processing which gains more attention. The development on this field has many influences in human life related to the machine interaction understand human to meet human needs. Existing research on emotion recognition focuses on recognizing basic emotions (happy, sad, surprise, disgust, fear, and angry), but less effort has been done for mixed emotion recognition due to its complexity. The challenge on mixed emotion recognition as a combination of basic emotions are still widely open and has not much been explored. We proposed a combination of Active Appearance Model (AAM) as a facial feature extraction framework and Hidden Conditional Random Field (HCRF) as a temporal classifier with hidden states as a model of mixed facial emotion recognition. The experiment on an arranged temporal CK+ dataset and our own mixed emotion dataset shows an improvement in accuracy rate compare to our previous methods, original CRF and SVM-CRF classifier.

Keywords: mixed emotion recognition, facial expression analysis, active appearance model, hidden conditional random fields.

1. Introduction

One of the biggest research challenge in intelligent machine is on exploring human behavior and how they interact with their environment. Social Signal Processing (SSP) is a research area which aims at bridging human and computer interaction through the analysis of nonverbal signal (social signal) such as facial expression, intonation, gesture, and body position [1]. Research on machine learning to analyze and synthesize human emotion become a leading issue. Recently, facial expression analysis has become a research focus because face gives more information about human emotion. Facial expression conveys 55% information of human emotion in a daily communication compared to another social signal [2].

Automatic facial expression recognition is amongst the hot topic in SSP and still facing many challenges. This field has many potential applications, such as in human computer interaction, human emotion analysis, robotics, biometric recognition, lie detection, special needs treatment, entertainment, and education. Particularly in human emotion analysis, human has variety of emotions from facial expressions including basic and mixed emotions. Mixed emotion from facial expression is somehow uneasy to be recognized even by another human. Designing a machine learning algorithm to recognize human complex emotions is by far still an open challenge [3].

This research encompasses two aspects; understanding mixed emotion in terms of human facial emotion and modeling the recognition of mixed emotion from facial expression images using machine learning classifier. We collaborate Active Appearance Model (AAM) as a framework which produces facial landmark and the Hidden Conditional Random Fields (HCRF) as a sequence classifier with hidden layer which yields mixed emotion's class label for sequence of images input. we organize our research paper into six sections. We start with introduction about the problem, related works on human facial emotion recognition, the design of the proposed work, experiment and results, and conclusion.

2. Related Works

Facial expression analysis and recognition aims to classify the emotion on a face image. Referring to Sumathi et al., facial expression analysis involves three stages: facial acquisition, feature extraction, and facial expression recognition [3]. Facial acquisition separates facial area from non-facial area in an image. Feature extraction extracts facial area into feature vectors, and facial expression recognition classifies feature vectors into appropriate emotion classes. Face acquisition is the first step to detect face either from a single image or on a set of images. Many methods applied for face detection including edge detection, boosting techniques, and automatic segmentation [4], [5]. Wu (2015) used Restricted Boltzmann Machine to detect face points [6].

Two common feature extraction technique for facial expression recognition are geometric and appearance feature extraction. Geometric features used facial points location (e.g. eye corner, lip corner, etc.) or face component's shape (e.g. eye, eyebrow, mouth, etc.). Appearance features used texture of face which is robust to the illumination variation [7]. The frequently used methods are Gabor wavelet and Local Binary Pattern (LBP) because it tolerates illumination changing and has simple computation [8]. Both features have strength and weakness. Appearance features might be good at handling the variation of illumination but it is less sensitive to a small shift. This weakness can be covered by geometric features which use the face area to describe changes in it. On the other side, geometric feature is lack of texture information. Good feature representation can be obtained by combining the strength of various features, this is called hybrid features [9], [10]. Active Appearance Model is a framework which combines appearance and texture features to produce facial landmarks [11]. Feature extraction plays an important role in facial expression recognition because at this stage the feature vector is generated as an input to the next stage and determines the recognition result.

Facial expression recognition is the last stage in facial expression analysis. There are two categories, frame-based and sequence-based. Frame-based expression recognition does not use temporal information in an input image. The input can be either a static image or separated image frames. Mostly, SVM is used as learning methods for facial expression recognition because it gives a high accuracy rate [12], [13]. Other methods are also applied with good results, such as multilayer perceptron (MLP) [8], convolutional neural network [14], [15], and fuzzy clustering [16]. Sequence-based recognition uses temporal information of the input sequence to recognize the expression of one or more frames. Sequence-based is more challenging because it used sequence classifier such as HMM and CRF, and it needs different modelling and representation [17]–[19]. The existing facial expressions recognition using temporal information used sequential classifiers such as Hidden Markov Model [17], [18] and Conditional Random Fields [19]–[21], and HCRF [19], [22].

Majority research on emotion recognition are classifying six classes of basic emotion (happy, sad, surprise, fear, disgust, and angry). Somehow, human real emotions are more complex and widely involving mixed emotion. Research on mixed emotion recognition is still on initial phase. Du et. al (2104) developed compound emotion recognition, a combination of basic emotions in one image [23]. Their research identified 21 classes of mixed emotions which consisted of 6 classes of basic emotions and 15 classes of compound emotions from still images and applied SVM for classification. Our previous works has been successfully classified 12 classes of mixed emotion on temporal image frames SVM-CRF classifier [24]. Our proposed work is using hidden structure of HCRF to repair the sequence classification process and to increase the accuracy rate.

3. Mixed Facial Emotion Recognition

We design temporal mixed facial emotion recognition using the combination of AAM and HCRF on a sequence of images. The recognition phase consists of three steps as in Figure 1, facial feature extraction and sequence mixed emotion recognition. The input to the system is a sequence of image frames which contains basic emotion in each frame. This sequence of basic emotions forms a mixed emotion class as result of the recognition. AAM extracts facial landmarks of each image frame based on the mean shape of reference image. Subsequently, HCRF classified the sequence of basic emotion classes into the respected mixed emotion class.

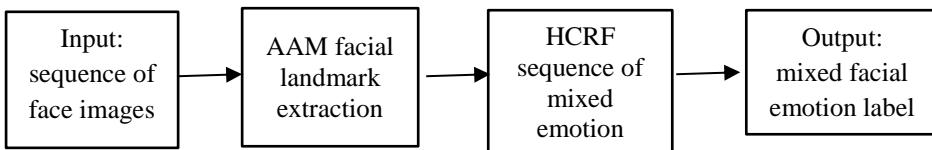


Figure 1. Mixed facial emotion recognition phases

3.1. Mixed Emotion

Emotion is an important element in social interactions since it shows a response in communication. Psychologist Ekman and Friesen define basic emotion as a separate discrete emotions which significantly differ from one another [25]. They categorized six classes of basic emotions: happy, sad, angry, surprise, disgust, and fear. They also organized basic emotion into a hierarchical of emotion family based on characteristics similarity such as expression similarity, psychological activity, and the event that trigger those emotions to occur. These characteristics distinguish emotion classes from one another.

Mixed emotion is an affective experience which involves two basic emotions, usually the opposing valence emotions such as happy and sad. The definition implies that there is emotion states transition over the time [26]. Moreover, an emotion can elicit other emotion instantly to develop an emotional experience. This is shown by the combination of facial expression in a short time duration [27]. Basic emotions are fundamental emotions in life which can be used as a guide to explain more complex other emotion. We used 12 classes of mixed emotion, as in Du, et.al. (2014) [23]: happily-surprised, happily-disgusted, sadly-surprised, sadly-fearful, sadly-disgusted, sadly-angry, fearfully-surprised, disgustedly-surprised, angrily-surprised, fearfully-disgusted, fearfully-angry, and angrily-disgusted.

3.2. Facial landmarks by AAM

Active Appearance Model is a statistical template matching model which captures facial characteristics and yields facial landmarks or facial points as an output [28]. AAM is a framework that works with the principle of feature extraction and combine both of shape and texture features on a face image. Those features are extracted using PCA to create a face model which consists of several landmarks or coordinate points. Facial points are scattered on specific face region: jaw, eyebrows, eyes, nose, and mouth.

AAM framework consists of several procedures which sequentially adjust the shape to the mean shape by using Procrustes method. AAM is applied on each face image and resulting a pairwise vector of facial point coordinates. AAM result becomes the input of the next phase, the recognition phase. At the next step, SVM is employed as a classifier of basic emotion class. SVM is chosen because of its high accuracy rate on classifying the multiclassification problem.

3.2. HCRF for Mixed Facial Emotion Recognition

Conditional random fields (CRFs) is an undirected graphical model which predicts the label of a given sequence by maximizing the conditional probability of sequence variables [29]. CRF has been known outperformed other sequential classifier such as Hidden Markov Model (HMM), and Maximum Entropy Markov Model (MEMM). The improvement of CRFs was made by Quattronio, et.al. who proposed the hidden-states of unobserved latent variables or so-called Hidden CRF (HCRF) [30]. HCRF used hidden variables to model the latent sub-structure of the problems. HCRFs discriminatively defines a joint distribution of the class label and the latent variable label conditioned by the observations. Just like hidden state in HMM, hidden variables in CRFs allows the use of training data without explicit label provided. HCRF is used in classification problem with hidden-state learning on local features.

Mixed facial emotion recognition task has an underlying sub-structure which builds the mixed emotion class. This sub-structure consists of sequence of basic emotions with undirected manner. The discriminative approach is suitable for this sequential case, because it discriminates one basic emotion class against other classes. Moreover, the problem can be modeled as a hidden structure using discriminative HCRF to predict the sequence label or mixed emotion label. Previous research on mixed

emotion recognition using CRF has shown promising results, but the model is unsuitable because it does not incorporate hidden variables which is naturally occurs by the problem itself [24].

HCRF is a discriminative model with hidden states and it is well-suited for the mixed emotion recognition problem. The original HCRF by Quattoni used hidden state to capture the spatial dependency between hidden object parts [30]. We model the HCRF to the sequence of input where the underlying sub-structure captures the temporal dependency between image frames. We design the HCRF sequence classifier for each observation x of a class label $y \in Y$, where x is a vector of m sequence of observations $x = \{x_1, x_2, \dots, x_m\}$. In our problem, x_i is an observation of facial image frame i . x_i is represented as a feature vector $x_i \in R$. The conditional probability of a mixed emotion class label from a sequence of image facial expression frames is computed using HCRF model:

$$P(y|x, \theta) = \sum_h P(y, h|x, \theta) = \frac{\sum_h e^{\psi(y, h, x; \theta)}}{\sum_{y' \in Y, h \in H^m} e^{\psi(y', h, x; \theta)}} \quad (1)$$

where $h = \{h_1, h_2, \dots, h_n\}$ is a set of hidden states in the model and each $h_i \in H$ captures the underlying structure of each six classes of basic emotion. Ψ is a potential function using parameter Θ to measure the label y , observation x and hidden states. In regular CRF, there is a certain label and no hidden states h , assuming that h is observable class. We used gradient ascent learning to gain the optimal value for θ by maximizing log likelihood of the data where $\theta^* = \text{argmax}_\theta L(\theta)$.

4. Experiments and Results

We test our proposed AAM HCRF model and compare it results with CRF model, and SVM-CRF model on a modified CK+ dataset [31] as well as our own made mixed emotion dataset. Each input sequence is limited to seven image frames consist of two different basic emotion in arbitrary order that form the mixed emotion. The output label comes from 12 classes of mixed emotion: sadly surprised, sadly fearful, sadly-disgusted, sadly angry, happily-surprised, happily disgusted, disgustedly surprised, angrily-surprised, angrily disgusted, fearfully disgusted, fearfully angry, and fearfully surprised. We arrange sequences of image from CK+ dataset which contains facial images of six classes of basic emotion (happy, sad, surprise, fear, angry, and disgust). We used 306 images as training data and create 80 sequences of testing data. We run experiment on our own dataset consists of 12 mix emotion classes from 15 subjects; Indonesian citizens with different ethnicity (Javanese, Batak, Sundanese, Malay, and Chinese). Our own mixed emotion dataset gives 270 training data and 48 sequences of testing data. Figure 2 gives example of images sequences from both dataset.

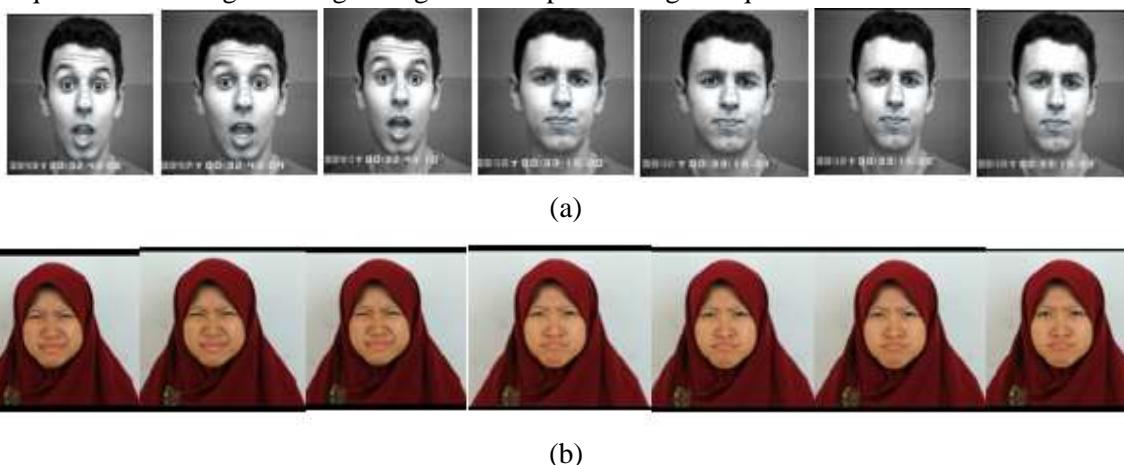


Figure 2. Sequence of image frames (a) CK+ dataset (b) mixed emotion dataset

AAM produces vector of 68 landmarks on each input image. Figure 3 shows the AAM result implemented using MATLAB programming. This vector becomes the input to the HCRF sequence

classifier. Figure 4 is a screen capture of the HCRF classification result over an instance of image sequence.



Figure 3. AAM facial landmarks



Figure 4. HCRF classification result

Table 1. Experiment results

Method	Accuracy (%)	
	CK+	own
CRF	82.65	77.5
SVM-CRF	90.48	83.33
HCRF	93.19	85.71

We compare our proposed HCRF classifier with the original CRF and SVM-CRF classifier from our previous works [24]. Table 1 summarizes the result. HCRF gains higher accuracy rate compare to the other methods, both on CK+ dataset and own mixed emotion dataset. On CK+ HCRF accuracy rate is 93,19%, while in own dataset is 85.71%. The proposed HCRF classifier has improved the accuracy rate than the original CRF as well as SVM-CRF methods.

5. Conclusion

We extend the common research on facial expression analysis for basic emotion recognition into a more real-complex mixed emotion recognition in a temporal dimension by collaborating Active Appearance Model and Hidden Conditional Random Fields. To the best of our knowledge, there is no reporting use of AAM-HCRF for mixed emotion recognition previously. AAM is a framework which produces facial landmark dynamically and HCRF works as a sequence classifier with hidden states that yields mixed emotion's class label for sequence of images input. The experiment shows that our proposed HCRF model outperforms the existing sequential classifier model and the accuracy rate is 93.19%. Our next will focus on increasing the performance of HCRF by modifying the internal structure as well as optimizing the learning algorithm.

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Smart Bus: An Automated Passenger Counting System

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Abstract

Smart Bus: An Automated Passenger Counting System is a hardware and mobile-based application system. This research involved the design and implementation of automated passenger counting which provides a solution to remove syndicate and corruption in the transportation sector. It counts how many passengers are sitting on the seat and shows on the display screen in real time monitor and the authority can see the total number of passengers. No paper receipt is needed to ride on the bus. It enables transport authority to obtain accurate bus fare from bus drivers and helpers remotely instead manually counting where corruption happens. This system is made with Arduino Uno, Bluetooth HC-05 module, pressure pad, potentiometer, data collection software module (Arduino IDE, Bluetooth terminal HC-05). The proposed passenger counting system would be beneficial for both bus owners and government (BRTC- The Bangladesh Road Transport Corporation). As a working prototype, this system has been detecting 3 seats with an accuracy rate of 90%.

Keyword: Smart bus; Automated Passenger Counting in Bus; Pressure Pad; Digital Display Screen; Bluetooth HC-05.

1. Introduction

Bangladesh is ranked 4th in the world's most populated country. According to the population survey of 2014, the Great Dhaka city has the population of approximate 1.7crore people [1]. Moving around inside the most densely populated city like Dhaka, turned out to be a headache for every general people. Due to the high travel fare in Taxi cabs, CNG and UBER, most of the people cannot afford them. So, they choose local bus services as their preferable transport because it is the cheapest and efficient way to travel but they had to face another problem which is corruption. This is a prime reason behind an unorganized transportation system. The drivers and the helpers don't care about their customer's comfort. They take passengers as much as they can and they give less amount of money to their authority. But it is possible to overcome this problem through an automated transport system. Our automated bus service will work like a virtual helper for the bus authority.

2. Concept Review

2.1 Proposed System

In our proposed android system, any passengers who will board, it will be shown in the display monitor installed in front of the bus. No manual counting would be needed. If there is no passenger on seat, it will show a blank seat. But when a passenger will be seated on the bus, it will show occupied on the display screen. Display will change the color for each seat occupied. The display database updates in every 30 sec. There will be some checkers for every stoppage. When the bus reaches any stoppage, checker will enter into the bus. He will access into the display database by giving his login credentials and send the updated data to server. So that, from every starting point to destination, the actual number of passengers will be automatic counted and it will reduce the window of corruption.

2.2 System Design

In this system, it has a pressure pad beneath every seat and the pressure pad acts like an open circuit connected to Arduino microcontroller and variable resistors. When passengers are sitting on the seat, pressure pad becomes closed circuit and passes the voltage into the circuit. The voltage goes to Arduino IDE and the Arduino converts the voltage into a digital signal like 0, 1. It means when a

passenger is sitting on the seat, it passes the value as 1. Also, when there is no passenger, it passes the value as 0.

2.3 Work Flow process

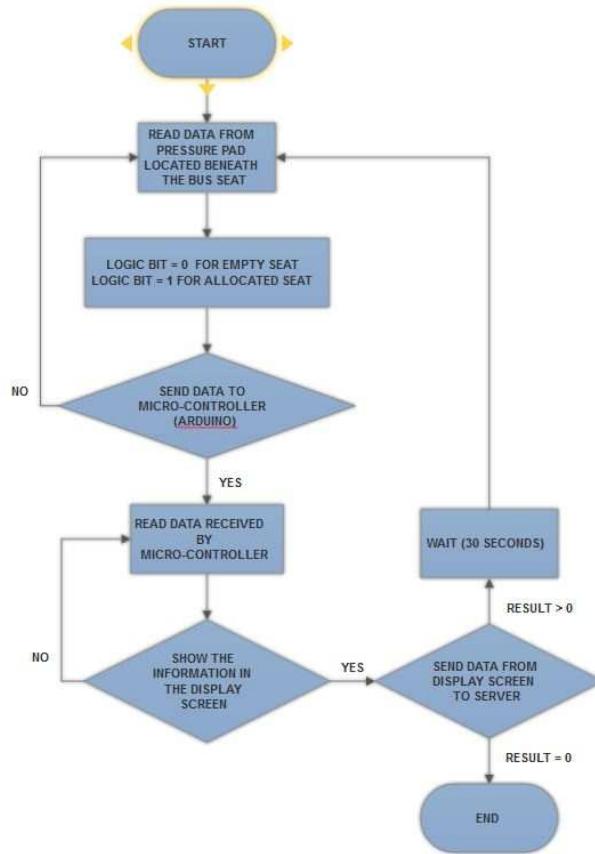


Figure 1: Flowchart of the Proposed System

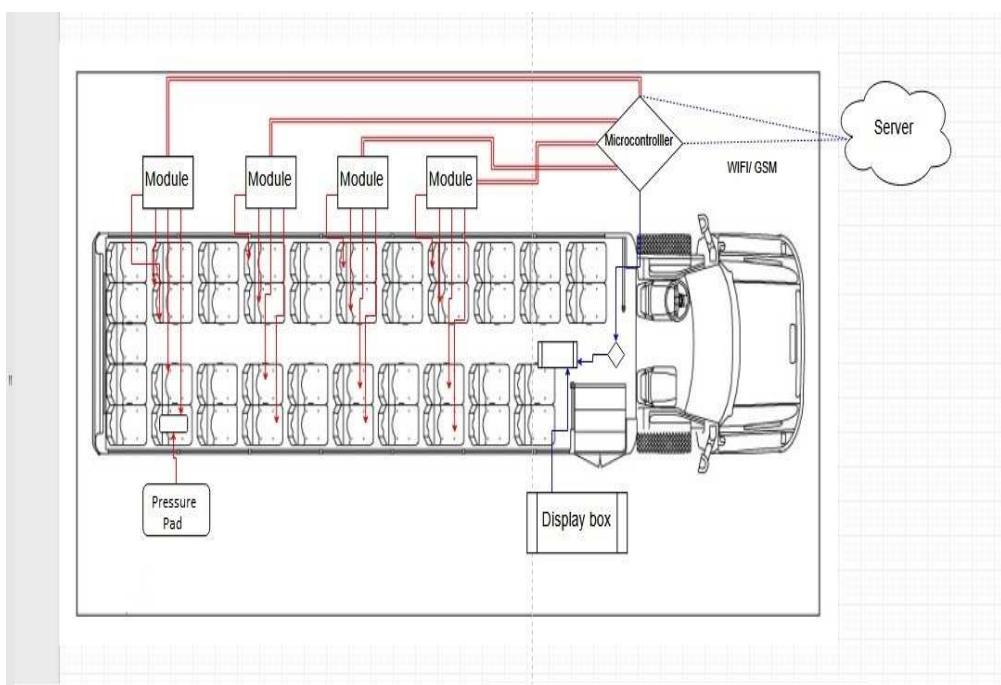


Figure 2: Proposed System Architecture

2.4 Operating Environment

List of Hardwires

1. Arduino Uno (microcontroller)
2. Bluetooth HC-05
3. Potentiometer
4. Pressure pad
5. Touch screen display/ Tablet

List of Software and Programming Language

1. Java
2. XML
3. MySQL
4. PHP
5. Python
6. Android Studio
7. Arduino IDE
8. HC-05 Bluetooth Terminal

2.5 Circuit description

Phrase 1: Making Pressure Pad

We made a pressure pad which will work as a pressure sensor for our project. Pressure sensor does its job as a pressure-sensitive component which measures the pressure of an object and converts the experiment value into an electrical signal output. We made the pad by placing aluminum paper and foam sandwiched between two cardboards. The foam will work as an inductor between cardboards. With the help of two wires, pad directly connected to the Arduino. As shown in the figure 3, when we give a pressure on the pad, it activates and gives an analog signal.

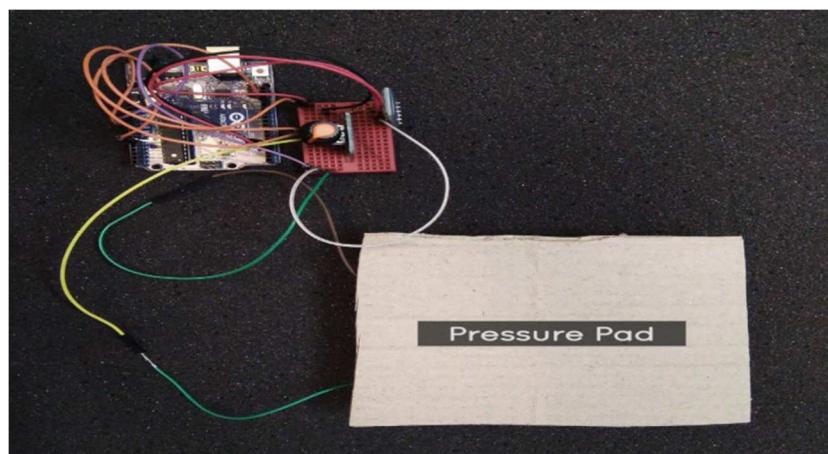


Figure 3: Pressure Pad Connected With Arduino

Phrase 2: Using Arduino Uno

Pressure pad is connected to Arduino through a bread board. In the Arduino board, we connected one terminal of the pressure pad to the 5V DC supply and the other across the VCC terminal of the potentiometer. Later, we connected the GND to the Arduino board and the signal to the analog AO port. This would give an analog voltage signal when a pressure was applied to transmit the signal using a module. We converted the analog signal to digital signal (1 and 0) using Arduino IDE.

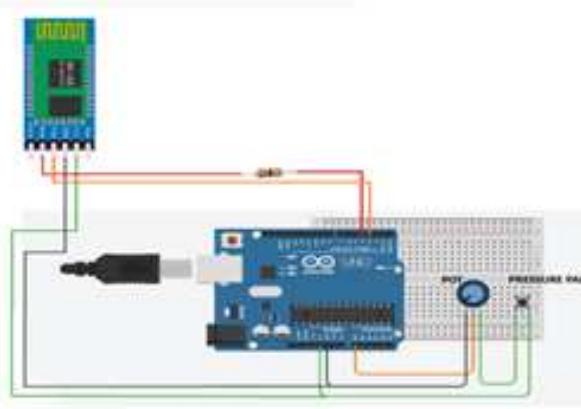


Figure 4: Block Circuit Diagram of the Proposed System

Phrase 3: Process Operating Bluetooth Terminal HC-05

We have used HC-05 Bluetooth module to transmit the signal because it is the most economical and easiest way to go wireless and also designed for transparent wireless serial connection setup. For conduction we get 1 and for open we get 0(zero). We connected the VCC and GND to the Arduino board and the TXD to port 3 of PWM region and the RXD through a resistor to the PWM of the port 4. As shown in figure 8, Bluetooth detected the value as on/off which represents whether there is any passenger in a seat or not.

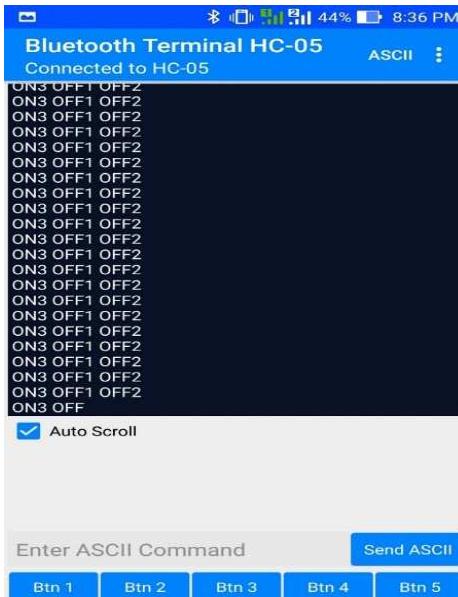


Figure 5: Receiving output from Bluetooth Terminal HC-05

2.6 Application Description

The display was designed for android mobile platform. We added different features like seat icon, checker id, password and complain box. After entering the bus, checker gives his login credentials and send updated info to authority server. In the complaint box, the passenger can complain about the driver, or service to the authority.

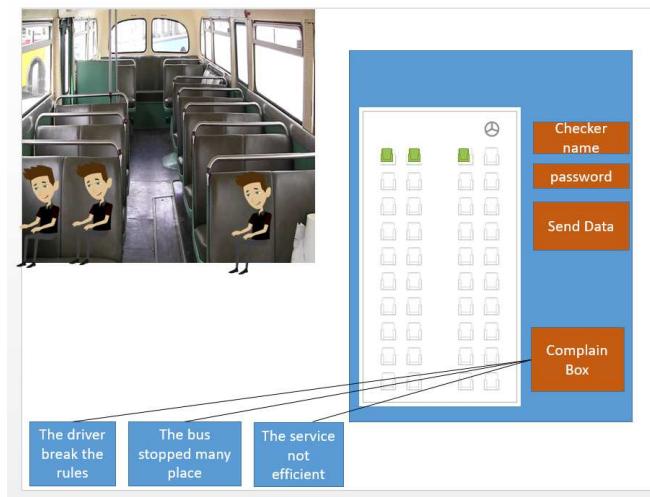


Figure 6: Proposed System API

3. Result and Discussion

We have done testing for three consecutive seats to compare the results. In this stage, we checked several functionalities. 1st of all, we checked the pressure pad whether it is working properly to pass the value or not. After that, we checked display screen. When we created pressure for a seat, display became RED color which means that particular seat is occupied. Later, we checked if the data is going to server accurately or not. The result comes in affirmative. Then the data goes to the server and authority can monitor the whole system.

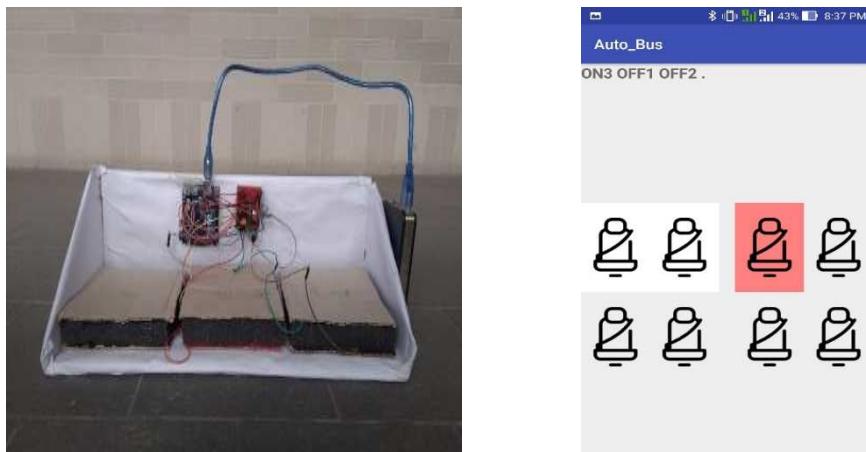


Figure 7: (a) Proposed hardware implementation, (b) Output in the display screen

We also examined the bus seats to figure out if our system can detect the seats and verify total amount of weight it required to send data. In the table 1, it is shown the different weights on the single seat that we have tested and the observed results if any signal was coming out or not. We came out with these readings.

TEST NUMBER	WEIGHT (KG)	RESPONSE	METER READING	SEATING PATTERN
1.	0	0	Not seated	-----
2.	2	0	Not seated	-----
3.	4	0	Not seated	Unknown
4.	8	0	Not seated	Unknown
5.	12	0	Not seated	Unknown

6.	16	0	Not seated	Unknown
7.	18	0	Not seated	Unknown
8.	20	1	Seated	Normal
9.	30	1	Seated	Normal
10.	44	1	Seated	Normal
11.	57	1	Seated	Normal
12.	61	1	Seated	Normal
13.	75	1	Seated	Normal
14.	89	1	Seated	Normal

Table 1: Different weights on the seat

Here we tested for empty seat first and there was no signal (0 in the output). 0 means not seated. After that, we put different weights but under 20KG there was no response. When we put 20KG on the seat, result was 1 which means seat occupied. So the pressure pad is able to detect a weight of 20KG or above. We put highest 89KG weight and we could put more weight on the seat.

4. Conclusion:

In this paper, we have presented an automated system for passenger counting in sitting service bus. The proposed project provides efficient and innovative way to give complete access, flexibility and satisfaction to the authority. It will work like a virtual helper. Corruption problem cannot be erased in one day but it can be cured if we stand against the matter. Our system can be a milestone to reduce the corruption in public transport system in Dhaka.

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Classification of EEG Signals during Meditation and Controlled State Using PCA, ICA, LDA and Support Vector Machines

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Abstract

In this work, the adaptable signal processing algorithm is proposed for Electroencephalogram (EEG) signals. In this algorithm, the Discrete Wavelet transform is applied to EEG signals for decomposing it into its frequency sub-bands. Statistical analysis is applied to these sub-bands to extract the statistical features which characterize the distribution of wavelet coefficient. Several classification algorithms such as Independent Component Analysis, Principal Component Analysis and Linear Discriminant Analysis which is popularly called as ICA, PCA, and LDA respectively is applied to these features to reduce its size. Then these reduced features applied to SVM classifier which categorizes the EEG signals into Meditation state and Controlled (Normal) state. Here Performance accuracy from different classifier is evaluated and then compare to know which classifier is best suited for EEG signal classification for meditation and controlled state. The meditation method used here was Vipassana Meditation which is a type of mindfulness meditation practice. The finding from above procedure gave the best classifier for classification of EEG signals during controlled and meditation state.

Keywords: Electroencephalogram (EEG); Meditation; Independent Component Analysis (ICA); Principal Component Analysis (PCA); Linear Discriminant Analysis (LDA); Support Vector Machines (SVM).

1. Introduction

Electroencephalograms (EEGs) are giving the electrical activity of the brain. EEG signals are a noninvasive method of detecting the brain status. These signals are nonstationary and nonlinear in nature. Hence, mathematical tools such as DFT, FFT are failed to give detail analysis of EEG signals. Hence wavelet Transform is used for analysis of EEG signals since it gives good time-frequency localization. Meditation technique which is used for this work is Vipassana meditation. This is mindfulness meditation technique frequently practices in Southwest part of the world. In this technique relaxing but the highly awake state of mind is achieved. The subject chosen for this research work consisted of 50 novice meditator (25 female and 25 male). These people were from educational and industry background with high-stress level. EEG signals were recorded during meditation practice of 50 novice meditators after 4-weeks of Meditation intervention training at Vipassana Research Institute (VRI), Mumbai.

Amongst the various available feature extraction techniques, Independent Component Analysis, Principal component analysis and Linear Discriminant Analysis (LDA) popularly known as ICA, PCA and LDA respectively are used for feature extraction. Feature extraction is nothing but converting the prevailing feature data into a lower size feature data. This was useful to avoid redundancy due to high dimensional data. Discrete Wavelet Transform (DWT) (db4) has been applied to recorded EEG signals for time-frequency analysis. The wavelet coefficients extracted after application of wavelet transform to EEG signals is then used for classification of EEG signals into Meditation and normal state. EEG signals were decomposed into its corresponding frequency sub-band $\{\delta(0-4Hz), \theta(4-8Hz), \alpha(8-12Hz), \beta(13-40Hz)\}$ using wavelet transform (DWT). Statistical Analysis on these sub-bands is carried out to extract statistical features which represent the distribution of wavelet coefficient. The dimension of these features is reduced using several feature reduction techniques such as LDA, PCA, and ICA. These reduced features are then applied as an

input to Support Vector Machine with two discrete outputs: Meditation and Controlled state. The accuracy is then calculated using several classifiers. The results of these classifiers are then compared and limitations and advantages of these techniques are discussed. Feature Extraction techniques using LDA, PCA, and ICA along with SVM always perform better as compared to without using these techniques. Moreover, LDA with Support Vector Machine achieved the best performance as compared to PCA + SVM and ICA + SVM [2],[4],[9].

2. Materials and Methods

2.1 Subjects and Data Acquisition

The EEG data is acquired from the 50 healthy novice meditator from different age groups. The subjects recruited for this research lies in between 20 years to 60 years with an average age of 40 years. The data were acquired from these subjects using 8-channel NE's Enobio with a sampling frequency of 500 Hz and line filter to remove the AC frequency of 50 Hz. The Enobio was connected to different positions on the scalp with reference electrode connected to left earlobe as shown in Figure 1.



Figure 1. EEG data Acquisition using 8-channel NE's Enobio when Subject Practicing Vipassana Meditation.

The data is recorded for the duration of 2-mins during normal state and 2-mins during meditation state. During the entire duration of these experiments, volunteers were relaxed in an awake state with eyes closed and subjects were in the normal seating position. The data acquired from these methods were further pre-processed for removing noise. The Classification of recorded data is processed as shown in Figure 2.

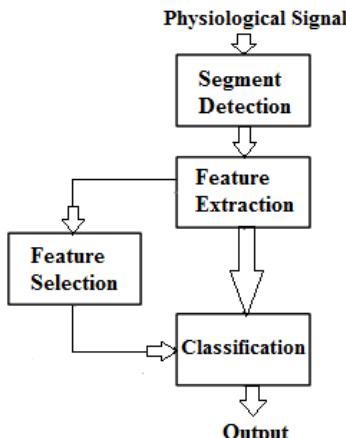


Figure 2. Block diagram of Classification of EEG signal during controlled and meditation state.

2.2 EEG signal Analysis using DWT

EEG signal is nonstationary in nature; discrete wavelet transform (dB4) is applied to EEG data for time-frequency analysis. It is essential to select the proper wavelet and its decomposition level. The proper decomposition level is chosen based on the dominant frequency of the EEG signal. The number of decomposition levels is chosen based on the dominant frequency components of the signal. The criteria for selection of decomposition levels have been chosen such that the part of the signal correlates well with the frequencies necessary for signal classification and it has been preserved in the wavelet coefficients [2],[13],[15].

EEG signal frequency above 30 Hz is not useful, hence after several trials, the number of decomposition level was selected to be 5. The complete EEG signal is then decomposed into the detail coefficient D_1 - D_5 and approximate coefficient A_5 .

The extracted coefficient after wavelet transform applied to EEG signals gives a compact representation that shows the distribution of Energy in frequency and time domain. The representation of frequencies corresponding to different decomposition level for dB4 wavelet has been given in Table 1 with a sampling frequency of 500 Hz [12].

Table 1. Corresponding frequencies after each decomposition level using Daubechies-4 (dB4) filter wavelet with a sampling frequency of 500 Hz.

Decomposed Signal	Range of Frequencies
D_1	43–86 Hz
D_2	21–43 Hz
D_3	10 -21 Hz
D_4	5-10 Hz
D_5	2-5 Hz
A_5	0-2 Hz

The set of feature vectors and statistical features were further reduced with the help of the set of the wavelet coefficients. The following statistical features were used to represent the time-frequency distribution of the EEG signals:

- (1) The Average of the absolute values of the coefficient in each frequency subband.
- (2) The mean power of the coefficients of wavelet transforms in each frequency subband.
- (3) The standard deviation of the wavelet coefficients in each frequency sub-band.
- (4) The ratio of the absolute average values of nearby frequency sub-bands.

First and second features represent the distribution of the frequency components in the signal and the third and fourth represents the number of changes in a distribution of the frequency components. The features vectors These feature vectors derived from frequency bands D_3 - D_5 and A_5 , were utilized for EEG signal classification [12].

Figure 3 shows fifth level EEG signal decomposition using wavelet transform (dB4) with detail and approximation during the normal state. Figure 4 shows fifth level EEG signal decomposition using wavelet transform (dB4) with detail and approximation during meditation state. The reconstruction of these detail and approximation signals takes place using Daubechies 4 (dB4) wavelet filter.

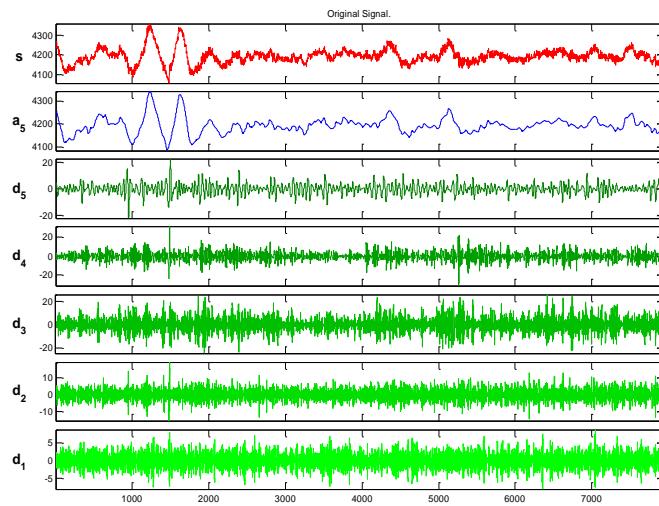


Figure 3. Approximate and detailed coefficients of EEG signal taken during normal State.

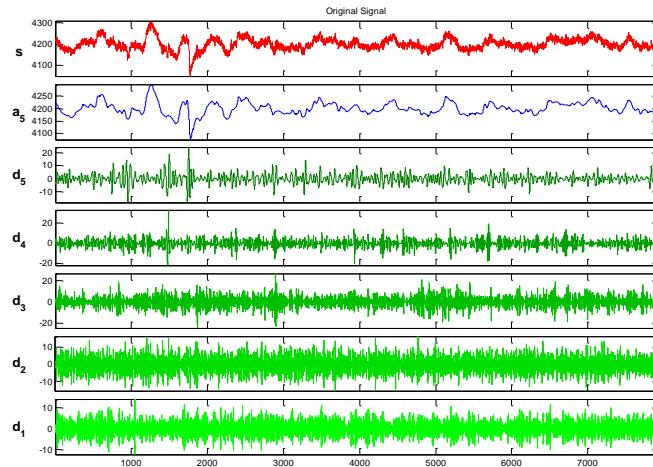


Figure 4. Approximate and detailed coefficients of EEG signal taken during Meditation State.

2.3 Methods of Feature extraction

2.3.1 Principal component analysis (PCA)

There are various methods for the features extractions and dimensional reduction of the EEG signal. Amongst all the available methods, Principal component analysis (PCA) is a well-known method. PCA is used to reduce the d -dimensional data into a lower dimensional space. It will help to decreased time complexities, the degrees of freedom and space. The main aim is to express the EEG data in a reduced space for the sense of a sum-squared error variation. This method is used to segment EEG signals into multiple sources. The basic concept in PCA is theoretically much simple than practically applying it [7],[19],[20].

Initially, the d -dimensional vector for mean values μ and $d \times d$ covariance matrix Σ are calculated for the whole data set. Then the Eigen Values and Eigen Vectors are calculated and organized in decreasing Eigenvalues. These Eigenvectors is represented by e_1 for Eigenvalues by λ_1 and eigenvectors e_2 for Eigenvalues λ_2 and so on. Subsequently largest k such Eigenvectors are chosen. This is achieved by observing the spectrum of the eigenvector. It is often that dimension indirectly an inherent dimensionality of the subspace which regulates the “signal”. The remaining dimensions represent the “noise”. Then this will lead to the formation of matrix A of size $k \times k$. The matrix consists of a column of k eigenvectors that pre-process the data using:

$$x' = A'(x - \mu) \quad (2)$$

This will represent the minimum square error criterion [7].

2.3.2 Independent Component Analysis (ICA)

Another popular features extraction technique is Independent Component Analysis (ICA) which transforms the multivariate random signal into mutually independent signal components. Independent components can be derived from the mixed signals by PCA method. In this way, independence indicates the particulars carried by one signal component cannot be deduced from the other signal components. It clearly indicates that the joint probability of independent quantities is acquired as the product of the probability of each of individual quantity as per the statistics.

Let $x_i(t)$ be the source signal which has c independent scalar for $i=1,\dots,c$. Here t is time index which is $1 \leq t \leq T$. For writing the notation in a simplified way, c values are group into a vector $x(t)$ and assume that it has zero average. Since this is independent assumption where noise is zero, the multivariate density function can be written as,

$$p(x(t)) = \prod_{i=1}^c p(x_i(t)) \quad (3)$$

If a d-dimensional data vector is noticed at each instant, then it is given by,

$$y(t) = Ax(t) \quad (4)$$

where A denotes the scalar matrix of size $c \times d$. The important point needs to note here is a condition $d \geq c$. The main job of ICA is to retrieve the source signals from the sensed signals. Particularly, the real matrix W is written such that,

$$z(t) = Wy(t) = WAx(t) \quad (5)$$

Here z denotes an estimate of the sources $x(t)$ where $W = A^{-1}$. Here both A and its inverse A^{-1} are unknown. Maximum-likelihood techniques are used to determine the matrix A . Here, an estimate of density is used and it is parameterized by $p(y; a)$. Here a represent parameter vector of Matrix A . It minimizes the difference between the source distribution and the estimate whereas $p(y; a)$ is an estimate of the $p(y)$ [7],[10],[20].

2.3.3 Linear Discriminant Analysis (LDA)

The objective of linear discriminant Analysis (LDA) is to produce new variable which is a union of the real predictors. This is achieved by maximizing the distinction between the predefined groups and new variable. The main aim is to merge the predictor score such that single new compound variable, the discriminant score, is established. This is a dimension reduction technique where excessive data is reduced by compressing p -dimensional predictors into single dimensional line. In the last step of the process, each class has normal distribution scores of highest possible distinction in mean scores for the classes. In a real sense, the degree of overlap between the discriminant score distributions decides the success of this method. This score is calculated from the discriminant function as:

$$D = w_1Z_1 + w_2Z_2 + \dots + w_pZ_p \quad (6)$$

The above equation shows that the discriminant score is a weighted sum of the linear combination of predictors. The weight is calculated to maximize the distinction between class mean discriminant scores. If it has larger differences then it has larger weights. And if weight is small then class means are homogeneous [11].

2.3.4 Support Vector Machines (SVMs)

Support vector machines (SVMs) are the supervised learning algorithm used for data classification. It has good accuracy as well as better ability to deal with a large number of predictors hence it is frequently used in Biomedical Signal Processing. SVMs can classify the data which cannot be separated linearly using hyperplane by mapping the optimize predictors onto a new, higher-dimensional space in which they can be separated linearly.

In this method, support vectors are the list of predictor values which lie nearest to decision boundaries that separate the classes. Practically it is assumed that these cases have the largest impact on the position of decision boundaries. In fact, if they have been removed then it has large effects on its position of Decision boundaries. Choosing the best position of decision hyperplane is actually a problem of optimization where different kernel functions are used to design the linear boundaries through mapping, the nonlinear transformation of the predictors. In this algorithm, the hyperplane is located in the predictor space as decided in terms of the input vectors and the dot product of features space. The distance between the vectors in high dimensional space can be found out using dot product. An SVM bifurcate the support vectors without representing the space explicitly and locates the hyperplane. The task of dot product played by the kernel function as an alternative in the feature space. The complex curve is used to separate the two classes absolutely in the real space of the predictor. Even the two classes cannot be separated by the best linear separator completely. On the other side, if real predictor values can be forecasted into more convenient feature space then classes can be separated completely with linear decision boundary. Hence, the critical problem is to obtain the appropriate transformation. Selection of kernel function and its parameter is crucial things in SVM. Proper selection of immensity of the penalty for breaching the soft margin between the classes is also one of the key factors in SVM. In short, SVM can be design successfully which depends on the types of data to be classified [1],[5],[6],[10],[11].

The perceptron is very much identical to basic support vector classifiers. Both of these classifiers are linear classifier and they considered data is separable. The SVM classifier separates the classes with maximal margin. The biggest ‘tube’ that doesn’t contain the samples which can be drawn around the decision boundary is called a margin as shown in Figure 5. Hence, maximum generalization capacity can be achieved using this particular solution.

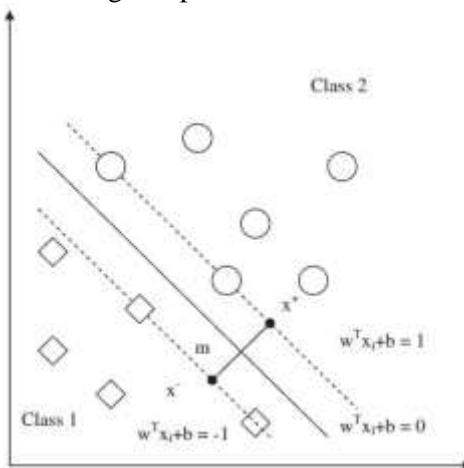


Figure 5. Linear SVM classifier.

The SVM classifier has a large number of advantages over other classifiers such as less computational efforts since it also uses nonlinear boundaries. It uses standard optimization software for finding a unique global optimum for its parameters. SVM’s performance is also better as compared to another method. The main disadvantage of this method is that the problem complexity is similar to the order of the number of samples and not of the order of samples dimension. General Software often fails for large sample sizes $N_s > 1000$. Hence, to solve the problem of optimization special-purpose optimizers is used [1],[5],[6],[8],[10],[11],[17],[18].

3. Results and Discussion

In this research, EEG signal is acquired from the 50 subjects during normal and meditation state in order to do a comparison between the ICA, PCA, and LDA using SVM. EEG signal is divided into several frequency subbands such as $\delta(0-4\text{Hz})$, $\theta(4-7\text{Hz})$, $\alpha(8-12\text{Hz})$, $\beta(13-40\text{Hz})$ and $\gamma(40\text{Hz} >)$ using Discrete Wavelet Transform. Then the EEG data is normalized and decomposed using wavelet transform. The Statistical features were extracted from these frequency sub-bands. These features were large in dimension and most of the data were redundant. Hence, these features were reduced using several feature reduction techniques such as ICA, PCA, and LDA. At the last, these data are classified using SVM.

The main aim of this paper was to design the classifier that is able to classify the input signal belongs to normal or meditation state. For designing the classifier based on neural network, 1500 samples were randomly chosen for training purpose and 500 samples were selected for the testing purpose from total 2000 samples. The distribution of sample's class training and testing data set is shown in Table 2.

Table 2. Distribution of the class samples in the testing and training data set.

Class	Training set	Test set	Total
Meditation	750	250	1000
Normal	750	250	1000
Total	1500	500	2000

In addition to this, Sensitivity and specificity were used as a performance measure for classification of data into two classes. Sensitivity (true positive ratio) and specificity (true negative ratio) are calculated from the data obtained from SVM classifier using confusion matrix. The formula for Sensitivity (True Positive Ratio) and specificity (True Negative Ratio) is as follows:

$$Sensitivity = TruePositiveRatio = \frac{TruePositive}{TruePositive + FalseNegative} \times 100 \quad (7)$$

$$Specificity = TrueNegativeRatio = \frac{TrueNegative}{TrueNegative + FalsePositive} \times 100 \quad (8)$$

3.1 Experiment Results

Meditation state from EEG can be a sort of Recognising pattern from the signal. The basic building blocks for classifying EEG signals into Meditation and normal state consists of EEG signal acquisition, Pre-processing, Extraction of Feature, Reducing features and finally classification. In this paper, a comparative classification of EEG using different methods is proposed, which is based on DWT. Redundancy in the data is reduced using various dimension reduction methods such as ICA, PCA, and LDA. SVM classifier is used for classification of data. The steps for classification of this data are as follows:

- Wavelet coefficient calculated from EEG signals using DWT and then statistical features estimated using wavelet coefficient.
- The extracted features have lots of redundant data. This redundant data has been reduced using PCA, ICA and LDA algorithm. This step is important as irrelevant features may even degrade the classifier performance.

- The classification process for meditation and the normal state is carried out using SVM-based classification.

These steps were repeated for all EEG signals recorded during normal and meditation state. Kernel function for SVM is chosen after several trials and Radial Basis Function (RBF) kernel is selected for SVMs. σ and γ are the two parameters related to RBF kernel. σ is the penalty term and γ is kernel parameter which is important in the performance of SVM. Improper value of σ and γ leads to several problems such as under-fitting and over-fitting. Hence the optimal value of σ and γ is necessary for accurately classifying the data. Here, 10-fold cross-validation is used for selecting proper values of σ and γ . Several combinations of σ and γ are tried for RBF kernel and finally the values of σ and γ are selected which has given better cross-validation accuracy. Finally, the classifier was designed with these values of RBF kernel function.

In this paper, training process has been started using several combinations such as ICA + SVM, PCA + SVM, and LDA +SVM. The result has been shown in Table 3. As per results in Table 3, the classification accuracy with LDA+ SVM is highest (95%) compared to other two combinations such as ICA +SVM (93.00 %) and PCA+SVM (93.00%). The simulation result reveals that SVM along with feature extraction using ICA, PCA or LDA can always give better results than without feature extraction (90%).

Table 3. Classification accuracy using PCA, ICA and LDA models for EEG signals

Feature extraction method	Accuracy	Specificity	Sensitivity
LDA (%)	95.00	100.00	90.00
ICA (%)	93.00	100.00	86.00
PCA (%)	93.00	100.00	86.00

Since the LDA has comparatively smaller support vectors than PCA and ICA. It has given better accuracy. Moreover, Training duration for Classification using LDA + SVM was longer than other two methods. Besides these, the problems of over-fitting and underfitting can be overcome by appropriate use of kernel function which can give best classification process.

3.2 Discussion

Many existing methods have shown better performance for classification of the EEG signal. But all the classification methods applied for seizure detection from EEG signal. This was the unique work for classifying the state of meditation from the EEG signal. Also in the previous work, all extracted features directly applied to classifiers that were affecting the classification accuracy. Here SVM is implemented along with Data reduction techniques such as PCA, LDA, and ICA. Depending upon the result following point can be discussed:

1. The large classification accuracy using SVM gives a better understanding for selecting the features for defining the EEG signal. The important conclusion which can be drawn here is DWT coefficient can be a good feature for representing EEG signals. This ultimately gives good distinction between the classes.
2. The results obtained here along with the selected statistical features reveals that SVM along with PCA, ICA, and LDA have a better success rate for EEG signal classification after comparing it with Artificial Neural Network (ANN). This proposed combination (SVM+LDA, SVM+ICA, SVM+PCA) can be a milestone in the classification of nonstationary Biomedical Signals.
3. The Performance of this proposed system is much more satisfactory and can be utilized in clinical studies also after it is developed.

4. Conclusion

Classifying EEG signal into normal and meditation state is actually a difficult task as it requires lots of observation and additional clinical information. Traditional methods for classification of EEG signal using either time domain representation of EEG signals or frequency domain representation of EEG signals. This conventional method fails to give efficient results. In this work, DWT was used to decompose EEG signals in time-frequency representation. Wavelet coefficient has been extracted using DWT is used to find the statistical feature. The statistical features are extracted using PCA, LDA and ICA were used with SVM for classification of EEG into two classes. This classification was based on two scalar performance measure which is derived from confusion matrices; namely specificity and sensitivity. The result shows that nonlinear feature extraction can improve the performance of classifier with respect to reduce the number of support vector for EEG Signal Classification. This concluded that the application of nonlinear feature extraction along with SVM will be a promising alternative for intelligent classification and diagnosis system in future. Also, it is clear that dimension reduction using PCA, LDA, and ICA can improve the performance of SVM.

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Code Level, Design Level Cohesion and Inheritance Metrics in Measuring Software Design Quality

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Abstract— Software engineering is vast domain illustrates the process of quality software development. Design of software is one of the crucial stage which impacts final product quality. Cohesion is a measurement of design at both code and design level. This metrics provides a statistics on the relativity of class attributes. Since programming-in-the-large is the style of recent software with much growing requirements “Separation of Concern” is tried to be reflected in the design and so as to at code level to support easy maintenance and sustainability. Hence study on cohesion at different scenario is always encouraging and useful.

Keywords— Quality metrics, Inheritance metrics, Cohesion, W9 property.

I. INTRODUCTION

Complexity is an intangible parameter of the software which increases with user requirements in a timeline. Direct measurement of complexity is not possible; however, it can be done in terms of other parameters such as software size, cohesion, coupling which influences the abilities of the software. Cohesion is one such parameter measures relatedness of the classes present in the software, can be measured either at the code level or during software design. According to IEEE definition [IEEE90], design is both “The process of defining the architecture, components, interfaces and other characteristics of a system or component “ and “the result of [that] process”. Thus, Software design is one of the SDLC activities where the framing of the solution domain is done. It is a cognitive process which models the solution domain by subdividing the solution in to different modules and their arrangement. It provides a blueprint of the solution which is used to analyze and evaluate whether all the requirements are fulfilled. Finally, the modules out of design process are used as input to coding and testing activities.

Class is a miniature of a module with data and functions as attributes. Cohesion expresses the relatedness of these attributes. Several metrics are defined at both design and code level. The solution domain of the –programming-in-the-large contains Classes and their relationships such as inheritance, aggregation, association, dependency and so on, and also Interfaces, abstract classes, packages, getter and setter functions. However, the attributes within and between them is expected to be co-related to uphold cohesiveness so that it facilitates abilities of a software such as maintainability, testability, reusability etc, at ease.

Cohesion metrics are defined at class level for data and function either at code (LLD) or design level (HLD). However, since inheritance is one of the modularization technique which supports reusability both in *vertical* (multilevel) and *horizontal* (multiple) manner representing is-a relationship between super class/s and sub class/s, the complexity of the code increases. Though , inheritance supports reusability, the code complexity in further classes in the ladder increases and need to measure its cohesion at every step of inheritance. Though, multi-levels of inheritance is now avoided in many object oriented programming languages like Java, C#, its is essential to have it to support reusability. Hence, measuring amount of reusability as well as cohesiveness among classes in a ladder is an open issue where our research is focused upon.

This paper is organized as below. Section 2 is the literature survey, section 3 is on code and design level metrics, and inheritance metrics, section 4 is on validating metrics and section 5 proposed work and concludes the paper.

II. LITERATURE SURVEY

Authors of [1] listed different cohesion metrics at code and design levels.

Authors of [2] explored on importance of cohesion in inheritance ladder.

Authors of [3] proposed flattening functions in the hierarchy among superclass and subclass. He considered both attributes and methods with and without conflicting names to build attribute and methods set in the subclass. He argued that the hierarchy not only provides reusability but also increases the complexity. He also argued that

complexity rises from before to after flattening the classes. The size, cohesion and coupling metrics were measured to justify flattening impact on complexity.

Authors of [4] explain how and when class flattening is done in Java. He further concludes that there is a need to study the impact of flattening when using internal quality attributes to indicate external quality attributes.

Authors of [5] proposed an inheritance metric based on UML diagram at design phase. The metric is empirically validated against Weyuker axioms and proved same as DIT of CK metric.

Authors of [6] proposed an inheritance metric DITC based on number of attributes and methods at each level of hierarchy. The metric is theoretically validated and further indicates effect on the development time (DEV).

Authors of [7] proposed two inheritance metrics, ICC (Inheritance Complexity of a Class) and ICT (Inheritance Complexity of a Tree). He further proved with many cases that interaction increases the complexity(W9 property).

Authors of [8] discussed the difference between inheritance and interface in C# programming. They calculated cohesion and coupling values of different projects and concluded that interface has less coupling value than inheritance and more reusable.

Authors of [9] proposed a metric NOPD (Number of Polymorphic Dispatches) for inheritance hierarchy. He stated that NOPD is useful in designing the test cases for inheritance structure. The paper concludes that NOPD presents number of test cases for the current hierarchical design of the project.

Authors of [10] had done the empirical study on evaluating the depth of inheritance on maintainability of Object Oriented Software. They designed and conducted experiments to prove influence of inheritance on maintainability.

Authors of [11] measured the design complexity using all inheritance metrics. They also measured the complexity with class interfaces and proved that interface is better than inheritance.

III. CLASS CODE AND DESIGN LEVEL METRICS

Class can be considered as set of attributes and methods [12].

$$C = \{D, M\}$$

where $D = \{d_1, d_2, d_3, d_4\}$ and $M = \{f_1, f_2, f_3\}$ are logically related subsets representing C as class, D as class data attributes and M as class methods. Quality of software is depending on how these two attributes bind each other either design level or code level. Several metrics are defined for measuring the degree of bondage in both levels. These metrics can be method-to-method, method-to-attribute and attribute-to-attribute in a class measured at both LLD and HLD stages.

Class Cohesion Metric	LLD/ HLD	Formula
Lack of Cohesion of Methods (LCOM1) (Chidamber and Kemerer 1991)	LLD	C is a class and M_1, M_2, \dots, M_n are its methods with set of class instances. $I_1 = \{a, b, c, d\}$, $I_2 = \{a, b, c\}$ and $I_3 = \{x, y, z\}$ are set of instances initiated by the methods M_1, M_2 and M_3 respectively. If intersection of object set is non-empty then the methods using them is cohesive and their relevance in the class is proved. i.e. $I_1 \cap I_2 = \{a, b, c\}$ means M_1 and M_2 are cohesive. But intersection of I_1, I_3 and I_2, I_3 is empty set. High count in LCOM shows less cohesiveness and class need to be divided to subclasses.
LCOM2 (Chidamber and Kemerer 1994)	LLD	$P =$ Number of pairs of methods that do not share attributes. $Q =$ Number of pairs of methods that share attributes. If $P - Q \geq 0$, not more cohesive, 0 Otherwise.
LCOM3 (Li and Henry 1993)		Relationship is represented as graph where method is a node and edge is represents sharing. LCOM3= Number of connected components in the graph.

LCOM4 (Hitz and Montazeri 1995)		Similar to LCOM3 and additional edges are used to represent method invocations.
Tight Class Cohesion (TCC) (Bieman and Kang 1995)		TCC= Represents method-to-method and attribute-to-method relatedness.
Loose Class Cohesion (LCC) (Bieman and Kang 1995)		LCC=Relative number of directly or transitively connected pairs of methods where two methods are transitively connected if they are directly or indirectly connected to an attribute. A method m , directly connected to an attribute j , is indirectly connected to an attribute i when there is a method directly or transitively connected to both attributes i and j .
Degree of Cohesion-Direct (DCD) (Badri 2004)		DCD= TCC+LCC
Class Cohesion (CC) (Bonja and Kidanmariam 2006)		CC= Ratio of the summation of the similarities between all pairs of methods to the total number of pairs of methods. The similarity between methods i and j is defined as: methods i and j , respectively.
Class Cohesion Metric (SCOM) (Fernandez and Pena 2006)		SCOM= Ratio of the summation of the similarities between all pairs of methods to the total number of pairs of methods. The similarity between methods i and j is defined as: Similarity $(I_i, I_j) = I_i \cap I_j / I_i \cup I_j $ where I_i and I_j are the sets of attributes referenced by methods i and j , respectively.
Class Cohesion Metric (SCOM) (Fernandez and Pena 2006)	LLD	SCOM= Ratio of the summation of the similarities between all pairs of methods to the total number of pairs of methods. The similarity between methods i and j is defined as: Similarity $(I_i, I_j) = I_i \cap I_j / \min(I_i , I_j) * I_i \cup I_j / l$ where l is the number of attributes.
Class Cohesion Metric(LSCC) (Jehad Al Dallal)	LLD	LSCC=The Method-Attribute Reference (MAR) matrix is a binary $k \times l$ matrix, where k is the number of methods and l is the number of attributes in the class of interest. The MAR matrix has rows indexed by the methods and columns indexed by the attributes, and so for $1 \leq i \leq k$, $1 \leq j \leq l$, $m_{ij}=1$ if i th method references j th attribute, 0 Otherwise.

Normalized hamming distance (NHD) metric	HLD	NHD= $2/lk(k - 1) \sum_{j=1}^{k-1} \sum_{i=j+1}^k aij = 1 - 2/lk(k - 1) \sum_{j=1}^l xj(k - xj)$ Where aij is the number of entries in rows i and j for which both are 1, and xj is the number of 1s in the j th column of the parameter occurrence matrix.
Cohesion Among Methods in a Class	HLD	CAMC=a+k/ k(l+1) Where The value in row i and column j in the matrix is 1 when the i th method has a parameter of the j th data type and is 0 otherwise. In the matrix, the class type is always included in the parameter type list, and every method interacts with this data type because every method implicitly has an identity parameter. This means that one of the columns is filled entirely with 1s.

Table 1. Class LLD & HLD Metrics

In recent years , research is more focused on finding the complexity of the inheritance tree since it directly impacts the class cohesion. There are many inheritance metrics proposed which measures the depth of reusability in an inheritance ladder.

Table 2. Class Inheritance Metrics

SI No	Metric Name	Description	Proposed by
1	DIT	Maximum length from the node to root node	C& K 1994
2	NOC	Number of immediate subclasses of a root	C & K 1994
3	DITC	Sum of attributes, methods at a class level by considering all visibility modes L $DITC(C_i) = \sum_{i=1}^L LEV_i * I$ $LEV_i = \text{Attribute } (C_i) + \text{Method } (C_i)$	Kumar rajnish Vandana Bhattacherjee 2006
4	NOPD	Number of Polymorphic Dispatches	Naveen Sharma, Padmaja Joshi, and Rushikesh K. Joshi 2006
5	DIC	Degree of Inheritance of a Class $DIC = \text{Number of inherited}$	Gagandeep Makkar\

		Attributes/Methods x (4 - level) if level <= 3 DIC = Number of inherited Attributes/Methods x (level - 3) if level >= 4	Jitender Kumar Chhabra ² and Rama Krishna Challa ³ 2012
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In Table 2. many inheritance metrics are listed, where DIT is very defined by Chedamber and Kemerer and tested against the properties defined. The metric DITC takes number of attributes and methods of different visibility modes such as private, public, protected and inherited. The metric NOPD addresses the number of message dispatch for polymorphism and DIC, the complexity level for a given class in terms of attributes.

IV. DIFFERENT PROPERTIES FOR VALIDATING METRICS

The metrics are mere measure until unless validated. Through, several metrics are proposed to measure cohesion and coupling, few of them are validated [13]. For researchers, Weyuker's 9 properties and Lionel Briand et al. principles are very informative in formulating the metrics.

LIONEL BRIAND et al, Properties

Lionel Briand, et al.,[14] had defined interesting strategies to define the metrics at High level Design. They considered all possible interactions of code segments and proposed several corresponding metrics. They also proposed 9 properties using which the metrics for cohesion and coupling are validated.

1. Normalization

Given a software part sp , the metric $cohesion(sp)$ belongs to a specified interval $[0, Max]$, and $cohesion(sp) = 0$ if and only if $CI(sp)$ is empty, and $cohesion(sp) = Max$ if and only if $CI(sp)$ includes all possible cohesive interactions.

Thus, class cohesiveness is expected either *max or 0* to get the design quality.

2. Monotonicity

Let $sp1$ be the software part and $CI(sp1)$ is the set of cohesive interactions. Let $sp2$ is modified $sp1$ with one more interaction. Then $cohesion(sp2) \geq cohesion(sp1)$.

This property illustrates that adding interaction will not decrease the cohesion.

3. Cohesive modules

Let $sp1$ be the software part and $m1, m2$ are two modules belong to $sp1$. Let $sp2$ is a new software part with new module $m=m1+m2$. If no cohesive interactions exist between the declarations belonging to $m1$ and $m2$ when they are grouped in m , then $cohesion(sp1) \geq cohesion(sp2)$.

Thus, the cohesion of the merged class is less than its individual classes.

When defining metrics for cohesion, either during high level or code level, the metrics are validated for the better design quality.

V. CONCLUSION

Research on software design is a continuous process. As requirements increases, so as to the complexity. Measuring complexity is in different form, one of which is inheritance and cohesion.

Same time the inheritance also adds to complexity in terms of size. So there is a collective need to study on all aspects related class, inheritance, reusability and cohesion.

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Study of LogSPA decoder with Quadratic residue sequences for Communication System

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Abstract

This paper shows the effective combination of LDPC codes along with DSSS technique to achieve the most reliable and an efficient transmission of information signal. Here the LogSPA decoder is selected for the decoding task and spreading of signal in DSSS is achieved by using Quadratic residue sequences based on prime numbers as Pseudo-Noise sequences (PN sequence). In particular the PN sequences being used here are Legendre and Weil sequences. Due to the significant increase in the trend of PN sequence's application in global positioning system (GPS) and satellite communication systems, in the present work an attempt is done to show suitability of PN sequences based on quadratic residues with LDPC codes which have gained substantial importance in recent advancements due to their excellent error-correcting capabilities.

Keywords: Low Density Parity Check(LDPC); Direct Sequence Spread Spectrum (DSSS); Bit Error Rate (BER); Logarithmic Sum Product Algorithm(LogSPA);

1. Introduction

LDPC codes are considered one of the best codes which approach Shannon-limits. LDPC codes are emerging trends in communication system due to their versatility in error controlling capabilities. LDPC decoder can be generally hard decision decoding or soft decision decoding. The LOGSPA decoder used in this paper is modification of the SPA(Sum Product Algorithm) which requires lot of computational resources i.e. multipliers and adders, whereas the LOGSPA algorithm only needs addition operation. The design of LogSPA[5] decoder is based on simplified sum product decoding algorithm given by Mackay-Neal and it is obtained by logarithmic reformulation of the original algorithm which reduces the complexity drastically.

In DSSS technique PN sequences are used for the spreading, which makes it possible for the data to occupy extra-large bandwidth and enables multiple users to access same frequency band simultaneously without interfering with each other. Hence, it is an efficient way for radio-wave communications. In the present work, PN sequences that are generated considering prime numbers and quadratic residue theory are considered which offer greater range of permissible lengths.

2. Related Works

2.1 Quadratic Residue Sequences

The concept of Legendre and Weil sequence [3] [11][12] is explained below :

Legendre sequence is a prime number based pseudo random sequence and it is obtained by determining the residues and non-residues, as given by [6],

$$L_i = \{L_{i-1} + (2^i - 1) \bmod p\} \quad (1)$$

'p' being the sequence length and a prime number.

For $p=13$, 'i' takes value from 2 to 6, $L_1 = 1$ we have, $2 \leq i \leq (p-1)/2$.

The residues represent '1' in the sequence bit position whereas non residues represent '0'.

Example: prime number, $p=13, 2 \leq i \leq 6$

$$L_1 = 1$$

$$L_2 = \{L_1 + (2^2 - 1) \bmod 13\} = \{4\} \bmod 13 = 4$$

$$L_3 = \{L_2 + (2^3 - 1) \bmod 13\} = \{9\} \bmod 13 = 9$$

$$L_4 = \{L_3 + (2^4 - 1) \bmod 13\} = \{16\} \bmod 13 = 3$$

$$L_5 = \{L_4 + (2^5 - 1) \bmod 13\} = \{12\} \bmod 13 = 12$$

$$L_6 = \{L_5 + (2^6 - 1) \bmod 13\} = \{23\} \bmod 13 = 10$$

Hence the residues are 1,3,4,9,10 and 12 and the non-residues are 0,2,5,6,7,8,11.

The Legendre sequence is given as:

$$s(k) = \begin{cases} +1, & \text{if } k \in \{L_i\} \\ -1, & \text{if } k \notin \{L_i\} \end{cases} \quad (2)$$

$S = \{-1, 1, -1, 1, 1, -1, -1, 1, 1, -1, 1, 1, -1, 1\}$ is the Legendre sequence obtained by the afore said method and which is just same as that obtained using Euler's criterion [3][12]. The major shortcoming of Legendre sequence is that it can generate at the most one sequence for any given prime number. This drawback can be eliminated by using the Weil sequence which can generate $(P-1)/2$ sequences[12].

Weil sequences are binary sequences of length 'p' which is a prime number and their correlation peaks are bounded by $2\sqrt{p+5}$. These sequences came to be known as Weil sequences because their correlation bound depended on the Weil classical bound of the magnitude of sums of Legendre symbols.

2.2 LDPC decoding :

Considering the fact that soft decision decoding[8] gives better performance with regard to BER as compared to hard decision decoding, the LogSPA algorithm[5], which is a low complexity LDPC decoder is used for the purpose of decoding. It uses logarithmic approach which simplifies the implementation by considering only addition and subtraction of fixed point number and eliminating the quotient and product terms of floating point numbers.

3. Proposed work

A simple communication system has been designed using Legendre and Weil sequence with LDPC LogSPA decoder as shown in Figure 1. The low bandwidth message input signal is spread to high bandwidth signal using direct sequence spread spectrum technique. Each message input bit is exclusive-ORED with Legendre sequence to produce spread sequence. The spread sequence is further sent to the channel encoder. For reliable transmission of the spread sequence over the channel, LogSPA LDPC ECC technique is employed. The spread sequence is encoded with the G matrix which is generated from respective H matrix (irregular parity check matrix)[15]. Redundant bits are added to the spread sequence to detect and correct the errors introduced in the channel at the decoder. The following LDPC LogSPA algorithm [5] is used in the decoder block at the receiver end. The LogSPA is an iterative message passing algorithm. As AWGN channel is used, the coded bits are transmitted using BPSK modulation. The algorithmic procedure for LogSPA decoder is explained in detail in the Table 1 mentioned below.

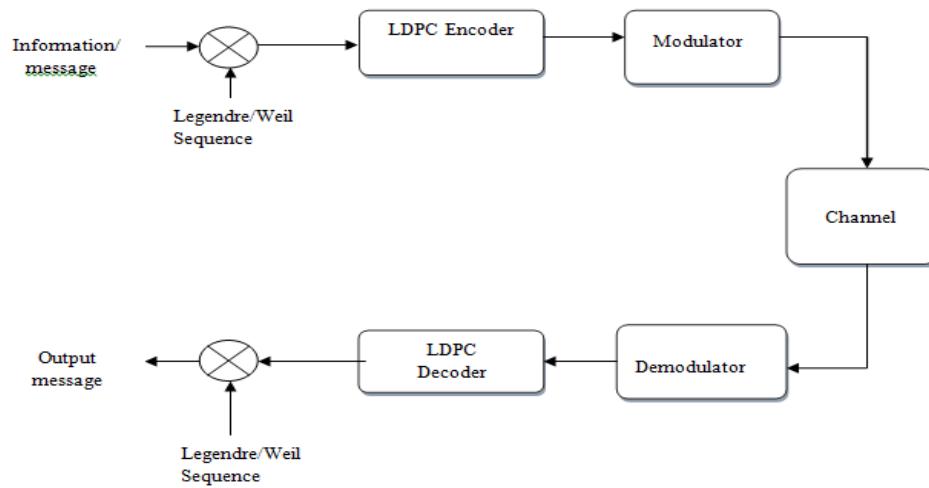


Figure 1: Block diagram of communication system

Table 1. **Logarithmic SUM PRODUCT ALGORITHM [5]**

Log SPA	
Initialization	$f_j^1 = \frac{1}{1 + e^{-\frac{2A r_j}{\sigma^2}}}$ $f_j^0 = 1 - f_j^1$ A is the amplitude of the bipolar signal transmitted. σ is standard deviation of channel Noise. r_j is received vector at the input of decoder. $ LQ_{ij}^0 = Lf_{ij}^0 $ $ LQ_{ij}^1 = Lf_{ij}^1 $ Where, $ Lz = \ln(z) $
Horizontal Step1	Its calculation of R_{ij}^0 and R_{ij}^1 from the δQ_{ij} values. Step 1: $ L \delta Q_{ij} = \min(LQ_{ij}^0 , LQ_{ij}^1) + f_- (LQ_{ij}^0 , LQ_{ij}^1)$
Horizontal step2	$ L \delta R_{ij} = \sum_{(j' \in N(i) \setminus j)} L \delta Q_{ij'} $ And $s \delta R_{ij} = \sum_{(j' \in N(i) \setminus j)} s_{ij'}$
Horizontal step3	STEP 3: If $s \delta R_{ij}$ is even, $ LR_{ij}^0 = \ln(2) - f_+ (L \delta R_{ij} , 0)$ $ LR_{ij}^1 = \ln(2) + f_+ (L \delta R_{ij} , 0)$ If $s \delta R_{ij}$ is odd, $ LR_{ij}^0 = \ln(2) + f_+ (L \delta R_{ij} , 0)$ $ LR_{ij}^1 = \ln(2) - f_+ (L \delta R_{ij} , 0)$
Vertical step	It involves calculation of Q_{ij}^0 and Q_{ij}^1 . $ Lc_{ij}^x = Lf_j^x + \sum_{(i' \in M(j) \setminus i)} LR_{i'j}^x $ $ LQ_{ij}^0 = Lc_{ij}^0 - \min(Lc_{ij}^0 , Lc_{ij}^1)$

	$+ f+ (Lc_{ij}^0 , Lc_{ij}^1)$
Estimation	It is estimation of $ LQ_j^x = \ln(Q_j^x) $ If $ LQ_j^0 < LQ_j^1 $ then $d_j = 0$ else $d_j = 1$

Steps in solving LOGSPA [5]:

1. Calculate the probability function
2. Perform initialization step
3. Perform horizontal step
4. Perform vertical step
5. Estimate the decoded vector
6. Syndrome calculation
7. Continue performing the horizontal step, vertical step and estimation and then syndrome calculation until the syndrome is Zero vector.

3.1 Simulation Results

The simulation results show the combination of Legendre sequence with LogSPA decoder and Weil sequence with LogSPA decoder. The Figure 2 shows the result of the complete system with spreading, despreading and decoding of the data for 32 bit input with Weil PRN sequence of 31 bits, G matrix of (4×12) and H matrix of (8×12) with LogSPA decoder. The Figures 3 shows the bit error rate performance of an $n=12$ and $k=4$ (Code rate $1/3$) for randomly constructed LDPC code[15] and $n=10$ and $k=5$ (Code rate $1/2$)[15] respectively assuming AWGN channel respectively for 50 iterations. The code rate $1/3$ gives the better performance compared to $1/2$. Similarly the Legendre and Weil sequence was tested with $(32,96)$ code rate of 0.333 but the maximum SNR for this is found to be 3 as shown in Figure 4. As we go higher the matrix in LogSPA decoder, the performance of both Weil and Legendre sequences is similar. The advantage of Weil sequence is that its properties match as that of Gold or Maximum length sequence which can be further improved by taking the bits 10230[4] which can be used for L1C signal with LDPC coding for the better performance of GNSS applications.

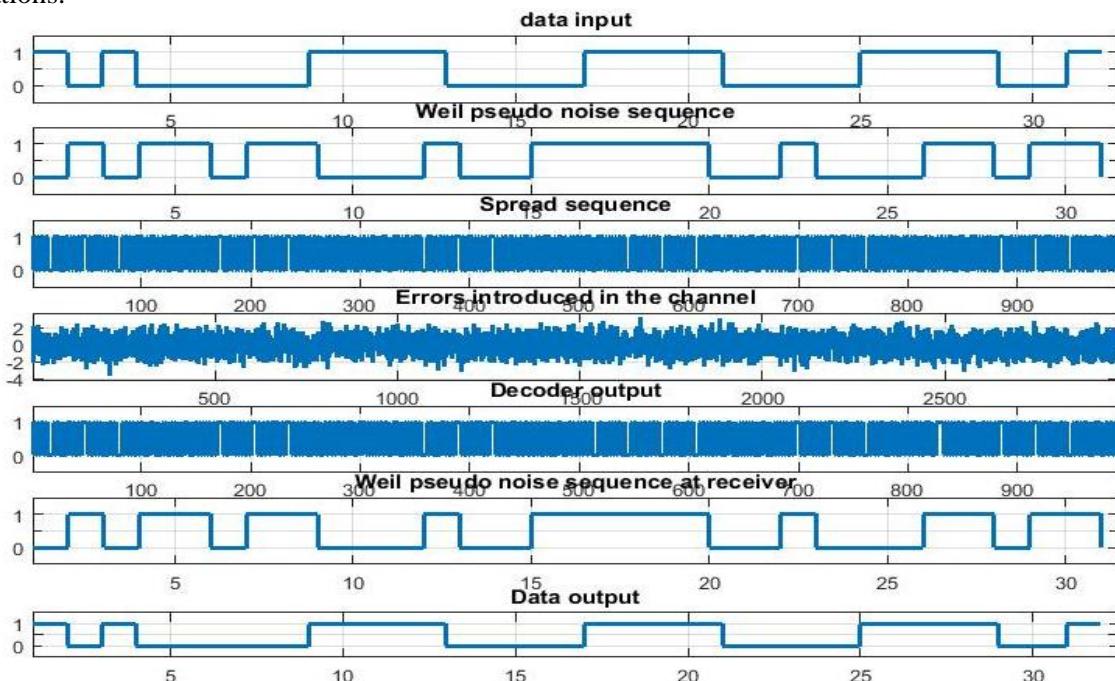


Figure 2: Simulation results obtained for data input of 32 bits, Weil PRN sequence of 31 bits.

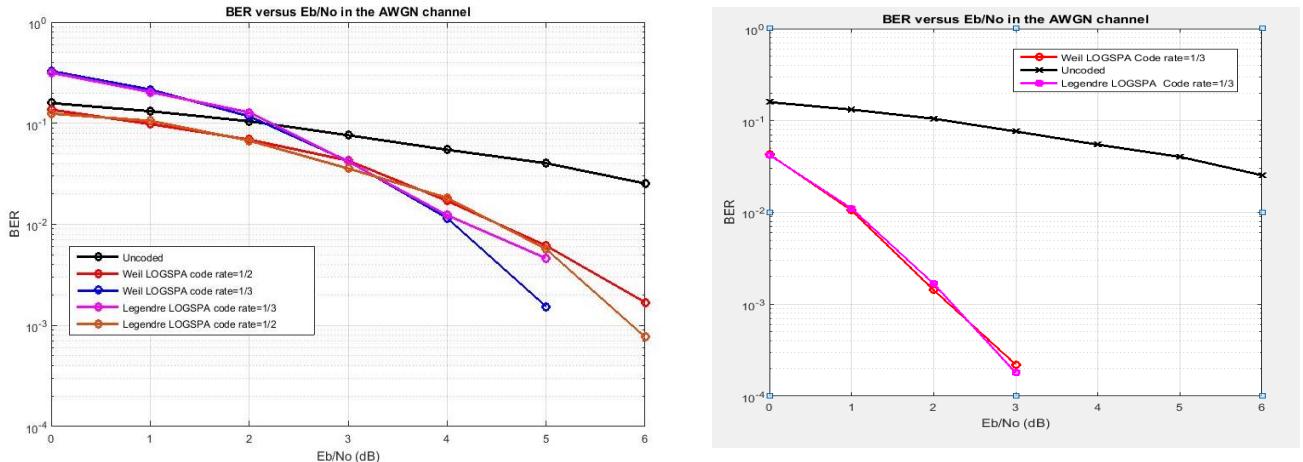


Figure 3: LogSPA Decoder with Weil and Legendre 50 iterations

Figure 4: LogSPA Decoder with Weil and Legendre 50 iterations(96X32)

4. Conclusion

This paper demonstrates an idea of combining LogSPA LDPC decoder along with DSSS technique using Legendre & Weil sequences for enhancing the capability of effective transmission in communication system. In the present work, the encoding and decoding algorithms are applied after spreading of the signal. LogSPA decoding techniques is successfully employed and simulated results are plotted taking an example design to illustrate the concepts discussed above. Weil sequences constructed from Legendre sequences are known to have the best correlation property for length of 10230 bits. There is a need to work on WSLCE sequences with LDPC LogSPA decoder. The other aspect that has to be looked into is the size of the family of these sequences for space communication application.

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Nature of Life and Survivability of Women and Men with Breast Cancer

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Abstract: Foundation: Breast cancer a standout amongst the most widely recognized cancer influencing ladies wellbeing overall cancer and reason for death from cancer. Stoutness has been connected with breast cancer chance. Reason: Weight misfortune post breast cancer finding has usually been connected with a lessening in danger of breast cancer repeat and mortality. The reason for this study is to inspect the hindrances, acknowledgment, and manageability of a practice intercession program offered at our foundation to over-weight ladies with recently analyzed breast cancer. Techniques: The Breast Cancer Database was questioned for ladies recently determined to have breast cancer and $BMI \geq 25 \text{ kg/m}^2$. Qualified patients took part in the Moving forever (MFL) practice program for 18 sessions. Surveys were regulated. Measurable investigations included descriptive and combined t-tests to abridge tolerant qualities and evaluate changes after some time. Results: Of 46 patients, 24 declined, 22 agreed and 17 (77%) finished the study. The mean age was 62 yrs. (run: 34 - 72). The mean BMI was 31 kg/m^2 . After the intercession, there was a reduction in weight and BMI ($p = 0.04$). The normal weight reduction was 10 lbs. Members reported more prominent happiness regarding exercise ($p = 0.02$) and diminished torment identified with treatment ($p = 0.05$). These underlying positive results were not kept up following 6 months and 1 year. Conclusions: The MFL mediation had a high rate of acknowledgment among overweight ladies recently determined to have breast cancer. These outcomes showed critical advantages of practice quickly after cancer finding and highlight the significance of creating sustainable way of life mediations. Intercessions focused at modifiable way of life figures ladies with early stage malady may give profit that is equivalent to certain adjuvant systemic treatments. In this manner, adjuvant way of life intercessions bolstered by clinicians may enhance breast cancer survival results.

Keywords: Breast, Cancer, Obesity, BMI

I. INTRODUCTION

Cancer information from Rajasthan is constrained; scarcely five studies have been all around distributed beforehand. We point to discover the range of dangerous neoplasms in Jaipur district by examining the extent and site astute dispersion of threat cases reported at five noteworthy clinics and pathology focuses in Jaipur locale. Settings and Design: A review investigation of histopathology records of 2 years (2012-2014) was done to evaluate the studies on about 1554 cancer patients the entire Bikaner Hospital region. The age group of the patients were 22 – 86 Years, wherein only 31 were male patients, rest all signed with female breast cancer. Conclusions: The aftereffects of the present study had demonstrated a negative relationship of overweight and heftiness with breast cancer in the southern Rajasthan, India populace.

II. CASE STUDY

Cancer range in a district is needy upon different hereditary, natural, dietary and social elements. Precise reporting of cancer profile from an area has a few constraints particularly in a creating nation. The issue of legitimate record keeping speaks to a noteworthy disable for medicinal insights and research in this setting. The issues required in gathering and investigating cancer registry information in creating nations have been because of absence of fundamental human services, absence of stable populace, absence of prepared work force, poor development, and

poor accessibility of statistics evaluations and information handling offices. In India, with more than 1.2 billion populace, cancer information comes chiefly from 23 populace based cancer registries (PBCR). These registries cover just around 7% of the populace (20% Urban and 1% Rural).

Keeping up a perfect weight, characterized as body mass record (Body Mass Index - BMI) 18.5 - 24.9 kg/m², after breast cancer conclusion has been connected with enhanced survival results, including diminished breast cancer repeat and expanded personal satisfaction [1] - [7] . Physical action is especially vital for fat ladies, who have an expected 33% expanded danger of general passing and breast cancer-particular demise, contrasted and non-corpulent ladies [8]. Intercessions focused at modifiable way of life consider ladies with early stage infection may give profit that is tantamount to certain adjuvant systemic treatments [9]. Thus, adjuvant way of life intercessions may enhance breast cancer survival results in large populaces, and give other medical advantages also.

Late studies have demonstrated that ladies who are physically dynamic after breast cancer analysis have a 26% - 40% lower danger of breast cancer repeat, breast cancer passing, and general demise, contrasted and stationary people [6] [10] [11] . Albeit more studies are expected to affirm the discoveries, randomized control trials have proposed practice may enhance survival results through helpful changes in flowing levels of insulin, insulin-related pathways, aggravation, and conceivably, resistance [11] - [13] . Furthermore, practice after analysis can prompt enhancements in personal satisfaction, exhaustion, and self-perception [9].

In 2010, the American College of Sports Medicine built up practice rules for cancer survivors by looking into the present confirmation on wellbeing and adequacy of practice preparing amid and after adjuvant cancer treatment. The board discovered that practice programs particular for ladies determined to have breast cancer were sheltered amid and after chemotherapy and radiotherapy [14]. With an expanding number of breast cancer survivors, bunches at especially high-danger of unfavorable survival results, including overweight and stout ladies, are liable to accomplish the best advantage from a way of life intercession, for example, work out.

There are numerous difficulties to executing weight reduction intercessions after cancer determination. Health improvement plans are intrinsically hard to actualize and include extra contemplations in populaces of cancer survivors. Symptoms of cancer-related medications, absence of social backing, sentiments of low self-viability, and different hindrances can prevent the interest of recently analyzed cancer patients in health improvement plans [15] - [17] . Practice projects are inalienably hard to keep up even in populaces not confronting extra difficulties postured to ladies experiencing cancer treatment.

The National Center for Health Statistics distributed a report in 2012 expressing that lone 21% of all Americans occupied with satisfactory relaxation time oxygen consuming and muscle-reinforcing exercises [18]. Cancer patients will probably practice less as an aftereffect of unfavorable impacts of the ailment and treatment, for example, treatment-related symptoms, absence of social backing and sentiments of low self-adequacy [15] [16] . Among patients who take an interest in way of life intercessions after conclusion, poor adherence can restrict the achievement of the mediation on enhancing survival results, particularly among overweight and fat people.

Few studies have inspected difficulties to actualizing weight reduction intercessions, particularly in breast cancer populaces [16] [19]. In any case, a planned investigation of 196 breast cancer survivors in Taiwan inspected the inspirations for practice recurrence following a 6-month mediation. The outcomes recommended that psychological wellness, practice obstructions, and practice result anticipation essentially added to contrasts in practice recurrence over this 6-month time span. Furthermore, pattern practice recurrence was the best indicator of general practice recurrence amid the study [19].

In any case, a noteworthy constraint of this study was the observational outline, in which subjects were permitted to self-choose their favored practice movement. Just standard practice has been appeared to yield long haul benefits for cancer survivors, however the inspiration variables for keeping up sound way of life changes after cancer analysis stay indistinct. The reason for this pilot study was to inspect the hindrances, acknowledgment, and manageability of a way of life mediation among overweight ladies with recently analyzed breast cancer.

III. ASSERTED FACTS ON BREAST CANCER

Male Breast Cancer: Men have a little measure of nonfunctioning breast tissue (breast tissue that can't create drain) that is packed in the range straightforwardly behind the areola on the mid-section divider. Like breast cancer in ladies, cancer of the male breast is the uncontrolled development with the potential for spread of a portion of the cells of this breast tissue. These phones turn out to be so strange in appearance and conduct that they are then called cancer cells.

Breast tissue in both young men and young ladies comprises of tubular structures known as pipes. At adolescence, a young lady's ovaries deliver female hormones (estrogen) that cause the conduits to develop and drain organs (lobules) to create at the closures of the channels. The measure of fat and connective tissue in the breast additionally increments as young ladies experience adolescence. Then again, male hormones, (for example, testosterone) emitted by the testicles smother the development of breast tissue and the improvement of lobules. The male breast, in this manner, is comprised of dominantly little, undeveloped channels and a little measure of fat and connective tissue. Some essential male breast cancer actualities are counted beneath:

- i. Male breast cancer is uncommon and represents just around 1% of all breast cancers.
- ii. Breast cancer hazard in men is expanded by hoisted levels of estrogen, past radiation presentation, and a family history of breast cancer.
- iii. Mutations in particular qualities are connected with an expansion in hazard for breast cancer in men.
- iv. Infiltrating ductal carcinoma is the most widely recognized sort of male breast cancer.
- v. A bump underneath the areola is the most widely recognized manifestation of male breast cancer.
- vi. Male breast cancer is arranged (mirroring the degree of tumor spread) indistinguishably to breast cancer in ladies.
- vii. Surgery is the most well-known introductory treatment for male breast cancer. Contingent upon the situation, chemotherapy, radiation treatment, and hormonal treatment are likewise considered.
- viii. The forecast of male breast cancer, similar to breast cancer in ladies, is overwhelmingly affected by tumor arrange.
- ix. The guess for early-arrange breast cancer in men is great, with 5-year survival rates of 100% for stage 0 and stage 1 tumors.

Breast cancer in men is an uncommon malady. Less than 1% of all breast cancers are found in men. In 2016, around 2,600 men are relied upon to be determined to have the illness. For men, the lifetime danger of being determined to have breast cancer is around 1 in 1,000.

IV. COMPARISION OF LEADING CANCER

The majority of the information on cancer profile in India is acquired from different populace based cancer registries. As cancer is not so far a reportable ailment in India, strategy of information accumulation by the PBCRs is dynamic, in that, registry staff makes visits to different wellsprings of enlistment to gather data on cancers recorded in the individual organizations. [8] But in a prodigious nation like India, because of absence of finish enlistment of recently determined cases to have these cancer registries, the correct tumor weight and profile is regularly belittled. Healing facility based predominance information in this way additionally frames a vital piece of assessing the cancer load.

This information is key for surveying geological contrasts in cancer profile and finding out the required medicinal services framework in the administration of these cancers. Our study traverses over a length of five years (2004-2008) and incorporates investigation of around 200,000 histopathological reports to discover different threatening neoplasms predominant in the Jaipur area. Ten driving cancer locales in both genders (Male and Female) are contrasted and the rate of cancer from populace and doctor's facility based cancer registry information from different parts of the nation.

Cancer in Males

Lung: Lung cancer was most basic site (13.25%) of cancer in males in our study. It was additionally the main site of cancer in men reported in past study from Jaipur district in 2009 [7] (8.45%). Lung as driving site of cancer in m was additionally reported from Chennai (10.84%), Delhi (10.11%), Mumbai (8.24%), Kolkata (16.21%), Imphal (20.8%) and Thiruvananthpuram (14.2).

Larynx: It was second most regular site in men (5.35%) while Laryngeal cancer was the tenth most normal site of harm in men (3.24%) reported in the past study from Jaipur. [7] Higher frequency was accounted for from Kolkata (7.50%), Delhi (6.60%), Barshi (6.20%) and Mumbai (5.34%). [8], [9] and [10]

Oropharynx: In the present study, cancer of Oropharynx was third with 5.09% while in past study from Jaipur, [7] it was accounted for as eighth most regular (4.22%) in men. Bring down rate was accounted for from Bangalore (1.26%), Chennai (1.20%) and different registries. [8], [9] and [10]

Cerebrum: In our study, malignancies of the Brain shaped the fourth most normal site of cancer in males (4.84%) while in past study from Jaipur, [7] Brain malignancies framed the 3rd driving site of cancers in males (6.04%). The present study indicates occurrence higher than that reported in different studies in Bangalore (4.61%), Delhi (4.51%), Mumbai (3.77%), Barshi (3.72%), Chennai (3.15%) and Ahmedabad (2.59%).

Tongue: In the present study, Tongue was fifth driving site of cancer in men (4.62%). It was 6th driving site (4.60%) reported in men in the 2009 study from Jaipur. [7] A higher occurrence was accounted for from Delhi (5.63%), Chennai (5.38%) and Mumbai (5.21%). Most noteworthy reported was from Ahmedabad (10.34%), trailed by Bhopal (9.59%) and Thiruvananthpuram (6.9%). Most reduced rate reported was from Mizoram (2.0%).

Prostate: Prostate cancer framed 4% of every single male cancer and 6th most basic site in men. It was lower than that reported in the past study from Jaipur [7] as the 2nd most basic site in men (7.12%). Second most elevated occurrence was accounted for from Delhi (6.96%) and 3rd most elevated in Mumbai (5.77%). Higher rate was accounted for from Bangalore (5.80%), Bhopal (4.24%), Chennai (4.22%), Kolkata (4.20%) and Barshi (4.13%).

Throat: Cancer of throat was the seventh most normal site of cancer in men in the present study (3.55%). It was 5th driving site in men (4.67%) in the 2009 study from Jaipur. [7] It was accounted for as driving site of cancer in men from Dibrugarh (17.9%) and Mizoram (11.1%). Occurrence was additionally high in Sikkim (9.9%), Chennai (6.91%), Bangalore (6.56%), Imphal (6.5%), Barshi (6.61%) and Thiruvananthpuram (5.1%).

Urinary bladder: The eighth most basic cancer site among men was urinary bladder (3.06%), though it was the fourth most basic site (5.31%) reported in 2009. [7] Higher occurrence was accounted for from Delhi (4.77%) and Mumbai (3.65%). Comparable occurrence was accounted for from Kolkata (3.03%).

Rectum: It was ninth most basic site of harm in men (2.17%) in present study and in 2009 study (4.22%) from Jaipur. [7] A higher occurrence was accounted for from Chennai (3.47%), Sikkim (3.20%), Bangalore (3.10%), and Mumbai (2.77%).

Hypopharynx: It was tenth most normal site of harm in men (2.02%). It was not among the 10 driving cancer destinations in the 2009 study from Jaipur. [7] Highest rate was accounted for from Barshi (8.68%) and 2nd highest in Dibrugarh (12.3%). Higher rate was likewise reported from Ahmedabad (7.05%), Mizoram (4.9%), Sikkim (4.7%), and Kolkata (4.57%). Rates like our study were accounted for from Chennai (3.93%), Bangalore (3.88%), Bhopal (3.87%) and Mumbai (3.54%).

Cancer in females

Breast: It was driving site of cancer in females (25.6%). It was additionally driving site as indicated by the National Cancer Atlas Data for 2001, [3] for Jaipur District (23.96%). Comparative discoveries (20.5%) were accounted for in the past study in 2009 study from Jaipur. [7] Breast as driving cancer site was accounted for from Mumbai (28.75%), Chennai (28.26%), Thiruvananthapuram (27.1%), Delhi (26.84%), Kolkata (26.76%), Bangalore (26.32%), Bhopal (26.01%) and Ahmedabad (21.72%). In Barshi (15.47%) and Dibrugarh (13.8%), it was 2nd driving site for cancer in females.

Cervix: Cervix was the second most regular site of cancer in females (10.2%) in the present and past study from Jaipur (14.99%). [7] In Barshi (36.98%), Imphal (15.9%) and Sikkim (11.1%), it was the main site of cancers in female. It was 2nd driving cancer sites in female in Ahmedabad (18.56%), Chennai (18.46%), Bhopal (17.87%), Kolkata (15.73%), Bangalore (15.69%), Delhi (14.90%), Mizoram (13.50%), Mumbai (13.20%) and Thiruvananthapuram (11.5%). Most minimal rate was accounted for from Dibrugarh (6.6%).

Ovary: Ovary was the third driving site of cancers in females in the present study (5.4%) and in the past study (4.4%) in 2009 from Jaipur. [7] A higher rate was accounted for from Dibrugarh (8.7%), Ahmedabad (7.71%), Bhopal (7.30%), Delhi (7.05%), Mumbai (6.31%), Kolkata (6.05%) and Barshi (6.04%). Relative frequency was accounted for from Imphal (5.9%) and Bangalore (5.26%). Bring down rate, from our study, was accounted for from Chennai (4.50%), Sikkim (4.4%) and Mizoram (1.7%).

Cerebrum: Malignancies of the mind shaped the fourth driving site of cancers in females (3.68%) in the present study and in the 2009 study (3.8%) from Jaipur. [7] The present study reported a frequency higher than that reported in different studies: Sikkim (3.0%), Delhi (2.55%), Bhopal (2.53%), Mumbai (2.25%), Bangalore (2.15%), Chennai (1.91%), Ahmedabad (1.75%) and Barshi (1.51%).

Throat: The fifth driving site of cancer in females was throat in our study (3.4%) and in the 2009 study (3.67%) from Jaipur. [7] It was driving site in Dibrugarh (13.9%) and 3rd driving in Barshi (6.79%). Higher frequency was accounted for from Sikkim (6.6%), Bangalore (4.78%), Chennai (4.01%), Bhopal (3.93%) and Ahmedabad (3.68%). Relative rate was accounted for from Mumbai (3.4%) and Imphal (3.1%).

Lung: Lung is the 6th driving site of malignancies in females (2.72%). It was not among the 10 driving cancer destinations in females in the 2009 study from Jaipur locale. [7] Mizoram reported most noteworthy frequency (15.1%). Others were Imphal (13.6%), Sikkim (8.3%), Kolkata (3.86%) and Barshi (3.77%). Near frequency was accounted for from Delhi (2.75%) and Mumbai (2.71%). Bring down occurrence was accounted for from Chennai (2.50%), Bangalore (2.36%), Bhopal (2.06%), and Ahmedabad (1.75%).

Bladder: Gall bladder is the seventh driving site of malignancies in females (2.35%) in present study. Bladder cancer was not reported among 10 driving cancer locales in females in the 2009 study. [7] Higher rate than our study was accounted for from Imphal (7.9%), Dibrugarh (7.7%), Delhi (6.09%), Sikkim (4.4%), Kolkata (4.26%) and Bhopal (4.21%).

Thyroid: The eighth driving site of cancers in females was thyroid (2.17%). Past study from Jaipur locale [7] reported thyroid as tenth most basic site with 2.3%. Practically identical frequency was accounted for from Bangalore (2.84%), Chennai (2.79%) and Delhi (2.54%). The most elevated recurrence was accounted for from Imphal (7.1%).

Uterus: Corpus uteri were the ninth most basic site of female cancers (2.1%) in the present study and 6th most normal (3.01%) in the 2009 study from Jaipur Incidence reported at different focuses were as per the following; Delhi (3.39%), Bangalore (3.25%), Mumbai (2.59%), Bhopal (2.34%) and Kolkata (2.18%).

Rectum: Rectum was tenth most normal site of threat in females (2.07%) in our study, though it was the seventh most basic site (2.80%) reported in 2009 from Jaipur. Higher frequency was accounted for in Mizoram (3.0%), Kolkata (2.46%), Imphal (2.3%) and Bangalore (2.27%). Similar occurrence was accounted for from Ahmedabad (2.10%) and Mumbai (2.0%).

An opinion survey with about **N = 1554 (Total Population) was done at Bikaner, Rajasthan** to test the awareness and ‘know-how’ about cancer, its occurrence and way-of-cure.

S.N	Parameters	No. of Patients
1	No. of Patients with Cancer in Left side	896
2	Patients with Cancer in Right side	658
3	Patients with Age Group 18 - 26 Years	187
4	Patients with Age Group 27 - 48 Years	971
5	Patients with Age Group 48 - 60 Years	396
6	No. of Male Patients	31
7	No. of Female Patients	1523

Statement: To identify the impact of living lifestyle and nature of job on the probability of occurrence of cancer.

Null Hypothesis (H_0): There is no difference between any patient living in cities or rural area and work profile of office/table job or physical labour job.

Alternate Hypothesis (H_1): Cancer is more in cities as compared to rural area for person with office/table job as compared to physical labour job.

Result: Our Data results the following figures:

Patients with Age Group 18 – 48 Yrs- Number of People liking the Online Medium to be the best: 169 (Out of 314)

Patients with Age Group 49 - 86 Yrs- Number of People liking the Online Medium to be the best: 197 (Out of 321)

For Z-Score Calculation for 2 Population, we have taken the Significance Level: 0.05The Z score test for two population proportions is used when you want to know whether two populations or groups (e.g., males and females; theists and atheists) differ significantly on some single (categorical) characteristic - for example, whether they are vegetarians.

Tabulation

Patients	Statement	Frequency	%
Patients with Age Group 18 - 48	Yes, Cancer is more in cities (as compared to rural area) for person with office/table job (as compared to physical labour job)	157 (Interviewed Total Population: 314)	50%
Patients with Age Group 49 - 86	Yes, Cancer is more in cities (as compared to rural area) for person with office/table job (as compared to physical labour job)	197 (Interviewed Total Population: 321)	61.30%

Equation used in this Z-Calculation:

$$\frac{(\bar{p}_1 - \bar{p}_2) - 0}{\sqrt{\bar{p}(1 - \bar{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

- a. The Z-Score is -2.8843.
- b. The p-value is 0.00398.
- c. The result is significant at $p < 0.05$.
- d. The proportion of Yes or No responses for Observation 1 is 0.5.
- e. The proportion for Observation 2 is 0.614.

Inference: It can be interpreted that Cancer is more in cities (as compared to rural area) for person with office/table job (as compared to physical labour job) both in Patients with age group 18-48 Yrs. (53.82% of the respondents, i.e. 169 of 314 respondents) as well as Patients with age group 49-86 Yrs. (61.3% respondents, i.e. 197 of 321 prefer Online). The p-value is 0.00398 and the result is significant at $p < 0.05$.

Therefore, insignificant hypothesis is rejected and the alternated hypothesis is accepted and, therefore, it can be concluded that yes, Cancer is more in cities (as compared to rural area) for person with office/table job (as compared to physical labour job).

DISCUSSIONS

This pilot study highlights the obstructions, acknowledgment, and manageability on a way of life and thus, mediation program offered by our foundation work is focusing on practices in overweight ladies who are recently determined to have breast cancer. The outcomes from this study exhibit the possibility and momentary advantages of a practice intercession bolstered by researchers and the significance of creating maintainable way of life changes after some time. The effect of way of life intercession programs has been demonstrated to adversary that of adjuvant treatments in early breast cancers without the unfavorable symptoms. Furthermore, way of life intercessions offers extraordinary open doors for patient self-adequacy. Consequently, executing a practice program that is institutionally upheld is a basic need in enhancing the wellbeing results and survivorship of obese ladies who are recently determined to have breast cancer. Keeping in mind the end goal to accomplish feasible positive wellbeing results, these practice programs should be congenial and open to all patients in an advantageous area consistently.

Perilous discoveries were, a higher recurrence of tobacco related cancers i.e., Lung cancer and head and neck cancer in men, and showing perceivable cancers (Breast and Cervix) in females. A higher recurrence of Lung cancer in females was additionally noted when contrasted with past studies. A surprisingly high reappearance of Gall Bladder Cancers particularly among the female population in this zone is additionally a reason of concern. Our information was contrasted with the national information.

The vast contemplation highlighted by this study was a high recurrence of tobacco related cancers (lung, laryngeal and pharyngeal cancers) in the male population and that of noticeable cancers in the female population (breast and cervical cancer). A curiously high recurrence of Gall Bladder Cancers particularly among the females in above specified districts is additionally a reason for concern. Northern India has a belt of high frequency of Gall Bladder Cancer. There may be an etiological variable identified with way of life, environment or nourishment which should be recognized promptly.

It was witnessed that threatening neoplasm of unspecified destinations framed 3.49% of aggregate cases recorded in our present study. It demonstrates the absence of orderly information accumulation and record support. Additionally, there is a more prominent need to build consistency in reporting of pathology information at different centers so that there is less uncertainty in information accumulation. Our study gives a thought of appropriation of different cancers in the reported locations. Impetus should be laid on arrangement of figures from different parts of the nation so that a complete national database could be acquired. There is a more prominent need to fortify the preventive oncology benefits with the goal that means can be taken for anticipation and early analysis of cancer cases.

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Analytics on Real Time Service Request Data for Ticket Volume by Industry Domain and Technology

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Abstract

Software maintenance as a service provided to the customer is a different perspective from the traditional view of software maintenance. Service delivery is one of the key aspects of software maintenance. The quality of a maintenance activity can be assessed by the quality of service provided to the customer. Each incident from customer is raised as a ticket which is raw, unprocessed data that have a huge amount of information. It is critical to proceed with the research on an incident related tickets since analysis of tickets is critical in deriving the patterns associated with it. The number of tickets is in millions and it's practically impossible for manual analysis. Ticket analytics is an evolving and essential research area that is yet to be exploited. The paper is on analytics of real-time ticket datasets and an interpretation of the results.

Keywords: Software Maintenance as a Service, Incident, Ticket Analytics, Ticket Volume, Service Desk

1. Introduction

With the advancement in technology, software systems play a major role in the nook and corner of everyday life. Any software system once delivered to the customer need to undergo modification changes bug fixes to fit the changing requirements. This phase of software maintenance is required for the sustainability of the software in the ever-changing world. A defect in the software system during production phase will add to the cost of the production. Further, the defect will propagate to the different phases of the development. Even though measures are taken to detect and correct defects/errors in the software during production, it is practically impossible to develop 100% defect free software.

The scenario changes when the software gets delivered to the customer. Post-deployment, the defects, and failures in the software has to be addressed by the software maintenance team. Research on software maintenance cost and effort shows that the cost associated with software maintenance is almost 90% of the entire software life cost and recent studies confirm that it has increased almost 50% in the past decade [1]. Significant research is going on to address this issue.

A failure to deliver the expected operation of the software or hardware will be considered an incident and is raised as a ticket by the customer. One dimension of the software maintenance is mentioned above. Handling the maintenance related requests through tickets comes under IT Service Management. A detailed sequence of operations on how a ticket is closed from the time it was opened is depicted in [5]. Optimization of operations in the IT service management sector is one of the major research taken up by IT service delivery firms since the cost associated with failure to deliver a requested operation will cost them millions of dollars per minute.

Ticket logs are the data that can be used to obtain interesting information that will aid in the aforementioned issue. Analysis and analytics can be performed on ticket logs that aid in understanding and solving the issues related to service delivery. IT firms come forward to invest more in this area because of the depth and complexity of problems they face[2].

The paper investigates the number of tickets raised for a period of time for different industry domains. The paper is organized as follows, Section 1 gave a brief introduction which is followed by

Section 2 which is a survey on the work carried out so far in the area of software maintenance as service and ticket analytics. Section 3 briefs on the methodology followed to conduct further data analysis in the study. Section 4 dives a detailed analysis of data based on ticket volume and industry domain and the observation on the analysis. Section 6 concludes the paper with a description of the scope of further research in the area. The same is followed by Acknowledgement, References and Authors Biography.

2. Related Work

The paper [3] gives a different perspective on software maintenance. The paper is about how software is maintained based on the requests from the customer. Therefore, in the perspective, any request from the customer is considered as a service request and is raised as a ticket. The quality aspect is raised by the authors wherein customers assess the quality of the service and indirectly the quality of maintenance activity as well as the IT Service firm itself. The paper further discusses service specific processes IT Service Capability Maturity Model (ITSCMM) and Information Technology Infrastructure Library (ITIL), the impact it has in the software service sector. The paper is basically a detailed examination of the difference between software development and software maintenance from the perspective of service provided to the customer. The paper gave an overview of the service management side of software maintenance.

The basic characteristics of the service delivered by a maintenance organization are taken into consideration by the authors of [6] in order to aid the organization in managing and evaluating the quality of the services. Maintenance Model Graph is introduced by the authors [6] in order to depict the workflow of each change request. The model uses K Means Clustering algorithm. The maintenance request assigned to each assignee is analyzed based on the model data. The main advantage of this aspect is that managers can rely on data generated instead of analyzing the entire set of service requests. Instance vector based on arrival time and waiting time and thereby feature vector is created which is used as the basic data input to the clustering. The same can be used as a foundation for the further estimation and analysis of activities on service request data.

The paper written by [7] depicts the challenges faced by Deutsche Post MAIL and its IT service management sector in accurately computing the effort, cost and time associated with each service request. The authors further implemented an experimental statistical cost estimation model to resolve one of the many issues listed. The authors approached multi-level aspects of the problem since the software system was large as well as heterogeneous. The paper gives an overview of the factors that should not be overlooked when modelling an effort estimation model. Further, insight from the paper is that it is not possible to develop a generalized model for effort and cost estimation. Therefore, the research conducted further will concentrate on one class.

The paper written by [8] gives a detailed description of how a service desk work. The process of request handling, as well as ticket management, is clearly mentioned in the paper. The importance of service level agreement in dealing with an open ticket is further mentioned in the paper. The paper mentions about the uncertainties in the service management sector are mentioned in the case of the budget as well as planning. The paper gives an overview of service categories as well. The paper gives a perspective of considering software maintenance as an IT service. Further, it states the difference between software maintenance and IT development. The authors could justify the perspective presented by elaborating and discussion on the diverse maintenance service requests that are processed by the maintenance team.

The author [9] proposes a platform that integrates text and predictive analytics of raw data use cases on incidents, problem and change datasets. This makes service desk operations proactive as well as reduces the amount of yearly ticket volume to 80%. The author further states that current work in the field is making data processing much faster when compared to traditional analytics. The features that are crucial in the incident management is identified and is proposed that the same be integrated into the platform.

The authors of [10] state that IT industry is shifting to a service oriented industry. The quality of service provided to the customer can be mapped as the quality the IT service firm has. In order to achieve the same, incident tickets are to be well handled. The paper further presents that ticket routing, that is an assignment of the ticket for a resolution to the right person is the crucial problem currently faced by the service sector and the same is manually operated in almost all of the IT firms. The authors propose a sequence based ticket recommendation platform enables the automation of service tickets. The proposal

gives an insight on the ticket classification and techniques used by the authors can be mapped to achieve the same. Once achieved, it is the initial step of service request effort estimation.

Incident management is one of the systems that is managed by Information Technology Service Management (ITSM). Per year cost spend on the managing the sector is in billions and the rate of in-flow of the incidents cannot be predicted [4]. The authors of [4] propose an automatic system that will process the level 1 repeated incidents. The methods proposed to used is Naïve Bayesian Classifier that will classify the open tickets. Based on the initial analysis, of the incidents raised under the L1 category, 87% of the tickets were closed with a high satisfaction rate from the customers. Further, the accuracy in the classification of a similar incident is 76.97% that can be improved further by considering the parameters that were left out in the initial modelling. This system will further reduce the man power as well as the work load of the employees. Even though the problem the author tries to address fall under automatic response system, the basic process can be used in the classification of the ticket using feature extraction.

The authors of [11] use text analysis from the ticket data to give an automatic remedial action for the same category of tickets. The authors use deep neural networks for the same. The basic research going on in the area of incident management is basically automating the tickets as well as recommending automatic solutions to a different category of tickets. The possibility of service request effort prediction and thereby optimizing the related resource requirement is an overlooked area of research.

3. Research Methodology

The empirical study performed examines the products from leading service-based and product-based software industries that is deployed to the customer for which the industry is providing customer service. The maturity level in the software development process of the organization is specified by the CMM level. CMM 5 is the highest level an organization can achieve. A product should be given maintenance services irrespective of the type of company.

The ticket logged related to incidents and its related data is congregated from CMM level 5 maintenance service based industries in order to perform the further analysis. The count of tickets considered for the analytics is 1,11,000 from 20+ clients which use the IT firm's product to which the service is delivered. The objective of the first phase of the research is to analyze the patterns associated with tickets. Tickets raised under ten clients for 26 different domains are considered in the analysis, even though analytics can be performed in all types of tickets and also on tickets registered under one package product and one custom product. Further, assumptions are made to overcome the complex nature of the datasets incurred from across the industries.

Assumption: All the ticket under analysis is logged for similar products in terms of technology, environment and programming languages used. Also, non-critical products are considered in the study. The database of the ticket logged from 2013 to 2015 was considered in the study. The preliminary investigation on classifying the reported tickets related to each incident was performed

4. Discussion

The analysis is performed on the incidents reported from a single production system. The incident related tickets are selected based on package and custom product. One case from each type of product is selected and the tickets logged on those cases are considered in the study. Tickets logged for a span of three months were considered. Both structured and unstructured fields in the tickets are considered in the study. The tickets are logged by ticket management tools like REMEDY, EASYVISTA, SAMANAGE, HP Service Manager, IBM Smart Cloud Control Desk etc. The data related to severity, priority, opening and closing time of the ticket is present as fields in the ticket. Tickets considered in the study are based on the severity, type of the product and resolution time. L1, L2 and L3 tickets are considered for the analysis. The following graphs show the result of the analysis: Figure 1 depicts custom and packaged product distribution of Ticket Volume by Severity. Figure 2 depicts Industry domain by ticket volume that was raised under each client.

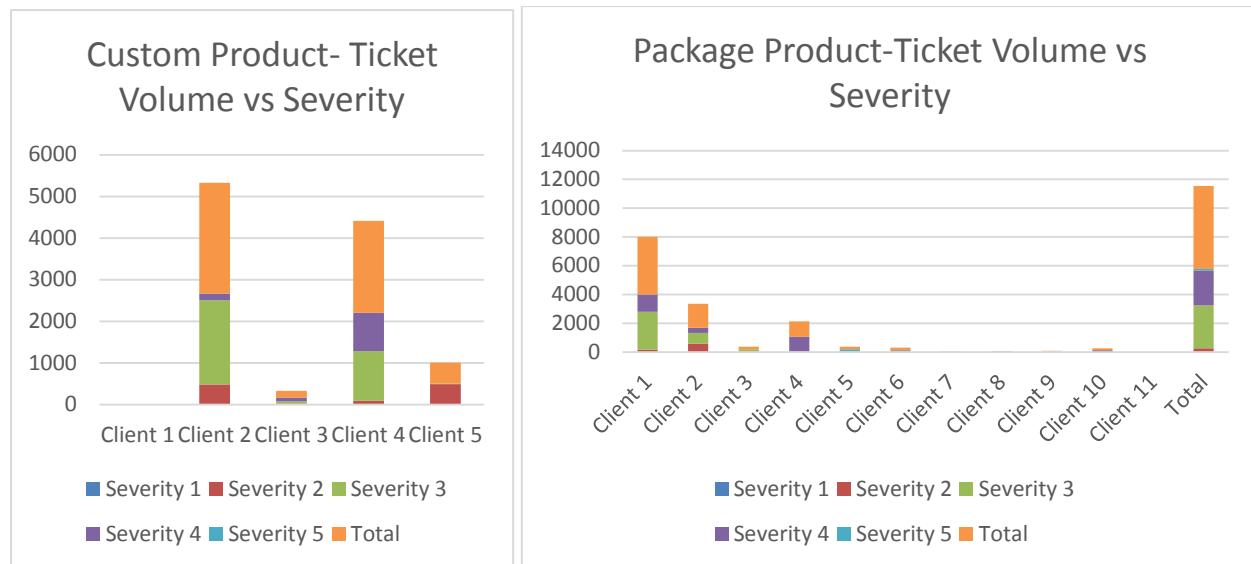


Figure 1: Custom and Packaged Product Distribution of Ticket Volume by Severity

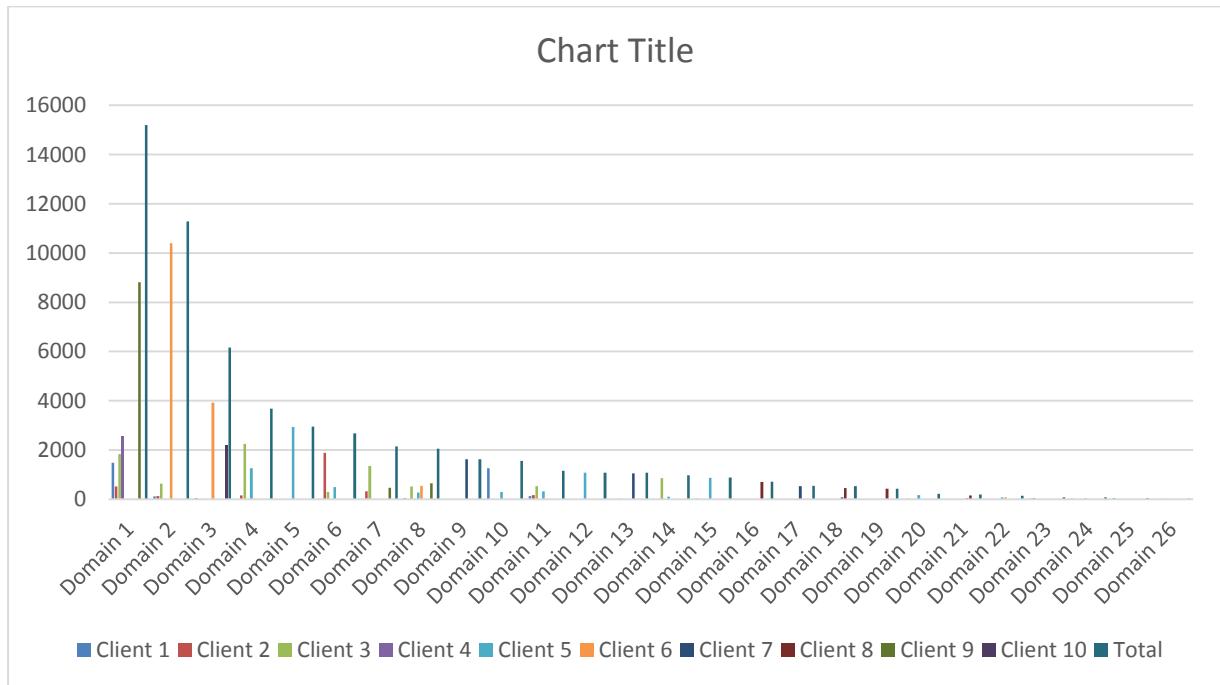


Figure 2: Industry Domain by Ticket Volume

4.1 Observation

The tickets are classified as per severity in both custom solutions and packaged products. The high severity tickets need quick resolution in view of their criticality since they may be show stoppers and may prevent resolution of other defects, due to dependencies. However, it is evident that high priority tickets are not always the ones that have a very high-resolution time. The time needed to resolve the tickets is based on the complexity of the problem and not the severity. It is observed that the volume of tickets that are severe is comparatively less in bot packaged and custom products, whereas the number of medium severity tickets are more. Also, it is important to note that high severity tickets are to be resolved in an urgent manner since, there would be service level agreements, contracted with such tickets. Organizations may be required to pay penalties, in case these tickets are not resolved in a timely manner. Severity classifications are the same for both custom built products and packaged solutions. Further, when industry domain is considered, the

volume of tickets raised under Domain 2 and 3 are more compared to close to zero percent tickets raised under domain 25 and 26. The inference is that not all the domains will have even distribution of tickets. The tickets raised can be domain specific, and also client specific.

5. Conclusion and Future Work

In this paper, analytics on ticket data history was performed. Features not related to incidents are considered in the analytics which includes industry domain, technology, and ticket volume. Tickets analytics was executed to get an analysis report on the severity of the tickets, its volume and industry domain. Tickets and a thorough analysis of the related details prove to be beneficial in the longer run. Analysis carried out shows the importance of incorporating ticket analytics in deriving policies and strategies in incident management. Trend analysis to lay out the strategies to prevent or reduce similar tickets in the future can be utilized to maintain the quality. Further, the obtained data can be used to predict cost, effort and resolution time associated with each incident ticket.

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Significance of Recognition and Classification of medicinal leaves in Image Processing

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1. Introduction

Plants are important part of our ecosystem. There is huge number of plants existing in nature. Many of them are at the risk of extinction. So it is very necessary to catalogue their identity, features and useful properties. Also there are many Medicinal plants which play an important role in Ayurveda. Now a days, whole world is facing various problems like global warming, biodiversity loss, effects of fast urban development, and various environmental damages. Hence there is an urgent need to apply advanced computer vision techniques to obtain the botanical knowledge like plant taxonomy, various features of plant and make this information accessible and useful to different kinds of people like researchers, farmers, botanists, and students. Hence plant identification is the first and important task.

There are many plant organs like leaves, flowers, fruits, seeds which can be used for plant identification. The traditional method is time consuming and requires tremendous efforts from botanists. However, due to the rapid development in computer technologies, there are now opportunities to improve the ability of plant species identification. Computerized plant classification systems are mostly based on two-dimensional images. This makes plant classification based on leaves as the appropriate choice compared to the use of shapes of flowers, seedling and morphing of plants which are three-dimensionally complex in structure[1].

Classification procedure is carried out through number of sub procedures. An identification or Classification issue is managed by mapping a input data with one of the unique classes. In this procedure, at first, database of a leaf images is created, that comprises of images of test leaf with their equivalent plant information. Essential features are extracted using image processing techniques. The features have to be stable in order to make the identification system robust. Subsequently the plant/leaf is recognized using machine learning techniques[2].

Researchers have done lot of work on plant identification. Some of the methods to be listed here are based on leaf image color histogram, edge features, texture features, shape features, Vein features. They also classify the leaves to their respective species by well known classifiers Linear Discrimination Analysis, Neural Network, Bayesian classifier, support vector machine which is widely used as a classifier.

Most of the researchers have worked on the standard Flavia dataset which is available online. The dataset consists of 32 species and so far researchers have taken 40 variations for each species to train the leaves and 10 leaves for testing. On an average the classification accuracy reached so far is 95%.

Generally the system architecture works in two phases i.e training phase and testing phase as shown below in the diagram.

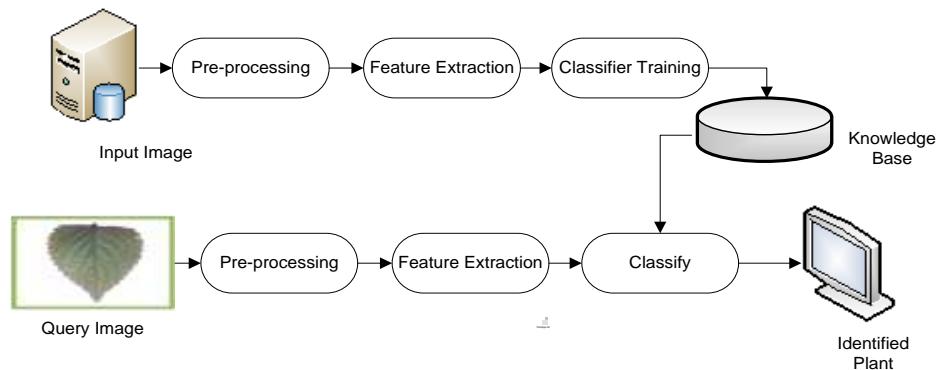


Fig 1: General framework of the leaf identification system

2. Proposed Application of Chebyshev algorithm on Medicinal Plants

The working principle of chebyshev algorithm, therefore directed towards its application by considering the flavia dataset with total of 270 leaves. The methods used for extracting the leaf features are HSV color moment, DWT for texture extraction of a leaf, roundness and Chebyshev moments. This combination of methods has proven in recognizing the leaf efficiently.

There are several pre-processing methods available in digital image processing. RGB to gray-scale conversion method is used, which converts the three dimensional RGB color image into a two dimensional gray scale image for further image analysis techniques.

In color features extraction, HSV color model is used for the reason that, the HSV model describes colors similarly to how the human eye tends to perceive color. RGB defines color in terms of a combination of primary colors, whereas, HSV describes color using more familiar comparisons such as color, vibrancy and brightness.

In texture feature extraction, Discrete Wavelet Transformation algorithm is considered for input leaf. The purpose of using DWT algorithm is images can be decomposed to different levels with less information loss. The application of DWT decreases the calculation time, it is basically timescale techniques which represent the input digital sample or pixel values in continuous form. In designed model the use of DWT help to recognize

the structure and texture of leaf image [3,4]. In spite of irregular shapes of leaves DWT is able to perfectly reconstruct the functions with linear and higher order polynomial shapes.

In shape feature extraction, Chebyshev moments which is considered as one of the efficient discrete orthogonal image moments. Author Mukundan et al. [5,6] have proved that Chebyshev moments are superior to geometric, Zernike, and Legendre moments in terms of image reconstruction capability and also it is invariant towards rotation. The purpose of taking this algorithm is, author [7] has considered only 10 species with 12 samples each, altogether 120 leaves are considered and classification rate has reached 100% because of less samples. Therefore in the proposed application, implementation carries the same algorithm for 270 leaves with 30 species of Flavia dataset and accuracy reached is 96.29%. Further extension of this implementation would be to increase the dataset, improve the classification rate and processing time.

Support Vector Machine is used as Classifier for the proposed application. SVM depends on the idea of choice planes that characterize choice limits. A choice plane is one that isolates between an arrangement of articles having distinctive class enrollments. All the more formally, a bolster vector machine builds a hyperplane or set of hyperplanes in a high or endless dimensional space, which can be utilized for order, relapse, or different undertakings. SVM separates the input data linearly. Once it is mapped to high dimensional space non-linearly and hence support vector machine is classified as non-linear classifier. This phenomenon of SVM enhances the classification performance of it. Basically SVM is a machine learning tool which has come out as one of the powerful problem solving technique[08].

SVM's main concept between the two transformed space classes is, using kernel function changing information into higher dimensional space and developing OSH (Optimal Separating Hyper Plane). This OSH is constructed by maximizing the margin between classes. A line is developed in the changed space and the information vectors which are closest to this built line are known as bolster vectors. Capacity utilized for characterizing the information into two distinctive classes is inspected by the SVM. It is independent of dimensionality of the input space. It has simple geometric construction and it generates spare solution. Classification is performed by support vectors on large number which is obtained by training set.

Conclusion

This paper focuses on the importance of leaf identification system and its classification. Various plant recognition system and classifiers are discussed. An efficient feature extraction algorithm along with a robust classifier is required for achieving a good recognition rate. In proposed application, an efficient algorithm for leaf recognition system is considered by taking 270 samples of flavia dataset. Further enhancement would be to introduce more samples with an efficient algorithm and reducing its processing time for same dataset or combination of the dataset.

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Exploratory Testing Challenges

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Abstract

One of the greatest challenges faced by IT industries is the detection of defects in the software even before the software is released to the customer. Testing is one of the rudimentary activities which ensure detection and elimination of defects in the software produced. Though, research is going on in the area of test automation, manual testing is still widely practiced and appreciated worldwide. This is because most unpredictable and significant defects are found using manual testing where testers think in a creative manner and hence come up with some good tests. Exploratory Testing is one such upcoming testing strategy where testers simultaneously learn, design and execute the tests without predefined test cases. Exploratory Testing is highly dependent on the experience and skills of the testers. Hence, there are various challenges that one faces while conducting exploratory test. This paper put forth a detailed study on challenges of Exploratory Testing and its consequences. This work enables one to formulate strategies that can overcome such challenges in compliance with their industry maturity levels and standards followed.

Keywords: Software Engineering, Software Testing, Exploratory Testing, Software Quality, Software Defect Management.

1. Introduction

All human endeavors of development today are highly dependent on software. This dependency on software has greatly increased the demand for high quality software since last few decades. However, the development of high quality software is challenging due to numerous problems related such as delay in the software delivery, cost of software crossing estimated budget and software being delivered having many residual faults. According to new survey report 31% of the projects get cancelled even before they are finished, 53% overrun their cost estimates by an average of 189% and for every 100 projects there are 94 restarts [1]. To resolve these problems software engineering follows principles and processes that aid in the development of good quality software that is maintainable, testable, delivered on time and within budget [2]. Software Testing is an important process in software engineering that contributes towards the development of high quality software by detecting the presence of defects in the software developed and consumes 40% to 50% of the total time and effort involved in the development of software[3].

Software Testing is a set of corrective methods that aim at determining the quality of software system by analysing the results of running it. Software Testing techniques are classified into first Bertolino's classification based on how the test cases are generated and has possible categories where test cases are generated based on tester's insight and experience, specification, code structure, faults to be discovered, field usage and application type. Second, Glass's Classification based on the goal of the testing techniques and has possible categories as requirements-driven, structure driven, statistics driven and risk driven. Third, Zhu's classification based on source of information used to generate the test cases and underlying testing approach. Fourth classification named classical classification is based on whether or not implementation knowledge is required to apply the technique. If implementation knowledge is required then it is white box otherwise black box testing technique [4].

As mentioned above in Bertolino's classification, one of approach is Exploratory Testing where the test cases are generated based on tester's insight and experience. Cem Kaner first brought out the concept of Exploratory Testing (ET) where it was a variation from existing testing techniques. ET emphasizes upon simultaneous learning, test design and test execution which means the tests are not predefined in a test plan but are dynamically designed, executed and modified[5]. Exploratory Testing

is an experienced based testing and differs from the conventional testing where the test cases are documented before they are executed. The test cases in conventional testing are designed based on the traditional test case design techniques in contrast to exploratory testing where a tester learns about the software under test, learns about the market, learns about different ways that a software could fail, designs the tests accordingly, reports the problem and develops new tests based on the concepts learnt so far [6].

The popularity of exploratory testing is because of its robust characteristics and wide variety of ways in which it can be used. Important characteristics of Exploratory testing include motivating testers to explore the software rather than making them to follow a predefined set of test cases, giving a rapid feedback on a specific risk associated with the software and also provides simultaneous learning of the software which further encourages testers to create good tests.

Exploratory Testing has many benefits such as effectiveness, efficiency, use of tester's creativity and providing rapid feedback about the quality of the software under test. Though most of the benefits mentioned above have scientific evidences but still there are many such benefits which lack research[7]. Further, the challenges that are applicable to the conventional testing are also applicable for exploratory testing. Thus, the aim of this paper is to study the challenges of exploratory testing so that its awareness enables one to formulate strategies to either resolve them or to minimize its impact on testing.

2. Related Works

Authors, Juha Itkonen, Mika V. Mäntylä, and Casper Lassenius (2007) in paper [8], performed a controlled experiment to compare the defect detection efficiency of exploratory testing (ET) and conventional testing (TCT). Based on the experiment conducted, the authors concluded that there is no difference in defect detection efficiency of the conventional test case based testing and that of exploratory testing.

Authors, Juha Itkonen, Mika V. Mäntylä, and Casper Lassenius (2009) in paper [9], present the observations of a study on manual testing practices in four software companies. The authors have made few observations in the study which includes testers to use a wide variety of techniques and strategies during test execution. They do not mechanically rely on test documentation. Further, authors observed that test execution time techniques are partly similar to test case design techniques but is strongly experienced based and applied in non-systematic fashion during test execution.

Authors, Laisa H. O. do Nascimento, Patricia D. L. Machado(2007) in paper [10] performed an experimental evaluation of two testing approaches for feature testing namely exploratory testing and model based testing. They have used Goal/Question/Metric model to evaluate the above mentioned testing approaches and found that exploratory testing produced better results than model based testing approach. Hence, they proposed combined approach of exploratory testing and model based testing to feature testing.

Authors, Juha Itkonen, Mika V. Mäntylä, and Casper Lassenius (2011) in paper [11] performed a field study on how testers use knowledge to detect failures while performing exploratory testing. It was found that testers applied their knowledge as a test oracle to determine whether the result was correct or not, or as a test wizard guiding them in selecting objects for test and designing tests. Authors, finally conclude that exploratory testing is an efficient method for utilizing domain experts as many defects were discovered based on domain knowledge.

Authors, Rashmi N and Suma V (2013) in paper [12] conducted a case study in a software company and collected relevant data to study the defect detection effectiveness of the combined approach of the conventional test case based testing and exploratory testing. From the case study it was found that the defect detection effectiveness of the combined approach was more compared to the

conventional test case based approach alone. Hence authors concluded that it is entirely beneficial to perform exploratory testing as a complementary approach to the conventional testing.

Authors, Rashmi N and Suma V(2014) in paper [13] further conducted a survey of factors that uniquely influence defect detection effectiveness of exploratory testing.

Hence, from the above literature survey it is clear that it is extremely beneficial to perform exploratory testing as an independent approach or as a complementary approach. But as mentioned in the papers above there are certain challenges associated with exploratory testing that needs to be addressed in order to obtain the complete benefit of the testing approach. Therefore, subsequent section in the paper discusses the challenges associated with Exploratory Testing.

3. Exploratory Testing Challenges

Exploratory Testing is simultaneous learning, design and execution of the tests by the testers without the use of predefined test case document. It is entirely based on the experience, skills and creative thinking of the tester. From the literature survey it is clear that performing exploratory testing is beneficial as there is no significant difference observed in terms of number of defects found, the type and the severity of the defects found in conventional testing and exploratory testing. Also it is found that the challenges that are applicable to conventional testing are also applicable for exploratory testing. Hence, the aim in this paper is to put forth the challenges of exploratory testing in detail.

Learning Challenge - Learning Challenge is about knowing the program under test. Exploratory Testing emphasizes learning which further influences exploratory testers to design good tests and hence execute the same. Hence, learning more about the product under test within a short span of time is a challenge for exploratory testers. For a good exploratory tester, it is essential to have knowledge of few things such as goals and quality criteria for the project, skills and resources available for the project. Exploratory testers follow a variety of strategies such as active reading, breaking the attacks, using models and using failure mode lists, bug taxonomies, learning from specifications etc. to learn about the software and its context[14].

Oracle Challenge - A test oracle refers to method used to distinguish between a correct and incorrect result during software testing. However, finding a reliable oracle is oracle challenge. Further, oracle challenge appears in all types of software testing. In both manual as well as automation testing, testers usually apply their knowledge and use various documentations to arrive at a reliable oracle. In exploratory testing, heuristics which are set of rules for checking the consistency of functionalities against project goals such as history of the product, comparable products and user's expectations are used to solve oracle problem.

Documentation Challenges - Preparing good test documentation within a short period of time is a challenging job. This is because preparation of test documentation is an essential expensive process which takes a longer time. This process requires an understanding of the requirements for which the documentation is being done. Requirements are gathered by finding the answers for some important questions such as what and why the documentation is being generated? Who would or the documentation? There are many types of questions for example open vs. closed, hypothetical vs. behavioral, historical vs. predictive, context dependent vs. context free questions. A context free question may be of the type who is using this feature? What does the user wants to do with it? etc.[15].

Measurement challenges - Measurement is difficult and challenging due to the fact that many software-related measurements involve psychological or subjective components involving human factors. Also there are metrics implementation challenges such as the need for strong management commitment, using correct metrics those lead to the goal, having unambiguous metric definition etc. , proper communication and training to the staff about the metric implementation program and interpreting the metrics data correctly [16].

Though exploratory testing is entirely dependent on human factors such as skills and creative thinking of testers, there are techniques such as session based test management which manage and hence measure exploratory testing[17].

Extent of Testing challenges - Extent of testing is the amount of time spent on testing a product over a certain period of time. Extent of testing may be decided based on factors such as product coverage, agreement based, project history based, risk based, evaluation, results, results and obstacles and effort. Finding a good measure for the extent of testing is challenging because the extent of testing measure depends on finding an ideal answers to the questions such as Measurement question - what is to be measured and how can we measure? Communication question - how to tell management how much testing is done and how much left? [18]

Reporting Challenge- Test result reporting is a means of presenting to the customer the state of the product from different perspectives. There exists various levels of testing like functional, performance/load/stress tests and so on. Writing a test result report for different levels of testing catering to different readers is a challenging job. Customers take decisions about the release of the product based on the test result reports. Hence reporting unbiased and transparent test results is essential. Also, the way in which the test results are reported is itself challenging due to the fact that there exists certain set of rules to be followed in writing a good test result reports[19][20].

Logistics Challenge - Logistics or the test execution environment are applications that assist testers in executing tests and collecting test results against the application under test. Test execution environments are executed under the same operating system and use the same programming languages as the application under test. They provide services that support interfaces and libraries for testing scripts. The creation and maintenance of these test execution environment is a challenging job for the testing team as they must provide testing solutions for heterogeneous application environments and languages which in turn involves a significant cost during the development of the software [21].

Test Selection Challenges - Regression Testing provides confidence to the project personnel that changes done to the software under test do not disturb the existing behavior of the software. With software evolving over time, test suites grow in size making it costly to execute the entire test suite. Hence, test selection approach enables one to identify the set of test cases that are relevant to recent changes. The main challenge here is to select the test cases which test the changed parts of the software in a cost effective manner .

Test Data Management Challenges - Test Data Management is the process of identifying, acquiring, conditioning, populating and maintaining test data during test planning, test preparation and test execution [29]. Test data management is essential for the success of any project as it determines the quality of testing done. Test data management challenges include minimizing additional time required for data set up, reducing additional administrative efforts in test data management, minimizing additional expense including hardware cost and employing of project personnel cost in lieu to automation testing and so on[22].

Test Execution Challenges - Test Execution process ensures one to execute the test cases by software testers that were planned and designed by test experts. The challenge in this process is to find efficient ways of executing the test cases and hence keep the cost of test execution minimum. Cost of test execution pertains to the time required to execute the prioritized and selected test cases [23]. Exploratory Testing is simultaneous design and execution of test cases. Hence, the challenge for an exploratory tester is to understand the software under test and explore various ways where the test cases may both be designed and executed in a cost effective manner[24].

4. Conclusion

Software Testing is an important defect detection activity that improves the quality of the software before it is delivered to the customer. In conventional testing the test cases are designed using the traditional test case design techniques such as equivalence partitioning, boundary value analysis, decision tables etc. The test cases in unscripted / exploratory testing is based on the experience and knowledge of the tester. Conventional testing is more popular among industries because of the techniques and strategies discovered. However it is evident from the literature survey that exploratory testing is equally efficient and effective when performed as an independent approach or integrated with the conventional testing. Nevertheless, exploratory testing is not popular as conventional testing due to lack of research and awareness of its benefits in detecting defects. Hence, this paper put forth the challenges of exploratory testing and opens future work to address exploratory testing challenges and hence contribute towards the improvement in the quality of the software developed.

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SoC-based Abnormal Ethernet Packet Detector for a High Performance Intrusion Detection System

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Abstract

In this paper, a high performance intrusion detection system (IDS) based on SoC (System on Chip) is proposed. The proposed system uses FPGA to detect 6-tuple (destination and source MAC address, IP address, port number). It also provides an interface for users to manage intrusion detection rules. The IDS identifies abnormal packets by comparing the received packet header information with the whitelist rule stored in the dual port block RAM (BRAM) in real time while the Ethernet packet is received. The implemented prototype uses 3.87% LUT, 2.27% Flip-Flop, and 26.88% block RAM of Zynq-7030 SoC.

Keywords: Ethernet packet detector; network intrusion detection system; SoC;

1. Introduction

Ransomware, such as WannaCry, which targets a recent Microsoft Windows system, has severely damaged many computers worldwide. As Internet technology advances, cyber attack penetration routes become more diverse and cyber security becomes more important. One way to prevent cyber attacks such as Ransomware is to use an intrusion detection system (IDS). IDS warns the user if the analyzed packet is determined to be an abnormal packet as listed in the blacklist and logs the analysis result. Software including Snort and Suricata are popular IDS software [1]. However, software-based IDS takes a long time to analyze Ethernet packets with software, so it can not detect abnormal network packets in real time. In addition, since the server or system running the IDS software consumes a lot of resources, packet loss can occur even in a low-bandwidth network environment [2-5].

In order to solve these problems of software-based IDS, researches have been carried out to implement hardware-based IDS [6-8]. Rahmatia et al. proposed a hardware-based IDS to confirm that malicious programs are running [9]. Hutchings et al. proposed a module generator for FPGA for the efficient processing the Snort rule [10]. Principal Component Analysis (PCA) implementation within a FPGA was also proposed to detect outliers [11]. However, these architectures have a common problem that the FPGA has to be reprogrammed to make modification on the rule set. There were other researches that improve the detection rate of Ethernet packet by using Snort rule [12]. It can be used on 10 Gigabit Ethernet.

In the IDS, it is difficult for a user to manage the rules while the system was running. To overcome this inconvenience, the IDS using the SoC is proposed in this paper. The hardware-based IDS is implemented using the SoC to solve the disadvantages of the software-based IDS. At the same time, proposed system provides an interface that allows the user to easily manage the rules while the system is operating.

The overall system implemented in the SoC is described in Section 2. In Section 3, the implementation results are explained, and conclusions are in Section 4.

2. Proposed Architecture

2.1 Overall System

The overall architecture of the proposed system is described in this section. Even though Xilinx's Zynq 7000 series SoC that consist of the Processor System (PS) and Programmable Logic (PL) was used to implement the prototype system to prove the concept, any type of SoC can be used. A serial interface from PS that runs Linux OS is provided to allow the users to manage whitelist rules. There is an AXI between the PS and the PL, which allows the user to read and write the rules from the PL's BRAM. A dual-port BRAM to store whitelist was implemented in the PL area. In addition, a Packet Parser (PP) for parsing Ethernet packets into 6-tuple is implemented. The comparator is used to compare the whitelist with the data parsed by PP.

Rules for specific devices can be defined by adding the MAC addresses to the Snort rule. A user may not know the IP address of the system when the IP address is automatically assigned by a private router or when the IP address is changed without the user's knowledge. Because the MAC address is added in this system, the rule can be defined even if the user does not know the IP address. In addition, MAC addresses are added to the rule to enhance packet detection in the Ethernet packet header. However, this system adds a MAC address to the rule to filter the packet more closely. Therefore, the analysis time can be reduced by reducing the detection case of the Ethernet packet payload.

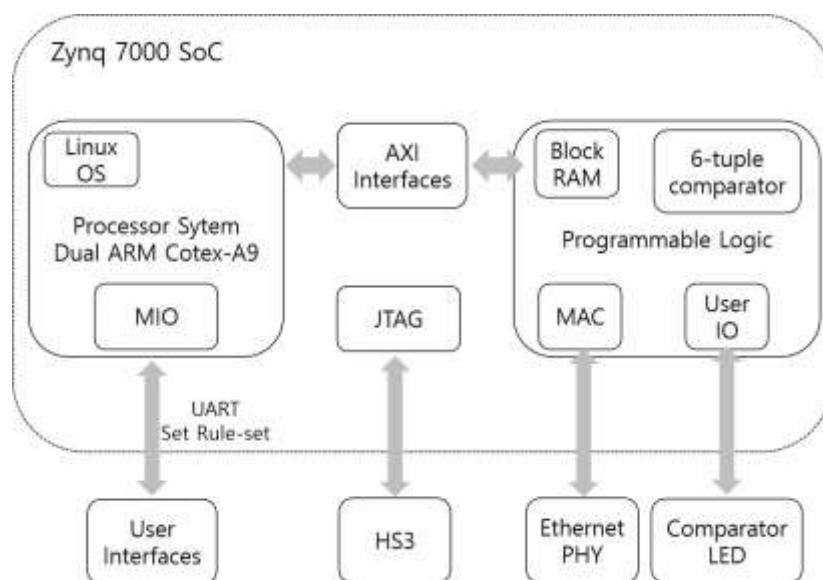


Figure 1 Overall System block diagram

2.2 Ethernet Packet Analyzer

A Media Access Controller (MAC) with a RGMII interface was implemented using the Zynq PL to receive Ethernet data. Implemented MAC receives the data from the PHY chip and stores it in the buffer. If the 6-tuple data of the Ethernet packet header are received, they are transmitted to a comparator to compare with the whitelist rule.

For example, when the 48th bit of the Ethernet stream that is the last bit of the destination MAC address is received, the data of the destination MAC address is transmitted to a comparator. The data transferred to the comparator is held until the next Ethernet packet arrives and a new destination MAC address is received. In the MAC buffer, the data is continuously stored until the data of the source MAC address is received, and when the source MAC address data is received, the data is transmitted to the comparator. It repeats until the data from the destination Mac address to the source port number is received. MAC is designed to compare with the whitelist rule before all the Ethernet packets arrive by comparing it to the comparator every time the data for the tuple is received. Because a speed of 100Mbps Ethernet is used, the PHY transmitted 4 bits of data with a clock of 25MHz.

2.3 Comparator

The comparator has eight registers inside. When the system begins, it takes eight rules from block memory and stores them in the register. In case of the MAC address, 48bit address data is stored with 16bit reserved data in BRAM. The IP address is stored two addresses in one row of the 64-bit width BRAM, so the rule is read and stored in two registers at a time. Then the comparator receives the parsed data from the MAC and compares it with the rule stored in the register. There are 32 comparators per tuple, and each comparator has 8 registers, so up to 256 rules can be compared. If the result of OR of the eight registers is true, the comparator has a whitelist rule. The internal clock of the PL operates at 250MHz, and data can be compared for one tuple at a minimum of 8 clocks. Therefore, it is possible to compare the data until the next tuple is received in the MAC.

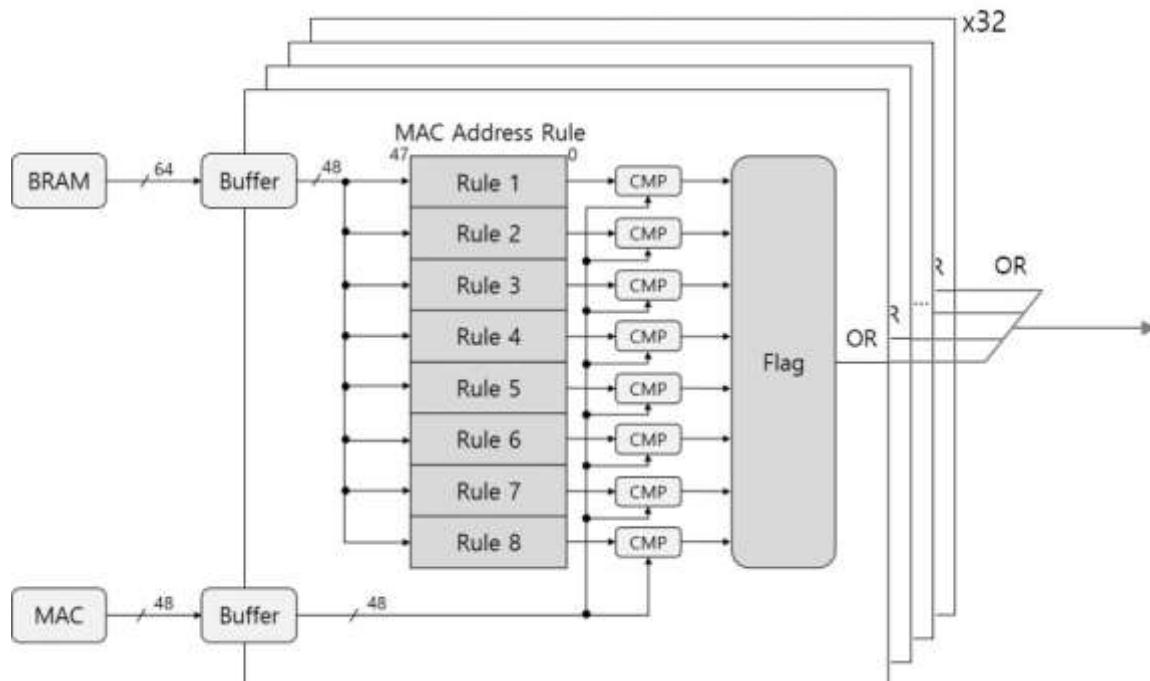


Figure 2 Comparator block diagram for MAC address rule

2.4 Rule management

The BRAM is configured as a dual-port memory, so it can be read and written both from the PS and PL. Using the advantages of the SoC, the rule was written to the BRAM from the PS. When a user enters a rule through the serial interface, the rule is stored in the BRAM of the PL through the AXI. Then, the PL reads the rule stored in the BRAM and compares the rule with data parsed from the Ethernet packet.

To store the rules for 6-tuple, the data width of the BRAM was set to 64 bits instead of 32 bits. It is possible to efficiently store rules for MAC addresses without affecting the storing of other rules. The MAC address is 48 bits, one address is stored in one row of the BRAM, and the remaining 16 bits are reserved. The IP address is stored 2 data in 1 row of the BRAM. In case of port number is stored 4 data in one row of the BRAM. In this paper, the number of each data is assumed to be 256, and the MAC address rules, IP address rules, and port number rules are stored in order.

3.Implementation

To prove the concept of the proposed architecture, a prototype system using the Xilinx Zynq SoC was implemented. An Ethernet packet detector for comparison detection of 6-tuple was constructed using the PL. A whitelist rule for 6-tuple was stored in the BRAM, and 6-tuple could be compared with the stored whitelist rule without delay time while the Ethernet packets were received.

The length of the packet header is 384 bits, equivalent to 48 bytes. Since the RGMII interface was used between the PHY and MAC, it can receive 4bit data in 1 RGMII clock. Since the interface clock rate is 25MHz, the time to receive the total packet data is $38.40\mu s$. Since the destination MAC address is 48 bits, it takes 12 RGMII clock, $0.48\mu s$, to receive the destination MAC address. Upon receiving the destination MAC address, the comparator compares it with the rule. As described in Section 2.3, the comparator operates at 250MHz and one clock is 4ns. Since there are 32 comparators with eight rules, 8 system clocks are required to compare the 256 rules within $0.032\mu s$. This comparison makes it possible to complete the comparison with the whitelist rule for 6-tuple before the whole Ethernet packets are received. The implementation result shows that 3.87% of LUTs', 2.27% of Flip-Flops', and 26.88% of block RAM of the Zynq 7030 were used.

4.Conclusion

In this paper, a high performance intrusion detection system using the SoC was implemented. The proposed system consists of a packet parser, a comparator, and a rule store implemented in the PL part of the SoC. The proposed system uses the FPGA to detect 6-tuple (destination and source MAC address, IP address, port number) and provides an interface for the users to manage intrusion detection rules. The Linux OS is used by the PS to manage the custom packet filtering rules. The implemented prototype uses 3.87% of LUT, 2.27% of Flip-Flop, and 26.88% of block RAM of the Zynq-7030 SoC.

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Extended Kalman Filter Design for Cost Effective Bio-medical Motion Sensor

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Abstract

Recently, various studies have been carried out to analyze physical ability of the body by measuring a body motion. Previous studies showed inadequacy in body movement measurement with inaccurate measurement capability, confined or limited space, or expensive equipment. In this paper, we propose an extended Kalman filter design that estimates motion trajectory of a body more precisely by using the length of the arm to estimate the positional measurement value. In the experiment, we compared the position of the left and right limbs by performing lateral raise with the shoulder joints as the axis. 2 sensors were attached to the left and right wrists for synchronization of the measurement between the limbs. These experimental results show that the low-cost sensors can measure movements of the left and right upper limbs.

Keywords: Extended Kalman filter, Body motion estimation, Motion sensor

1. Introduction

According to the American Academy of Orthopedic Surgeons, improper bodily posture and movements can be caused by certain deficiency of each segment of the human body. Causes for deficiency can be related to prolonged exposure to discomfort, pain, and deformation along with psychological program. Maintenance of bad posture and repeated disproportionate activities of daily living and habits have been known to lead to disability, dysfunction, and pain. Repeated exposure to either posture or movement imbalance for a prolonged period of time may lead to muscular imbalance. If imbalanced muscular strength exists for a prolonged period, inadequate tension may become prevalent in the adjacent muscles and joints. Chronic tension in the adjacent muscles and joints with muscular strength imbalance may also leads to reduced flexibility, aggravated pain, and movement limitations, resulting in changes in adjacent soft tissues and bones due to impaired coordination and incongruity of the body [1].

Muscular imbalance is fairly common because most people have dominant side that they are comfortable utilizing in everyday life. For example, in most adults, the neuromuscular activity of one of the left and right is dominant and the other is less active. This pattern also affects the imbalance between the left and the right [2]. Although such bilateral imbalance can be seen in general public, athletes frequently show imbalance due to greater amount of biased muscular activities. If the imbalance of the stabilizing muscles between the left and right muscles increases during simultaneous contraction, the risk of posterior joint buckling due to the rotational force of the joints will increase. If contraction of the stabilizing muscles of either sides does not occur at the simultaneously or muscular strength imbalance exist, risk for joint buckling will increase due to the increased rotational force [3,4].

The shoulder region and connected arm has the largest range of motion and is relatively unstable compared to other joints. Problems that arise from the shoulders vary from shoulder impingement and

rotator cuff tear to scapular winging due to various reasons including erroneous motion. Repeatedly conducted improper movements during every day activities or exercise may initiate and aggravate the difference in muscular strength between left and right shoulders [5].

Muscle imbalance and improper exercise techniques can impair daily performance ability and may lead to clinical situations. In particular, excessive or improper load used during weight lifting may exacerbates muscle imbalance and increases the incidence of injuries [6]. Non-dominant or weaker side may be disposition in an undesirable position during resistant exercise with excessively heavy weight load for possible acute and chronic injury. Since most of people practicing resistant exercise aspire for muscular hypertrophy and muscular strength, neglecting overall musculoskeletal stability and balance. This creates a disproportionate joint and muscle imbalance due to repetitive undesired postures and deflected exercise choices, putting those practicing resistant training at risk of injury [7]. Therefore, it is important to inform and practicing resistant training about the imbalance of the exercise by analyzing the exercise data in real time to prevent injury.

2.Related Works

Motion sensor has also been utilized to monitor human movements. Motion sensor is convenient and low in cost due to its wireless data transmitting capability and miniature size. Mera et al. [8] characterized dyskinesia through angular velocity data of hand-worn gyroscopes. In this study, repeated flexion-extension movements of the arms were measured for assessment of dyskinesia. Limitation of this study was that movement analysis was carried out using only a fixed motion task. This would limit measurement to angular velocity without consideration of position. Fisher et al. [9] attached an accelerometer to athletes to assess musculoskeletal and neuromuscular disorders. The measured data were analyzed for dysfunctional state through the Artificial Neural Networks (ANN).

In this paper, the researchers evaluated bilateral muscular imbalance by comparing the patients' diary on training with the analyzed results. Through the data analysis, it was concluded that prediction of dyskinesia was not possible due to inconsistency between the data and real-time evaluation. Delrobaei et al. [10,11] assessed musculoskeletal and neuromuscular diseases by attaching motion sensors including 17 accelerometers and gyroscopes to a wearable suit. Both studies captured bodily motion with four IMUs placed along the wrists, elbows, and shoulders of each arm, assessing for movement anomalies during repeated measurements of the moving and resting arms. The studies have been proven to be effective in assessing movement abnormalities, however, wearing 17 sensors attached suit and limiting to a designated area limited mobility and accessibility for measurement of awared movements. Lennon et al. [12] attach motion sensors to a body and divide the exercise score for movement according to the changes in accelerometer and gyroscope results. Although this method could determine the intensity of exercise, exercise capacity of both side of the body was not measured simultaneously.

Although studies on measuring and evaluating body movements have been previously carried out, to our knowledge, studies using motion measurement data to evaluate the balance of the left and right exercise capacities have not yet been conducted. Furthermore, previous measurements were conducted with expensive equipments in limited controllable areas. In order to elucidate dyskinesia movements, simultaneous measurement of symmetric body parts should be conducted. In addition, there is a need for a measurement method that can measure movement ability anywhere, regardless of the location. In this paper, we used a low-cost accelerometer and gyroscope MEMs sensor that can be utilized everywhere to measure bilateral movements such as erroneous upper or lower segment motions. Therefore, we aim to measure the movement imbalance between the right and left upper limbs during synchronized lateral raise movements.

3.Proposed work

The extended Kalman filter (EKF) presented in this paper is designed to measure joint movements such as shoulder or knee joint. In general, each sensor alone is not suitable for motion estimation due to drift errors. The proposed EKF compensates for the drift error of position estimates using accelerometer and gyroscope sensors to more accurate estimate static and dynamic state motion. The fusion of different sensor data and additional input information can increase the accuracy of the estimates. The EKF design of this paper uses two sensors, an accelerometer and a gyroscope to acquire motion data and increase the accuracy by adding the moment arm length of the joint motion as an input value.

3.1. Extended Kalman Filter Design and Implementation

The acceleration vector measured from the accelerometer and angular velocity vector measured in gyroscope are denoted \mathbf{a}_m and $\dot{\Theta}$ respectively. The linear acceleration, the linear velocity, and the position vector in the inertial frame are denoted by \mathbf{a}_I , \mathbf{v}_I and \mathbf{p}_I respectively. The rotation of the acceleration, velocity, and position vector from the sensor coordinate system to the inertial coordinate system is denoted by $\mathbf{R}_{S,I}$, and the rotation of the angular velocity is denoted by $\mathbf{R}_{\Theta,S,I}$ by adding the subscript Θ .

The state transition model of the EKF is composed of four kinds of variables as follows.

$$\mathbf{x}_{k+1} = \begin{bmatrix} \Theta \\ \mathbf{a}_S \\ \mathbf{v}_I \\ \mathbf{p}_I \end{bmatrix}_{k+1} = \begin{bmatrix} \Theta_k + \mathbf{R}_{\Theta,S,I}\dot{\Theta}_k \\ \mathbf{a}_m - \mathbf{R}_{I,S}g_I \\ \mathbf{v}_{I,k} + \mathbf{R}_{S,I}\mathbf{a}_{S,k}\Delta t \\ \mathbf{p}_{I,k} + \mathbf{v}_{I,k}\Delta t \end{bmatrix} \quad (1)$$

First, the attitude angle is constructed by rotating the angular velocity measured by the sensor into an inertial frame and integrating it at each time. The linear acceleration consists of the acceleration value in the sensor coordinate system from which the gravity component is removed from the measured value. The linear velocity can be obtained by integrating the acceleration into the inertial coordinate system, and the position can be obtained by integrating the velocity with each time.

The measurement model of the EKF consists of roll ϕ , pitch θ and position values as follows.

$$\mathbf{z} = [\phi \quad \theta \quad p_{I,x} \quad p_{I,y} \quad p_{I,z}]^T \quad (2)$$

In the above measurement model, the roll and pitch are obtained from the acceleration sensor readings. It can be obtained by calculating how many angles the measured value of each axis of the sensor is rotated based on the gravity value. Position is determined by rotating the moment arm length and its rotation matrix, which is given by

$$\begin{bmatrix} p_{I,x} \\ p_{I,y} \\ p_{I,z} \end{bmatrix} = \mathbf{R}_{I,S} \begin{bmatrix} 0 \\ 0 \\ -l \end{bmatrix}. \quad (3)$$

EKF is implemented through the state transition equations and measurement equations in Eq. (1) and (2). This model is designed to reduce estimation errors such as drift of position estimates due to drift. The EKF is composed of the EKF in the general form through the above state transition model and the measurement model.

3.2. Experiment Result

As shown in Fig. 1, the experiment measures the acceleration and angular velocity from the TI SensorTag, stores the data on the smartphone, and then performs motion estimation through MATLAB of the PC. To verify the validity of the result of the estimation algorithm proposed in this paper, we compared the results by performing a lateral raise exercise, a movement using the shoulder joint, with 2 sensors attached to the left and right wrists.

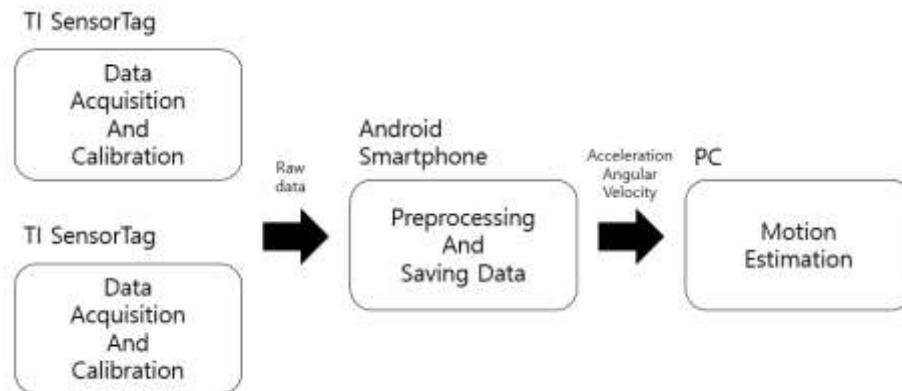


Fig. 1. Block diagram of the experimental configuration

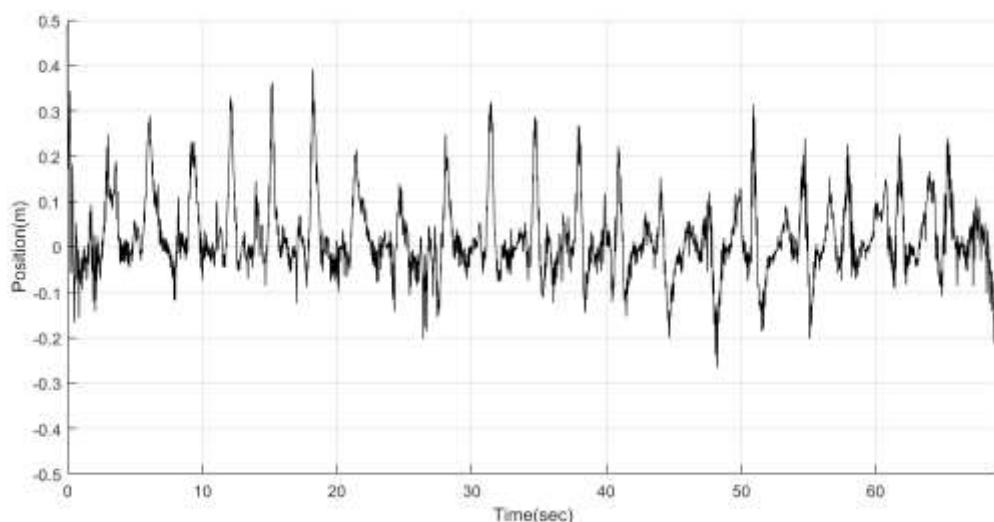


Fig. 2. Differences in the position estimated between the right and left sensors

Fig. 2. shows the positional difference between the z-axis position value of the right sensor and the left-hand sensor by subtracting the z-axis position value of the left sensor. Experiments show that in the measured data as shown in Fig. 2, the right sensor is generally faster and faster than the left sensor, allowing the left and right motion estimation. Therefore, these results show that the balance of athletic performance in the left and right side of the body can be measured.

4. Conclusion

Recently, various studies have been carried out to analyze the physical ability of a human body by measuring bodily motion for elite sports performance or clinical purpose. Most of the studies were inadequate to measure body movements with inaccurate measurement capabilities, even when using limited space, expensive equipment, or low-cost sensors. In this paper, we propose an EKF design that estimates the motion trajectory of the body more precisely by using the length of the arm to calculate positional values. The Experimental results using the EKF proceeded to measure the lateral raise motion of the left and right limbs around the shoulder joints. The experimental results of this paper show the possibility that low cost sensors can be used as a medical measurement tool requiring accuracy. Future studies will confirm that this method can be used for medical purposes by measuring and performing multiple joint movements to more subjects through this method.

ACKNOWLEDGMENT

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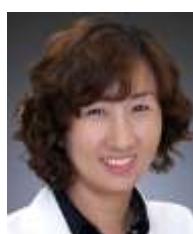
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FRUIT FLY ALGORITHM FOR ESTIMATION OF QUALITY RIPENING OF FRUITS

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ABSTRACT

Ripening is the progression by which fruits and vegetables attain their smart taste, brilliance, colour, edible nature and other textural properties. Ripening is related with variation in work i.e. vary from starch to sugar. A scheme for estimating ethylene (C_2H_4 in ppm) stage employing soft sensor is the purpose of this work. The projected method relies on the color of the fruit or the vegetable which denotes the various stages of ripening which in turn indicates the amount of ethylene gas necessary for the ripening method. Apples, pears, bananas, and mangoes are some of the fruits that release ethylene while ripening. Ethylene is responsible for varying in texture, softening, color, and other processes anxious with ripening. The evaluation of ethylene concentration released from the fruits indicates the stage of fruit ripening and measurement of ethylene is predictable during the post gather of the fruits and also throughout the haulage of the fruits in order to avoid over ripening. The capability of ethylene required for fruit ripening is carried out using a Feed Forward Neural Network (FFNN) trained with Back Propagation Algorithm (BPA) also required to sort out the type of ripening. Fruits are also ripened by artificial ripening methods which are not supportable for consumption. The intensity values in color images of the fruits are used for characteristic mining which is then used as inputs to train the FFNN. In order to attain high exactitude and sensitivity, various provisions have to be taken in order to eradicate hindrance effects. These comprise, for instance, the compensation of temperature or pressure variations in the gas, which may have a control on the ripening process. The accessible techniques for measurement of ethylene gas are chromatographs, Fourier Transform, infrared spectroscopy and electrochemical sensors which are laboratory based logical methods and are pricey. To overcome the limitations of the accessible logical techniques a simple and cost valuable soft sensor desires to be developed.

Keywords: Artificial Intelligence, Back Propagation Algorithm, Ethylene gas emission and Characteristic extraction.

1. INTRODUCTION

Ripening is a progression which adds colour, taste, flavor, aroma and appearance for the fruits and vegetables become feasible. They are alienated as climacteric and non-climacteric for ripening of the fruits. Climacteric fruits are defined as fruits that enter ‘climacteric phase’ after yield *i.e.* they prolong to ripen. During the ripening process the fruits release ethylene along with increased rate of respiration [1]. Ripe fruits are malleable and feeble and usually cannot bear rigors of transport and frequent handling. These fruits are harvested solid and green, but fully grown-up and are ripened near consumption areas. Small quantify of ethylene is used to persuade ripening process under prescribed conditions of temperature and moisture. They include mango, guava, fig, apricot, banana, kiwi, apple, plum, pear and passion fruit [2]. The other category is the non-climacteric fruits once harvested do not grow-up further. Non climacteric fruits produce very small quantity of ethylene and do not respond to ethylene treatment. There is no characteristic increased rate of respiration or production of carbon dioxide. They consist of orange, grapes, litchi, watermelon, blackberry etc [3].

2. EXISTING METHODS FOR RIPENING OF FRUITS BY SURVEY IN PRACTICE

Lack of easier and rapid methods for constant ripening pose a key difficulty in the fruit industry. Approximately all methods of ripening, either predictable or the modern chemical methods, come with their own behavior. There are quite a few easy technologies and methods existing today for farmers for good ripening. In general, the number of days taken for edible ripening varies for different fruits and prevailing climatic conditions. They consist of

1. Mango ripening in an air tight rice container. This is a usual process of ripening but not valid on large scale.
2. Smoking inside smoke chambers using acetylene gas.
3. Layers of paddy shell or wheat straw as a natural ripening medium.
4. Immerse immature fruits in 0.1 per cent ethrel solution, clean dry and extend them over a newspaper or clean cloth without touching each other.

5. 10 ml of ethrel and 2 gm of sodium hydroxide pellets are added in five litres of water in a broad mouthed container placed within the ripening chamber near the fruits and the room is preserved air tight.

6. Fruit ripening by means of calcium carbide as a artificial ripening agent.

Prevention of Food Adulteration (PoFA) has forced stringent rules to discard the usage of calcium carbide as it is dissolved in water, produces acetylene which acts as an artificial ripening cause. Acetylene is found to affect the nervous system by reducing oxygen supply to brain. Arsenic and phosphorus are noxious and exposure may cause severe health hazards. Hence from this survey it is recognized that ,The only safe and worldwide conventional method is using ethylene, which is a natural hormone for ripening when done under controlled temperature and relative humidity conditions and pressure can be used for ripening process which is considered as a secure process.

3. RIPENING PROCESS USING ETHYLENE GAS

Ethylene is an innate hormone and does not stimulate any side effects to the human community when consumed in large quantities over long periods [4]. This de-greening agent is capable of converting the chlorophyll responsible for the green colour of the fruits to yellow colour which indicates the carotenoids when applied under optimal ripening conditions [5]. The optimal conditions are listed in Table 1

Table 1. Finest Ripening Conditions

S.No	Substantial Parameters	Finest Range
1.	Temperature	18 °C to 25°C
2.	Dampness	90 to 95%
3.	Ethylene concentration	10 to 100 ppm
4.	Extent of Exposure	24 to 74 hours depending on fruit type and stage of maturity
5.	Air flow	Sufficient to ensure distribution of ethylene
6.	Aeration	Require adequate air exchange in order to prevent accumulation of O ₂ ' which reduces effectiveness of C ₂ H ₄ .

Structure chosen for applying ethylene depends on cost, viability and security factors. Diluted ethylene gas mix is securer than using pure ethylene, which is volatile and also combustible at 3% or higher concentration [6]. Fruits to be fully grown are placed in a hermetically preserved ripening room maintained at a constant temperature (18-21°C for most fruits, but 29-31°C in mango). The most favorable storage and ripening temperatures for various fruits are given in Table 2.

Table 2. Finest storage and ripening temperatures for various fruits

S.No	Name of the Fruit	Ethylene Concentration (ppm)	Ethylene exposure time (hrs)	Ripening temperature °C	Storage Temperature °C
1.	Avocado	10-100	12-48	15-18	4.4-13
2.	Banana	100-150	24	15-18	13-14
3.	Honey dew melon	100-150	18-24	20-25	7-10
4.	Kiwifruit	10-100	12-24	0-20	0.5-0
5.	Mango	100-150	12-24	20-22	13-14
6.	Orange degreening	1-10	24-72	20-22	5-9
7.	Stone fruit	10-100	12-72	13-25	-0.5-0

There are two structures of revealing fruits to ethylene.

1.Trickle method involves trickling ethylene gas into room so as to sustain a concentration of 10 ul per litre, naturally for a period of 24 hours. Room is then ventilated after 24 hours to avoid carbon dioxide exceeding 1% concentration, which would delay ripening process. Forced-air ripening affords more uniform temperature and ethylene concentration throughout ripening room.

2. Ripening can also be commenced using ethylene generated by passing ethanol over a bed of activated alumina. This structure is securer than using pure ethylene gas. Care should be taken to ventilate the ripening rooms daily so as to ensure that Carbon-di-oxide (CO_2) levels do not exceed 1%.

4. CHALLENGES IN RIPENING PROCESS

Ethylene gas is introduced into ripening rooms from high-pressure cylinders via flow-meters or by ethylene generators,which transform alcohol into ethylene via a heated metal catalyst. Controlling the rate of ripening effectively for fruits ripening is a great deal to meet the consumer demands, which involves considerable practice.

The various dynamics such as initial fruit maturity, temperature, relative humidity, air flow, as well as ethylene and carbon dioxide concentrations within the ripening room may all affect the rate of ripening. Carbon dioxide, as a by-product of ripening; process on excess levels (>5%) will rotten the fruits and vegetables. Hence an valuable method for measurement of the ethylene gas as well as carbon dioxide from the color of the fruits is projected.

5. PROJECTED METHOD FOR FRUIT RIPENING PROCESS

The ripening is a process reliant on step by step color change of the fruit, initially from green to yellow color stands as a base for this work. Color image processing finds application in this area to evaluate the ethylene and CO_2 gas levels with respect to the color of the fruit.

The video of the fruits image is attained by using the infra red camera. The video is changed into frames using video splitter and these frames are further analyzed. The characteristics are extracted from the images captured and these characteristics are used for C_2H_4 and CO_2 gases estimation as discussed in [1]. The major steps involved in the projected ripening quality monitoring system as depicted in Figure 1 includes the following

1. Infrared camera by means of servo motor mechanism.
2. CCTV set up is placed in the control room.

3. TV tuner is installed for transferring the video from the CRT monitor on to the PC.
4. Image processing packages are stacked in the laptop connected to the TV tuner.
5. The video file which is split up into frames for further scrutiny.
6. Image processing algorithms for analyzing the constituents of the images.
7. Intelligent control scheme to monitor and estimate the ripening process.
8. The validation of the developed algorithms.



Figure 1. Schematic diagram of the projected fruit ripening monitoring system

6. OBJECTIVE OF THE PROJECTED METHOD

The primary objective of this work is to develop a fruit ripening quality monitoring system using fruit image scrutiny by colour image processing in the container. According to the brightness value of the image pixels, the ripening characteristic parameters are picked up from the images. The online monitoring of ripening quality, C_2H_4 and CO_2 gas estimation using intelligent image processing technique thereby offers dynamic adjustment of C_2H_4 flow rate so as to ensure effective ripening process.

7. RESULTS AND DISCUSSION

The results for various conventional and intelligent schemes for monitoring fruit ripening process are discussed elaborately in this chapter. The images are preprocessed to ensure that it should be noise free and the desired images are used for scrutiny and monitoring purposes alone. The schematic for the projected concept is shown in Figure 2.

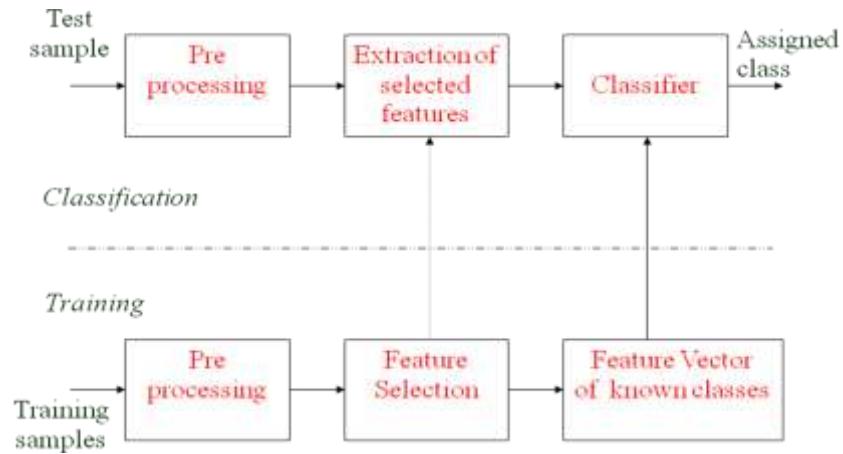


Figure 2. Methodology for Fruit ripening process using Image processing

The fruit images are captured by the infra red camera as a sensor placed at the top corner of the room with a servomotor mechanism for changing the direction of the camera. The infra red camera is of Sony make. The video acquired is converted to frames using video splitter software. The images acquired are preprocessed, analyzed before feature extraction and classification. The collected data is recorded in Table 3.

Table 3. Ripening parameters corresponding to various fruits

Ripening parameters	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
Images of Banana fruit							
Images of Mango fruit						NA	NA
Ethylene conc.(ppm) for Banana fruit	140-150	130-140	120-130	115-120	110-115	110-100	100 -10
Ethylene conc.(ppm) for Mango fruit	140-150	130-140	120-130	110-120	110-100	NA	NA
Ethylene exposure time (hrs) for Banana fruit	24	24	24	12	12	6	6
Ethylene exposure time (hrs) for Mango fruit	24	24	24	12	12	NA	NA
Ripening temp. °C for Banana fruit	15-15.25	15.25-15.5	15.5-16.25	16.25-16.5	16.5-17.25	17.25-17.5	17.5-18
Ripening temp. °C for Mango fruit	22	22	22	21	20	NA	NA

The preprocessing includes dithering, filtering and edge detection. The filtering removes noise so that the noise free images can be used for additional analysis and the edge detection is carried out to extract the region of interest which in turn determines the characteristics to be extracted.

Image approximation is done to decrease the number of colors in an image; the ensuing image might look mediocre to the original, because some of the colors are vanished. Dithering is performed to amplify the visible number of colors in the output image and also changes the colors of the pixels in the vicinity so that the normal color in each neighborhood approximates the unique RGB color. The output for dithering and filtering for Banana is shown in figure 3.

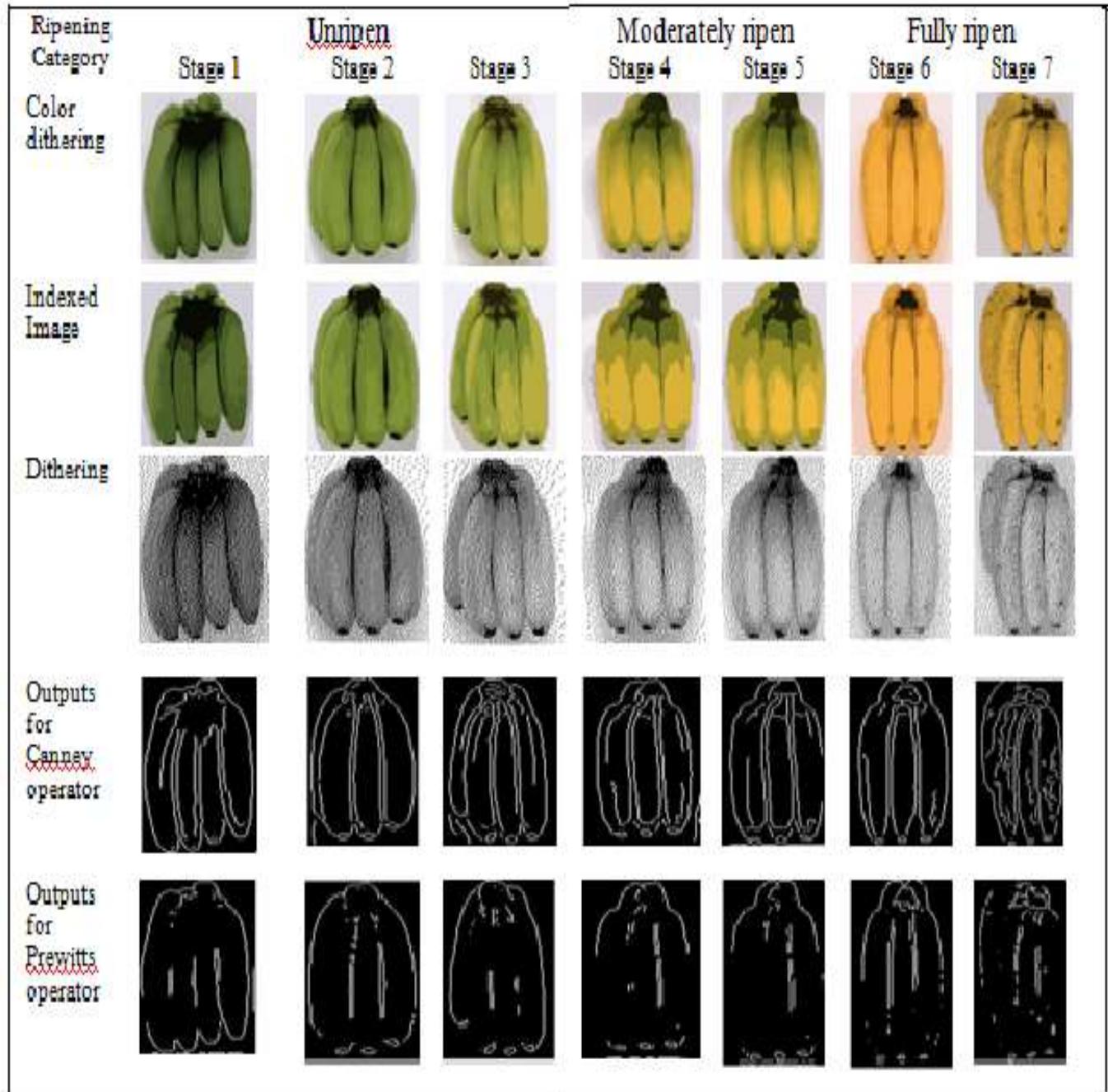


Figure 3. Output for Dithering and Filtering

The output for dithering and filtering for Mango is shown in figure 3

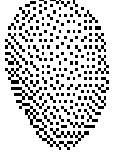
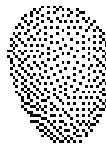
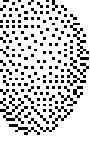
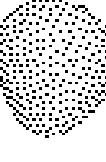
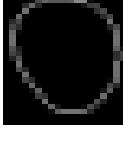
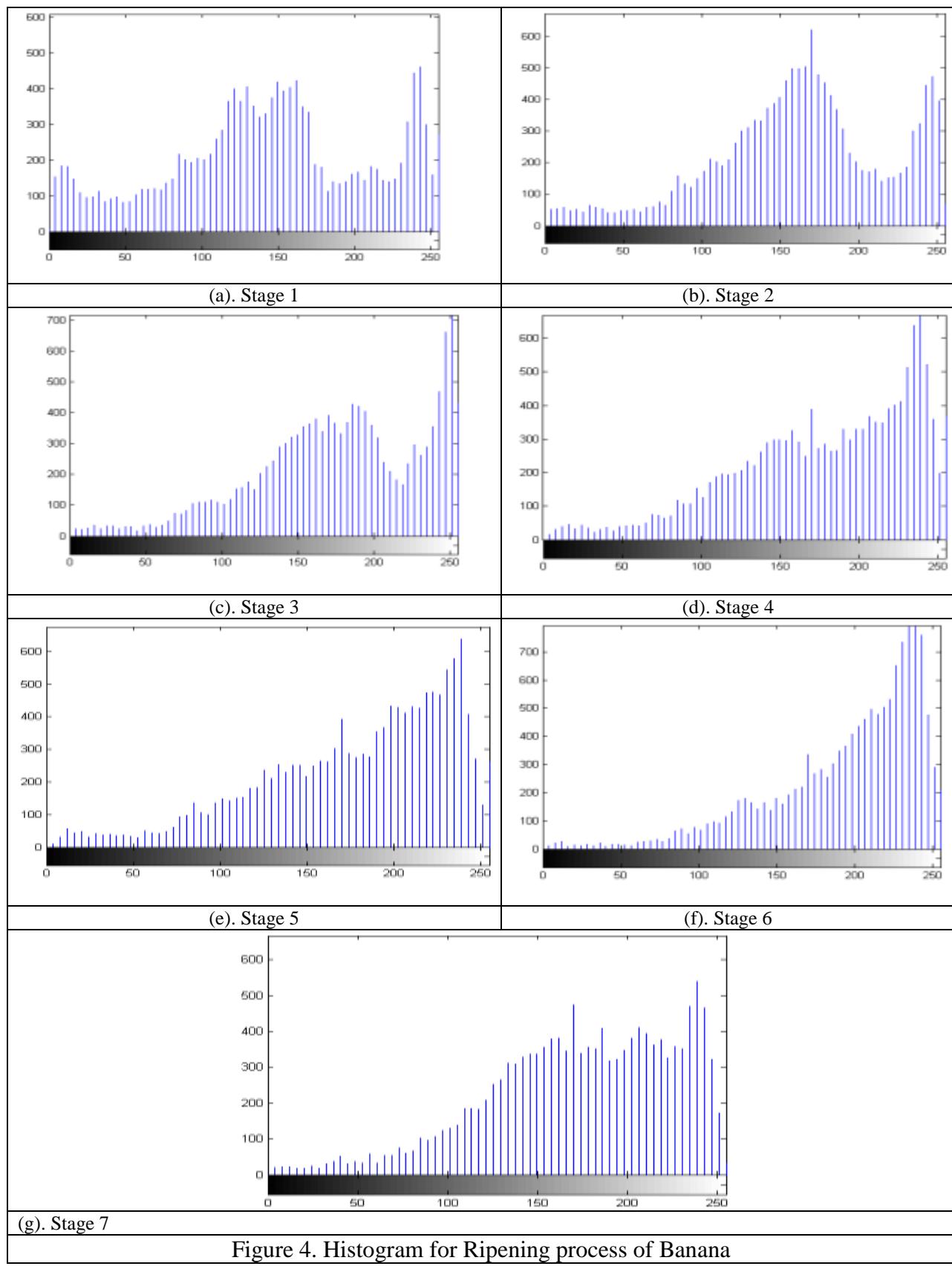
Ripening Category	Unripen		Moderately ripen		Fully ripe
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Color dithering					
Indexed Image					
Dithering					
Outputs for Canney operator					
Outputs for Prewitts operator					

Figure 3.Output for Dithering and Filtering



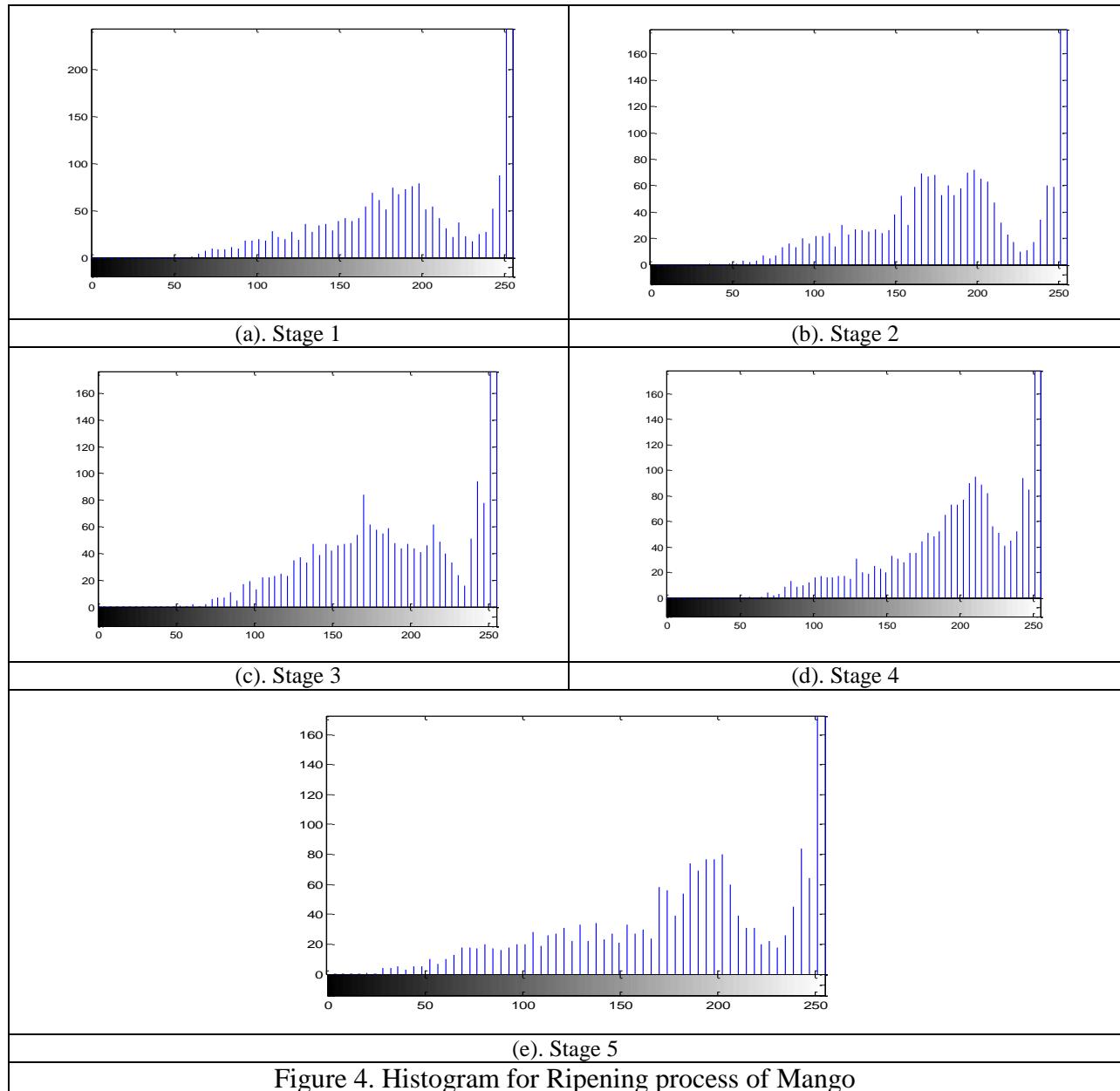


Figure 4 denotes the histogram which is the plot between the pixel strength and their frequency of occurrence. During the initial stages (from 1 to 3 stages denoted as Unripen) of ripening, the strength values lie between a minimum of 100 to a maximum of 175 which is totally green in colour (see Figure 4(a) to (c)). For the stages 4 and 5 (denoted as Moderately ripen) the maximum and minimum strength range is 175-225 (Figure 4(d) to (e)). These stages are partially green and yellowish. For the remaining 2 stages (denoted as Fully ripen) which is entirely yellowish; the strength values range from 175- 255 which is evident from Figure 4(f) to (h). This histogram analysis is done to verify that the colour variation facilitates the measurement and control of the ethylene gas supply which is used as the ripening agent.

The various features like mean, standard deviation, mode and variance are extracted from the images. The features represent the basic pattern that gets repeated in various directions to form an image. Hence by extracting the selective features the ripening state as well the amount of ethylene gas inside the ripening chamber can be calculated.

Table 4. Feature Extraction for Banana

S.No	Mean	StdDev	Mode	Median
1.	110.541	68.044	255	91
2.	140.89	59.907	244	125
3.	174.705	56.475	246	170
4.	187.24	55.931	255	206
5.	181.119	57.356	218	199
6.	231.265	35.707	246	245
7.	196.985	38.898	221	203

Table 4. Feature Extraction for Mango

S.No	Mean	StdDev	Mode	Median
1.	201.948	48.483	255	182
2.	195.823	47.657	255	177
3.	197.311	46.854	255	181
4.	205.218	40.925	255	187
5.	188.681	54.928	255	169

The evaluation was done using Feed Forward (FF) architecture of trained with Back Propagation Algorithm (BPA). The FF Neural Network (NN) is constructed by highly interconnected processing units (nodes or neurons) which perform simple mathematical operations. Neural networks are characterized by their topologies, weight vectors and activation function which are used in the hidden layers and output layer. The topology refers to the number of hidden layers and connection between nodes in the hidden layers. The activation functions that can be used are sigmoid, hyperbolic, tangent and sine.

The network models can be static or dynamic. Static networks include single layer perceptrons and multilayer perceptrons. A perceptron or adaptive linear element (ADALINE) refers to a computing unit. This forms the fundamental building block for neural networks. The input to a perceptron is the summation of input pattern vectors by weight vectors. Information flows in a feed-forward manner from input layer to the output layer through hidden layers. The number of nodes in the input layer and output layer is fixed. It depends upon the number of input variables and the number of output variables in a pattern. In this work, there are seven input variables and one output variable. The number of nodes in a hidden layer is fixed by trial and error. In this application, the network parameters such as the number of nodes in the hidden layers and the number of hidden layers are found by trial and error method. In most of the applications one hidden layer is adequate. As the name implies BPA the weight updation takes place in the reverse order i.e. from the output layer to input layer [7].

FFNN structure trained with BPA is used to identify the estimation of ethylene gas for ripening process so as to prevent the fruits from rotting during the process of de-greening. Emission of CO₂ is likely to rotten the ripened fruits ratio and flame temperature. The features obtained from the images are given as the inputs to the FFNN. Table 5 contains the values for various features extracted. The target is the value

of the C_2H_4 gas concentration. The normalized values of the features are used for obtaining results from the various intelligent classifiers. For normalization each value of the feature divided by the maximum value of that feature is used as the formula so as reduce the computational complexity.

The inputs for FFNN trained with BPA require 4 features as given in Table 5. A set of final weights are obtained by training with desired target value (C_2H_4 gas concentration). Testing the projected algorithm to infer the ripening state and C_2H_4 gas concentration from the fruit image is done with final weights obtained after training to achieve feed forward control C_2H_4 gas concentration. The outputs of the FFNN trained with BPA are shown in Figure 5. Similarly the FFNN was trained and tested as discussed above. The Table 5 shows the network parameters with values prescribed for the objective function.

Validation of FFNN with four features as input and one output is done. Table 5 given below shows the data relating to the fruit images collected at some other stage of time. The results in Table 6 support that intelligent estimation is valuable for fruit ripening quality monitoring. The training and testing results are very close to the validation results. The precision and recall for all the three classes are shown in Table 7 below.

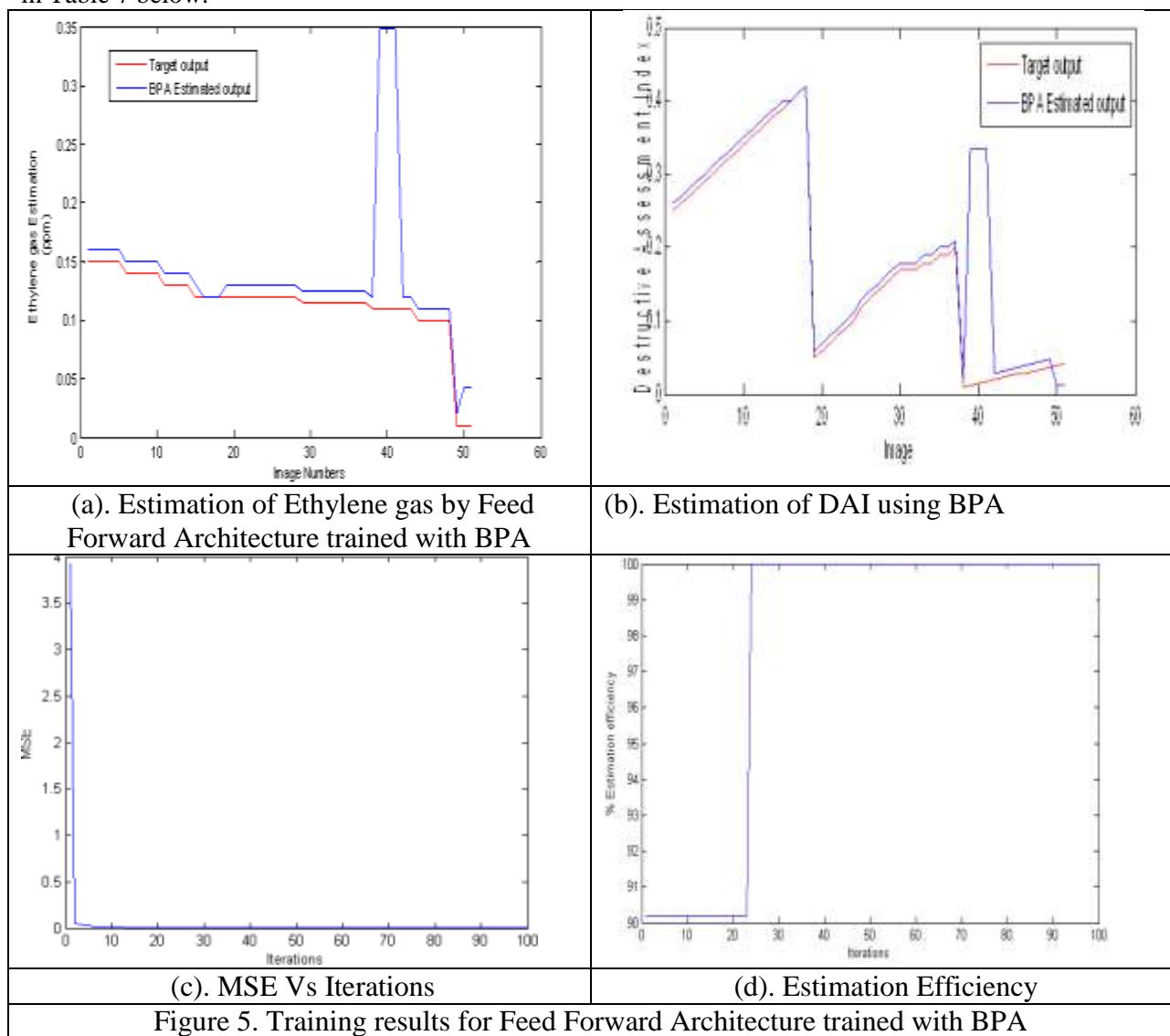


Table 5. Network Parameters for training the ANN

S.No	Network Parameters	Values
1.	No. of nodes in the input layer	4
2.	No. of nodes in the hidden layer	3
3.	No. of nodes in the output layer	1
4.	No. of patterns for training	51
5.	No. of patterns for testing	51
6.	Mean Squared Error	0.0198
7.	Activation function	sigmoid
8.	Network Architecture	Feed Forward
9.	Algorithm used	BPA

8. GENETIC ALGORITHM

Genetic algorithms are based on biological progress. Genetic algorithms can be used to explain a wide variety of problems. Given a problem a genetic algorithm generates a set of possible solutions and evaluates each in order to choose which solutions are fit for reproduction. If a particular solution is more fit then it will have more chances to generate new solutions. Finally we can find a real solution.

The genetic algorithm uses three main types of rules at each step to produce the next generation from the current population:

- *Selection rules* select the individuals, called *parents*, that contribute to the population at the next generation.
- *Crossover rules* combine two parents to form children for the next generation.
- *Mutation rules* apply random changes to individual parents to form children.

Artificial Intelligence (AI) is the study and creation of computer systems that can perceive reason and act. The primary aim of AI is to produce intelligent machines. The intelligence should be exhibited by thinking, making decisions, solving problems, more importantly by learning. AI is an interdisciplinary field that requires facts in computer science, linguistics, psychology, biology, philosophy and so on for serious research. Genetic algorithm is a kind of Artificial Intelligence which is used to train the neural network.

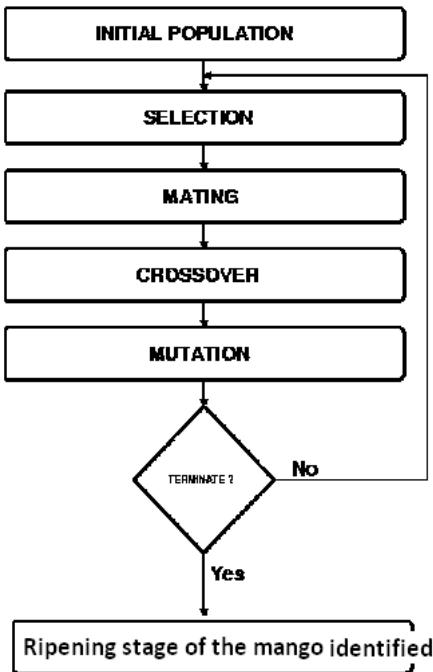


Figure 6. Flowchart for Genetic algorithm

The extracted features are used for estimation by Genetic Algorithm. The Genetic Algorithm along with the extracted features is used for training the ANN. The close connection between the training and testing patterns in identification of mango ripening with respect to intensity is shown in Figure 7. Similarly the surface plot in Figure 8 shows the relation between the intensity and ripening stage. The estimation of Quality ripening process and generations is depicted in Figure 9. The improvement made in application side denotes that earlier a circuit with capacitance is used to generate ethylene gas for this purpose which is on other hand replaced by using a soft sensor. The parameters of GA is shown in Table 6.

TABLE 6. Parameters of GA

S.No	Parameters in GA	Parameter value
1.	No. of Generations	40
2.	Population size	150
3.	Fitness value	0.022
4.	Probability of mutation	0.1
5.	Type of cross over	Single point cross over
6.	No. of bits in cross over	8

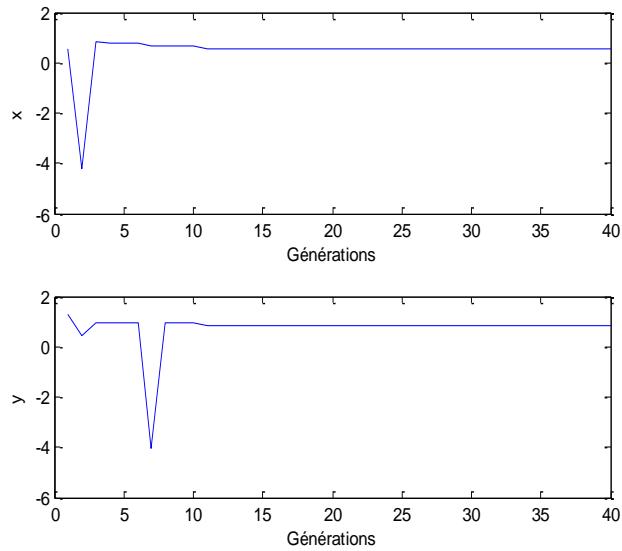


Figure 7. Estimation of intensity values by GA in ripening stage identification

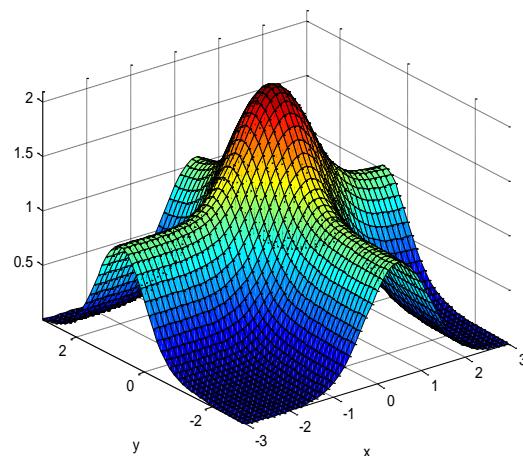


Figure 8. Surface plot for Ripening stage

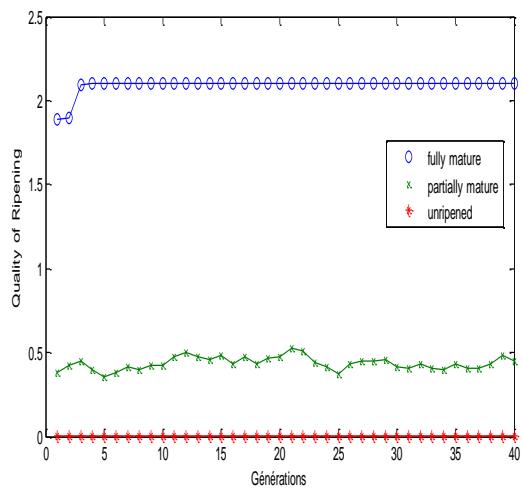


Figure 9. Estimation of Quality ripening process by GA

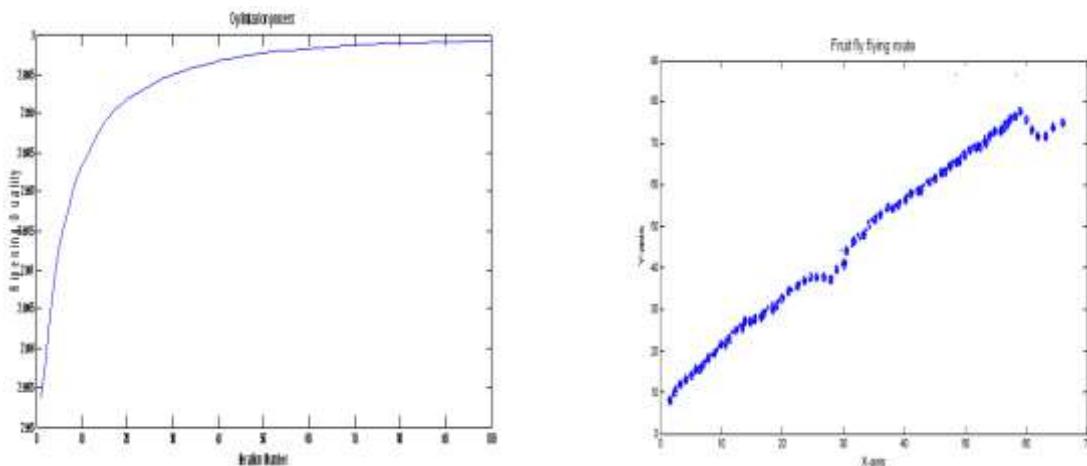


Figure 10. Results for fruit fly algorithm

Iteration Number

9. CONCLUSION

In this work, 102 images collected from the ripening room. The images are pre-processed and features are extracted. Training of FFNN using BPA is done with 51 images taken for unripen, moderately ripen and fully ripen so as to achieve the final output. Also other AI based methods like GA and FFA are incorporated. Testing and validation results shown in Table 7 indicate that maximum classification performance is obtained using FFA. Classification performance can be improved by further pre-processing of the acquired images. Depending on the quality of ripening; corresponding to the colour of the fruit images necessary action is taken to increase or decrease the C_2H_4 gas supply so as to ensure complete efficient ripening process. The inferred parameters can be displayed through the cloud service for anytime monitoring and control providing a cost valuable solution. To conclude with there is a further scale to extend the work by considering the spectrum of the images.

Table 7. Comparison of performance criteria for testing and validation

Comparison Testing/Validation	Class 1		Class 2		Class 3	
	Precision	Recall	Precision	Recall	Precision	Recall
Testing results	1	1	0.894	1	0.85	1
Validation result	1	1	0.8358	1	0.8	1

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Analysis of Quality Assessment methods in Distance Education- A case-study based approach

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Abstract

The competitive environment & flexibility in education led to the promotion of its importance in distance mode which helps learners who are in remote place reach out to education. Distance education (DE) is one of the methods for providing knowledge to executives & adult learners. There are various key points that are inter-related to distance education. Further study leads to a different strategy of education which is termed as pedagogy. There are many factors that contribute to the advancement of Distance Education. These factors measure the quality of education in DE. The quality assessment in Distance Education is a continuous ongoing process due to change and advancement in technology. This paper addresses the factors that are important for quality assessment in Distance Education. The study is an exploratory research in which sample size of 240 respondents is taken from an eLearning company called Benchmark Private Limited situated at Bangalore. These samples are taken from them which they actually upload on their Learning Management System and the data taken are related to various aspects such as use of technology, a content of course material, the class atmosphere, classroom sessions, interactions among student & instructor, assignments, tests, facility of the library, the infrastructure and the attitude of students. These considerations are variables of our interest that are reduced by applying data reduction technique such as factor analysis using the statistical tool.

The paper highlights five factors obtained from factor analysis, which contributes to assessing quality. They are knowledge level of instructor,

student's performance, the administrative efforts, the participation and interaction of students & availability of resources.

Keywords: Distance education, quality assessment, factor analysis, knowledge of instructor, student's performance, availability of resources, administrative efforts, interaction of students, availability of resources

1.1 Introduction

In order to determine quality factors in distance education, there should be clarity on the definition of distance education. The term distance education “encompasses a commitment to open opportunity and levels inequalities, a pedagogy that redirects some of the control and authority that conventionally lies with teachers toward the learners, a set of instructional design principles and methods of facilitating interaction, special leadership and managerial practices, a rethinking of educational policy and a way of organizing resources that changes the balance of system” [1].

Quality in Distance Education

In today's changing global environment, assurance and sustenance of quality in education is a complex phenomenon. Different educationists have perceived the quality of education in different ways. Judgment about quality differs according to whose views are sought [2]. Indian complex socio-economic system accesses the impacts of quality [3]. This quality of education means the quality of teachers, quality of learners, quality of courses, quality of planning and management, quality of infrastructure/resources and quality of teaching and evaluation methods. In terms of the system approach, the quality of input and process will shape the quality of outputs that the graduates of an education system. Therefore, the quality of distance education is not a one-time affair. It is a continuous process involving sustained efforts.

Assessing Quality of Distance Education

The most difficult task in quality assessment is to find the quality factors or indicators. There are various tools used or recommended for quality assessment. According to Stewart, Hong, and Strudler, they constructed an instrument that “allows instructors to conduct a comprehensive evaluation of the quality of Web-based courses”. One of the limitations of the instrument construction was the inability to locate a previous instrument to assess construct validity. Accordingly, an instrument was pilot tested, reliability coefficient scores were calculated (Cronbach's alpha), and a factor analysis was utilized to determine the structure of the data. There was no mention and description of procedures used to reduce cultural bias [4].

Distance education programs are playing a very important role in educational programs conducted throughout the world. Despite the rapid growth in distance learning, some efforts have been made to conceptualize, particularly in terms of offering a quality educational product. The current investigation provides a holistic model with five primary factors that affect the overall ecology of a distance learning experience. Included in the model are considerations for course delivery, instruction quality, student participation and involvement, course and program administration, and the culture of teaching and learning [5].

Research Methodology

The present study is an exploratory research design where primary data is collected from an eLearning company called Benchmark Private Limited, Bangalore who provides eLearning services to most of the universities across India for face-to-face learning, self-paced learning, and blended learning. They also provide services such as skill-based certificate course for few corporate companies at Bangalore. The study is done on few of the actual data which are taken as sample and will be extrapolated to actual data. The time frame in which the data was considered is between April 2016 and March 2017. The proposed data is also being used in the extended paper. The population of the study comprises of all the students enrolled in distance education. For the selection of respondents, simple random sampling technique was adopted. For data collection, questions were mailed electronically. The total number of respondents who were enrolled in the learning management system for the survey was two hundred ninety. The responses received were 247 (85%) and the usable data was 240 (82%). So the sample size of the study was 240. The respondents under study belong to different demographic groups like sex, education level (both undergraduate and postgraduate), income level etc. The questions related to factors for quality assessment of distance education are framed in a five-pointer scale in which the value 0 stands for no impact, 1 stands for very low, 2 stands for low, 3 stands for medium, 4 stands for high & 5 stands for very high. The responses received on the question pertaining to students attitude towards learning process indicates that 41% of students have given a specific factor as high consideration and 20% have given that factor as very high consideration, the total score gained by this factor is 976.

Factor analysis is a method for identifying whether a number of variables of interest $Y_1, Y_2 \dots Y_n$, such as course material, classroom session, use

of technology as on, are linearly related to a smaller number of unobservable factors F1, F2, ... Fk. The total numbers of variables in the present study were 13. The variables taken into consideration were as shown in Table1.

Table 1 List of variables used in factor analysis

S.No	List of Variables	Total score	Total % of Variance
1	Classroom Session	875	19.017
2	Attitude	976	12.913
3	Classroom Atmosphere	683	12.262
4	Infrastructure	877	9.096
5	Use of Technology	866	8.572
6	Students Placement	679	7.117
7	Library	517	6.888
8	Course Material	680	6.280
9	Assignment	587	5.628
10	Testing Ability of Faculty	940	5.272
11	Location	912	3.753
12	Interaction	557	2.850
13	Qualification of faculty	934	0.353
13	Qualification of faculty	934	0.353

Preliminary Analysis:

In the correlation matrix, the upper half of the matrix contains the person correlation coefficient between all pairs of variables where the other half contain the one-tailed significance of these coefficients. There is no singularity of data is found as the significance values & correlation coefficient values are in accordance (significance values < 0.05 & correlation coefficient values < 0.9).The determinants value is 2.454E-02 which is greater than the necessary value of 0.00001.

The Kaiser-Meyer-Olkin measure of sampling adequacy the statistical values lies between 0 to 1. The data value is 0.502 in the study which lies between 0.5 to 0.7 i.e. mediocre range. Bartlett's Measure tests null hypothesis that the original correlation matrix is an identity matrix. A significant test tells us that R-matrix is not an identity matrix concluding that there is some relationship between the variables in the factor analysis.

All preliminary analysis prevails that factor analysis is appropriate for the present study which is as shown in Table 2.

Table 1.2: Rotated Component Matrix

Variables	Component				
	1	2	3	4	5
Qualification of Faculty	0.945				
Testing Ability of Faculty	0.945				
Use of Technology	0.523	0.46			
Students Place- ment		0.765			
Classroom Session		0.68			
Infrastructure			0.81		
Classroom Atmos- phere			0.772		
Assignment				0.704	
Interaction				- 0.674	
Attitude				0.502	
Course Material					-0.646
Location					0.615
Library			-0.43		0.454
Extraction Method: Principal Component Analysis.					
Rotation Method: Varimax with Kaiser Normalization.					
Rotation converged in 8 iterations.					

The principal component method is used for factor analysis, the component matrix shown above extracts five components or factors which are important to assess the quality of distance education.

Interpretation

Factor analysis reduces thirteen variables into five important factors which are important for the quality assessment of distance education. The factor produced by the analysis represents some common themes. Therefore, the variable that loads highly on factor one (F1) seems to be related to knowledge of faculty member, factor two (F2) relates to the aspects of the performance of students. In factor three (F3), all the variables are related to a common theme of administrative efforts, factor four (F4) is related to participation and interaction of students and the last factor, five (F5) the variables are related to a common theme availability of resources.

Conclusion

From prior research, it is found that there are five factors which are important for the quality assessment of distance education. These factors are:

Knowledge of Instructor/Faculty: is one of the most important factors which emphasize on the qualification, testing ability & technical knowledge of the instructor. Instructor responsibility has been described as vital to distance learning program success, and it entails both curriculum design and delivery. Faculty involved in teaching through various distance learning technologies have the responsibility to design instructional programs that involve learners at delivery sites in class dialogue, where possible, and in the establishment of course goals and objectives[6].

Student Performance: The performance of student depends upon their ability to use the technology, their achievements including placements & learning ability in the classroom.

Administrative Efforts: This factor includes infrastructure, facility of library & classroom atmosphere. It refers to provide the students with access facility to the library with relevant course material, providing a computer lab with internet facility and supporting with necessary services for effective distance learning.

Participation and Interaction of Students: The interaction between student & the faculty decides interactivity of the classroom session. This factor also includes the attitude, process, and involvement of the students

while doing assignment given by the faculty members. The involvement of participants in the learning process is an inherent component of both adult learning theory and the involvement in learning concept for undergraduate education.

Availability of Resources: The factor mainly focuses on the approachability of the resources such as course material delivery, facility in the campus library and the location of the campus. Course material includes many aspects such as the mechanism adapted for delivery of course material and planning a course material that covers the whole syllabus. Use of e-books is growing therefore, there is a huge need for online library management system.

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EEG Feature Extraction using Daubechies Wavelet and Classification using Neural Network

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Abstract: Electroencephalography (EEG) is a simple method which gives an idea about the potential generated on the surface of the brain which helps in understanding the functionality of the brain. So EEG signals play an important role in detecting the Human emotions. In this paper, new features are extracted using Discrete Wavelet Transform (DWT) and further the emotions are classified using EEG signals of 10 subjects collected using 24 electrodes from the standard 10-20 Electrode Placement System which is placed over the entire scalp. Feature Extraction is performed by using DWT and the Decomposition of EEG signals is extracted for 8 levels using “db4” wavelet. Features like Energy Density, Power spectral Density are extracted. The feature extracted signals are then classified using Artificial Neural Network (ANN) and the neural system is trained, evaluated and the classification is performed which can be compared for emotional states classification.

Keywords: Electroencephalogram (EEG), Discrete wavelet transform, Feature extraction, Artificial Neural Network (ANN), Daubechies 4 Wavelet

1. Introduction

Researchers are finding ways to focus on Human computer interaction to empower computers to understand human emotions. Murugappan et. al [1] analysed that emotion perception relates to similar thinking, learning and remembering a consequent of complicated brain activity. These detected emotions can be used as a user input to the brain computer interface system.

Researchers on human EEG signal reveal that brain activity plays a major role in the assessment of emotions. M.A.Khalilzadeh et.al [2], proposed the emotional states from neural responses is an effective way of implementing brain computer interfaces. K.Schaaff et.al [3] relates the studies related to an important functional activity of EEG signals. Many methods are used for estimating human emotions in the past. Different researchers have carried out different methods for feature extraction and classification which is been discussed. Mingyang et.al [4], proposed a novel approach for the Classification of BCI signals. In their work Discrete Wavelet Transform (DWT) was implemented for feature extraction using Daubechies wavelet db4, for a 5 level Decomposition of EEG signals. They have considered 100 samples in a single channel EEG at a sampling rate of 173.61 Hz. The features computed were mean of the envelope spectrum in each sub-band, energy, standard deviation, maximum value of the envelope spectrum in each sub-band. The classification of EEG signals was performed based on bagging method. In this method a Neural Network Ensemble (NNE) Algorithm was developed for the classification of EEG signal by implementing the N-class classification into N independent 2-class classification, which uses Classification accuracy of about 98.78% was achieved. Jasmin Kevric [5] implemented two feature extraction methods namely DWT and Wavelet Packet Decomposition methods. Both these methods generate several sub-band signals from which six different statistical features, including higher order statistics were extracted. A sampling rate of 100 Hz was considered by using Symlet 4 wavelet. Classification of BCI signals was implemented using K nearest neighbor (K-NN)

algorithm and an average classification accuracy of 92.8% was achieved. Gilsang Yoo et al [6], developed a human emotional state from bio-signal system that can recognize human emotional state from biosignal. The by considering six emotional states. In this work, two methods were proposed namely Multimodal Bio-signal Evaluation and Emotion recognition using Artificial Neural Network. An accuracy of 85.9% was obtained for Back Propagation. The study results can help emotion recognition studies to improve recognition rates for various emotions of the user in addition to basic emotions. Gyanendra et.al [7] has performed the feature extraction of EEG signals using Daubechies Wavelet by considering 32 channels. The physiological signals were recorded at 512 Hz sampling rate and down sampled to 256 Hz, for a 5 level decomposition to obtain the detailed and approximate co-efficients with a sampling rate of 512 Hz to capture the information from signals as it provides good results for nonstationary. The experiments were performed to classify different emotions from four classifiers namely, Support Vector Machine (SVM), Multilayer Perceptron (MLP), K-Nearest Neighbor (K-NN) and Meta Multiclass (MMC). The average accuracies are 81.45%, 74.37%, 57.74% and 75.94% for SVM, MLP, KNN and MMC classifiers respectively. Suwicha Jirayucharoensak et. al [8] implemented a system by collecting 32 subjects of EEG signals. The EEG signals were down sampled from 512 Hz to 128Hz. The power spectral features of EEG signals on these channels were extracted .The emotion recognition was performed by using a deep Learning Network with 100 hidden nodes in each layer and it was reduced to 50 hidden nodes for investigating the effect of hidden node size in the DLN. The Principal Component Analysis (PCA) extracted the 50 most important components. The extracted features were fed as into the DLN with 50 hidden nodes in each layer. The purpose of PCA is to reduce dimension of input features. The classification accuracy of the DLN with PCA and CSA is 53.42% and 52.05 %. Amjad S. Al-Fahoum et.al [9] has described a mathematical method by considering five different signal extraction methods. The main methods of frequency domain and time-frequency domain methods for linear analysis of one-dimensional signals for EEG signal feature extraction. Noppadon Jatupaiboon et.al[10] considered a wireless EMOTIV Headset for collection of EEG signals, which consists of 14 channels. The sampling rate is set at 128 Hz. The EEG signals were decomposed by implementing Discrete Wavelet Transform. In this paper a real time EEG data is considered to classify happy and normal emotions by giving an external stimulus in the form of pictures and classical music. Different frequencies were analyzed, in that Gamma and Beta band gave a better result than low frequency bands. By using SVM as a classifier, power spectral density was analysed as a feature and an average accuracy of 75.12% and 65.12 % was achieved. Umut Orhan et.al [11] proposed a classification model using Neural Network for epilepsy treatment. An EEG data of about 100 single channel EEG signals were considered which was decomposed into sub-bands by using db2. The decomposition was performed for 11 levels. The wavelet coefficients were clustered using the K-means algorithm for each frequency sub-band. Wavelet coefficients obtained from EEG segments with 4097 samples were clustered by K-means algorithm. In this work, the MLPP Model is supported by the Levenberg–Marquardt (LM) algorithm by considering a single hidden layer of 5 hidden neurons resulting in classification of the EEG segments. Classification accuracy of 95.60% was achieved for normal and abnormal patients using the test data. Abdulhamit Subasi et.al [12], EEG signals were decomposed into the frequency sub-bands using DWT and a set of statistical features was extracted from the sub-bands to represent the distribution of wavelet coefficients. In this work, DWT has been applied for the time–frequency analysis of EEG signals for the classification using wavelet coefficients. Using statistical features extracted from the DWT sub-bands of EEG signals, three feature extraction method namely PCA, ICA, and LDA, were used with SVM and cross-compared in terms of their accuracy relative to the observed epileptic and normal patterns. According to this result, the application of nonlinear feature extraction and SVMs can serve as a promising alternative for intelligent diagnosis system. Xiao-Wei Wang et.al [13], in this paper, four emotion states ,namely joy, relax, sad, and fear are considered. The EEG Signal classification k-nearest neighbor (k-NN) algorithm multilayer perceptron and support vector machines are used as classifiers. Experimental results indicate that an average test accuracy of 66.51% for classifying four emotion states can be obtained by using frequency domain features and support vector machines. In our Research, different classification algorithms have been implemented, to classify three different emotional states, in this paper one Classification of EEG signals

is proposed using artificial neural network. In this work, implementation of Feedforward Back-Propagation Algorithm is performed.

2. Discrete Wavelet Transform (DWT)

Discrete wavelet transform is performed by repeated filtering of the input signal using two filters. The filters are a low pass filter (LPF) and a high pass filter (HPF) to decompose the signal into different scales. The output co-efficient gained by the low pass filter is the approximation co-efficient. The scaling function output is in the form of:

$$\Phi(t) = 2 \sum_{q=0}^M h(q) \Phi(2t - q) \quad \dots \quad (1)$$

The output of the high pass filter is the detailed co-efficient. The wavelet function output is in the form of:

$$w(t) = 2 \sum_{q=0}^M g(q) \Phi(2t - q) \quad \dots \quad (2)$$

The approximation co-efficient is consequently divided into new approximation and detailed co-efficients. By choosing the mother wavelet the co-efficient of such filter banks are calculated. This decomposition process is repeated until the required frequency response is achieved from the given input signals. The selection of an appropriate wavelet function has been a challenge in this research. Among different wavelets, daubechies wavelet has been chosen as they have a maximal number of vanishing moments and hence they can represent higher degree polynomial functions. With each wavelet type of this class, there is a scaling function known as “father wavelet” that generates an orthogonal multi-resolution analysis. Each wavelet has vanishing moments equal to half the number of coefficients. The number of vanishing moments is what decides the wavelet’s ability to represent a signal. Every resolution scale is double that of the previous scale. Daubechies family of wavelets has been chosen because of their high number of vanishing moments making them capable of representing complex high degree polynomials. Thus Daubechies 4 wavelet provides a good signal output.

2.1. Daubechies 4 Wavelet

The Daubechies wavelet transforms are defined in the same way as the Haar wavelet transform by computing running averages and differences via scalar products with scaling signals and wavelets the only difference between them consists in how these scaling signals and wavelets are defined.

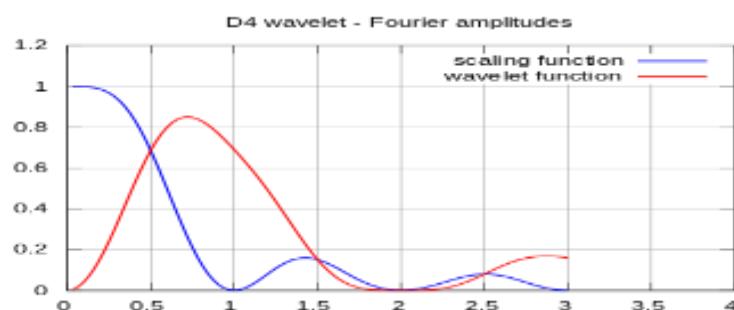


Figure 1. Daubechies Wavelet representing scaling and wavelet function

For the Daubechies wavelet transforms, the scaling signals and wavelets have slightly longer supports, i.e., they produce averages and differences using just a few more values from the signal.

The Daubechies D4 transform has four wavelet and scaling function co-efficients. The scaling function co-efficients are:

$$\{h_0 = \frac{1+\sqrt{3}}{4\sqrt{2}}; h_1 = \frac{3+\sqrt{3}}{4\sqrt{2}}; h_2 = \frac{3-\sqrt{3}}{4\sqrt{2}}; h_3 = \frac{1-\sqrt{3}}{4\sqrt{2}}\} \quad \dots \quad (3)$$

Each step of the wavelet transform applies the scaling function to the data input , if the original data set has N values and the scaling function will be applied in the wavelet transform step to calculate N_2 smoothed values in the ordered wavelet transform and the smoothed values are stored in the lower half of the N element input vector.The wavelet function co-efficient values are:

$$\{ g_0 = h_3 ; g_1 = -h_2 ; g_2 = h_1 ; g_3 = -h_0 \} \quad \dots \dots \dots \quad (4)$$

The wavelet transform applies the wavelet function to the input data if the original data set has N values. The original data set has N values and the wavelet function will be applied to calculate $N/2$ differences. The scaling and wavelet functions are calculated by taking the inner product of the co-efficients and four data values. The equations are shown as:

Daubechies D4 scaling function:

$$a[i] = h_0s[2i] + h_1s[2i+1] + h_2s[2i+2] + h_3s[2i+3] \quad \dots \dots \dots \quad (6)$$

Daubechies D4 Wavelet function:

Each iteration in the wavelet transform step calculates a scaling function value and a wavelet function value.

3. Neural Network

A neural network consists of formal neurons which are connected in such a way that each neuron output further serves as the input of generally more neurons similarly as the axon terminals of a biological neuron are connected via synaptic bindings with dendrites of other neurons. The number of neurons and the way that they are interconnected determines the architecture (topology) of neural network. The input and output neurons represent the receptors and effectors, respectively, and the connected working neurons create the corresponding channels between them to propagate the respective signals. These channels are called paths in the mathematical model. The signal propagation and information processing along a network path is realized by changing the states of neurons on this path. The states of all neurons in the network form the state of the neural network and the synaptic weights associated with all connections represent the configuration of the neural network shown in Figure 2.

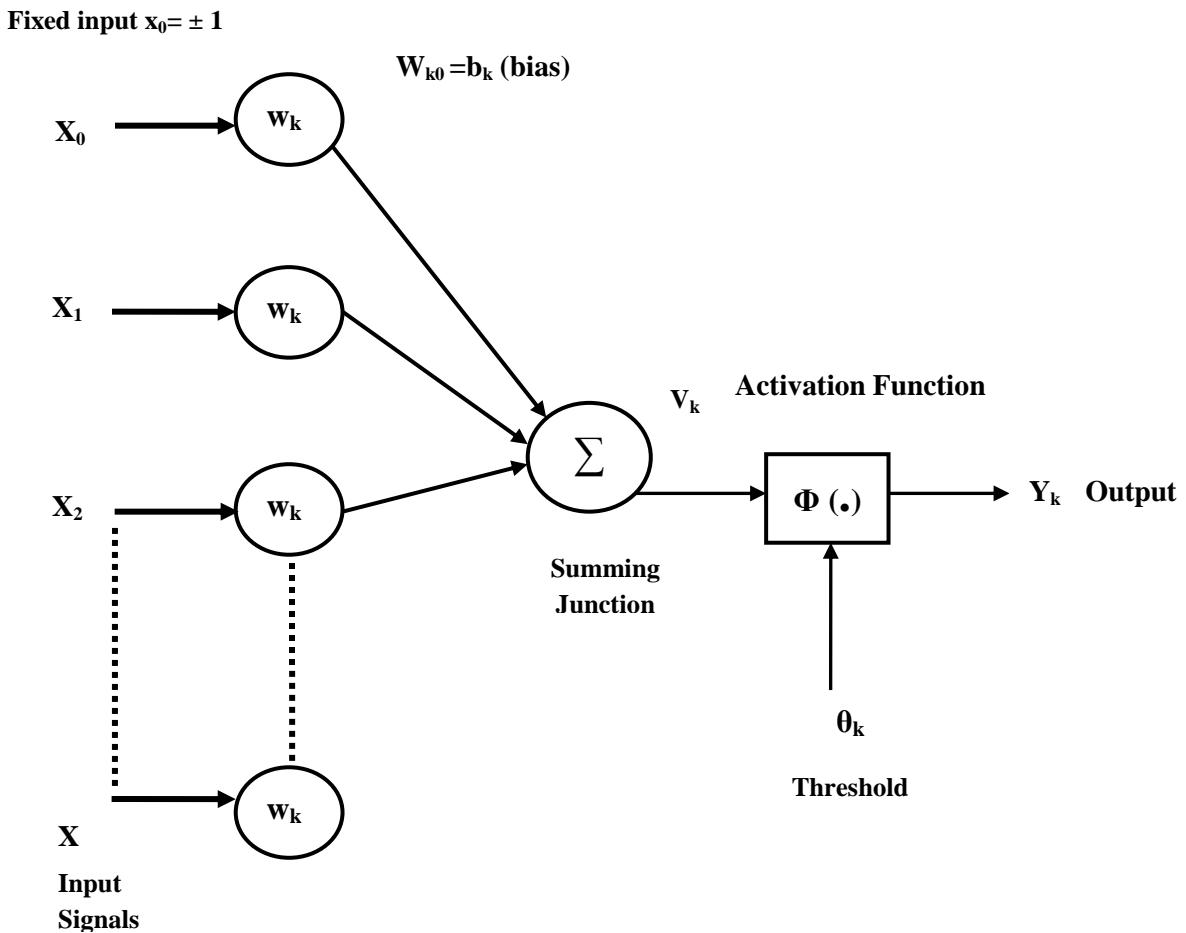


Figure 2. Mathematical Model of Neural Network.

From the mathematical model an artificial neuron has three basic components are. The synapses of the biological neuron are modeled as weights which interconnect the neural network and gives strength to the connection. All inputs are summed together and are modified by the weights. This activity is referred as a linear combination. An activation function controls the amplitude of the output. From this model the interval activity of the neuron is represented as:

$$V_k = \sum_{j=1}^p w_{kj} x_j \quad \dots \dots \dots \quad (9)$$

The output of the neuron, y_k will be the outcome of the activation function on the value of v_k

4. Proposed Work

The proposed work describes the raw EEG which is acquired by using 10-20 electrode placement system. Though there are multiple acquisition system, the acquisition is done using 10-20 electrode placement system and it is found that 10-20 system is the best for the data acquisition with respect to the data

consistency. Since it is a standard system for measuring the electrical activity of a brain with respect to all the standard positions on the scalp therefore it is considered as most suitable method for EEG acquisition.

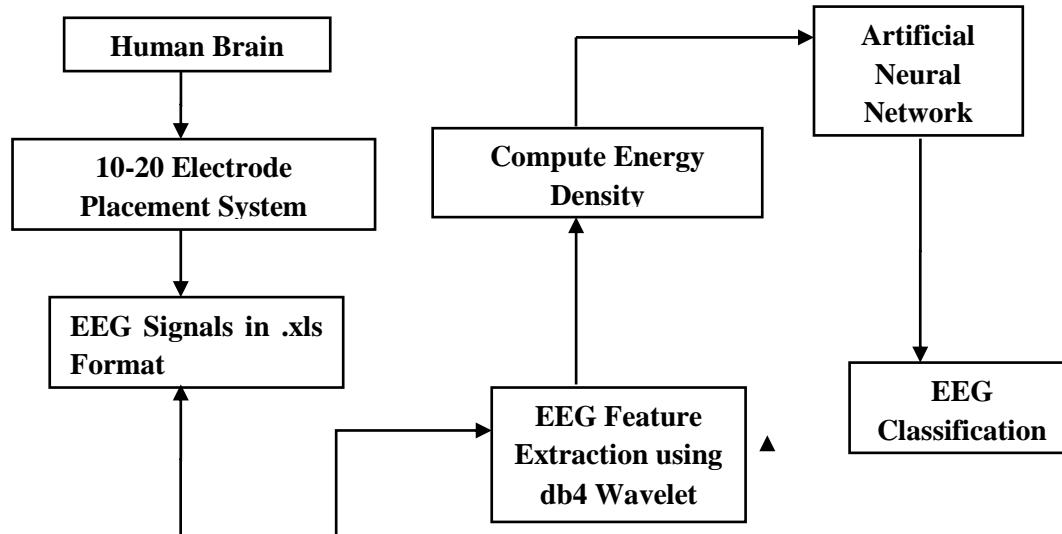


Figure 3. Proposed Block Diagram of Emotion Recognition System

The acquired EEG signal which is in the format of .xls is loaded to the MATLAB workspace and converted to .csv format for further processing. The formatted EEG dataset is analyzed by using Daubechies wavelet transform to extract all the fundamental frequency components of EEG signal i.e. alpha, beta, gamma, delta and theta. EEG frequency bands which relates to various brain states. The extracted EEG bands are further decomposed. After further decomposition, prominent features like Energy and Power Spectral Density are computed. The features extracted are fed as input for Classification using Artificial Neural Networks. The proposed Block diagram is shown in Figure 3.

5. Implementation

Feature Extraction is the process of identifying a particular information form EEG which is been measured by the neuronal activity from the brain. The emotions are detected by analyzing the characteristics of the signals. The main task of feature extraction is to derive the salient features which can map the EEG data into consequent emotion states. The wavelet decomposition of any signal $x(t)$ is represented in terms of its decomposition coefficients given by the equation:

$$x(t) = \sum_{k=-\infty}^{\infty} A(k)\phi_k(t) + \sum_{j=0}^{\infty} \sum_{k=-\infty}^{\infty} D(j, k)\psi_{j,k}(t) \quad \dots \quad (10)$$

After obtaining the noise-free signals from the signal enhancement phase. In this work, "db4" (Daubechies wavelet) is chosen for decomposition, db4 wavelet is known for its orthogonality property and its smoothing features and it is useful for detecting the changes in EEG signals. The raw EEG signal

$x(n)$ is decomposed by a sampling frequency of 500Hz is shown in Figure 4, where each stage output provides a detailed co-efficient and a approximation co-efficient. The filters are low pass filter and high pass filter which is decomposed into different scales. The low pass filter is the approximation coefficient. The multi-resolution analysis is decomposed using “db4” for eight levels of decomposition, which yields five separate EEG sub-bands. The main objective of the proposed method is the division of the original EEG signals into different frequency bands. Table 1, shows the decomposed EEG bands lying at their frequencies after decomposition.

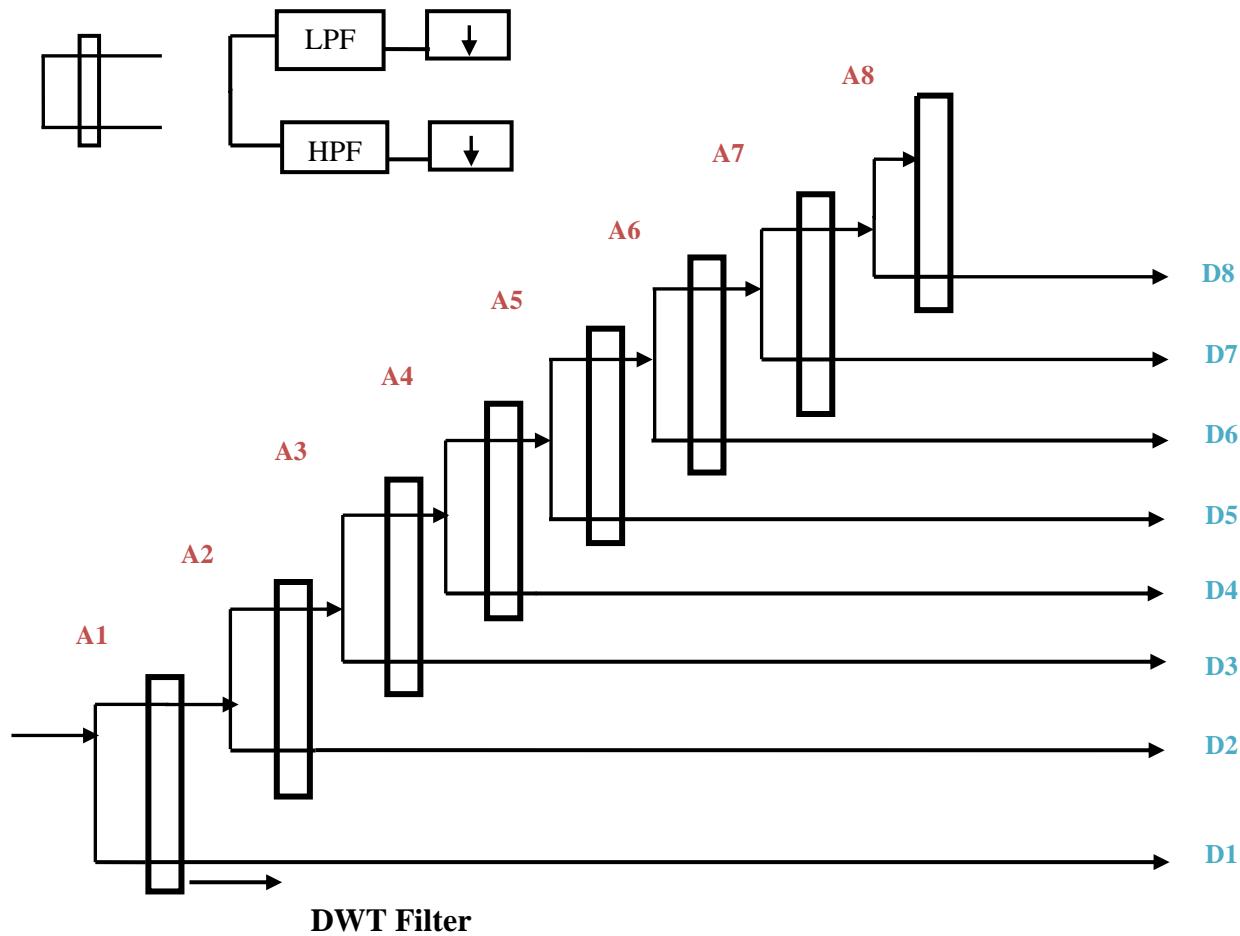


Figure 4. Decomposition of input signal into its Detailed and Approximation Co-efficient for 8 levels

Decomposition Levels	EEG Bands	Frequency Range (Hz)
D5	Gamma	37-56 Hz
D6	Beta	11-37 Hz
D7	Alpha	6-11 Hz
D8	Theta	4-6 Hz
A8	Delta	0-4 Hz

Table 1. Decomposition of EEG Signals and their frequency range in Hz

The following flowchart shown in Figure 5, represents the decomposition of EEG data using Matlab which is decomposed to 8 levels and further reduced to 3, 2 and 1 levels and the energy computation is performed.

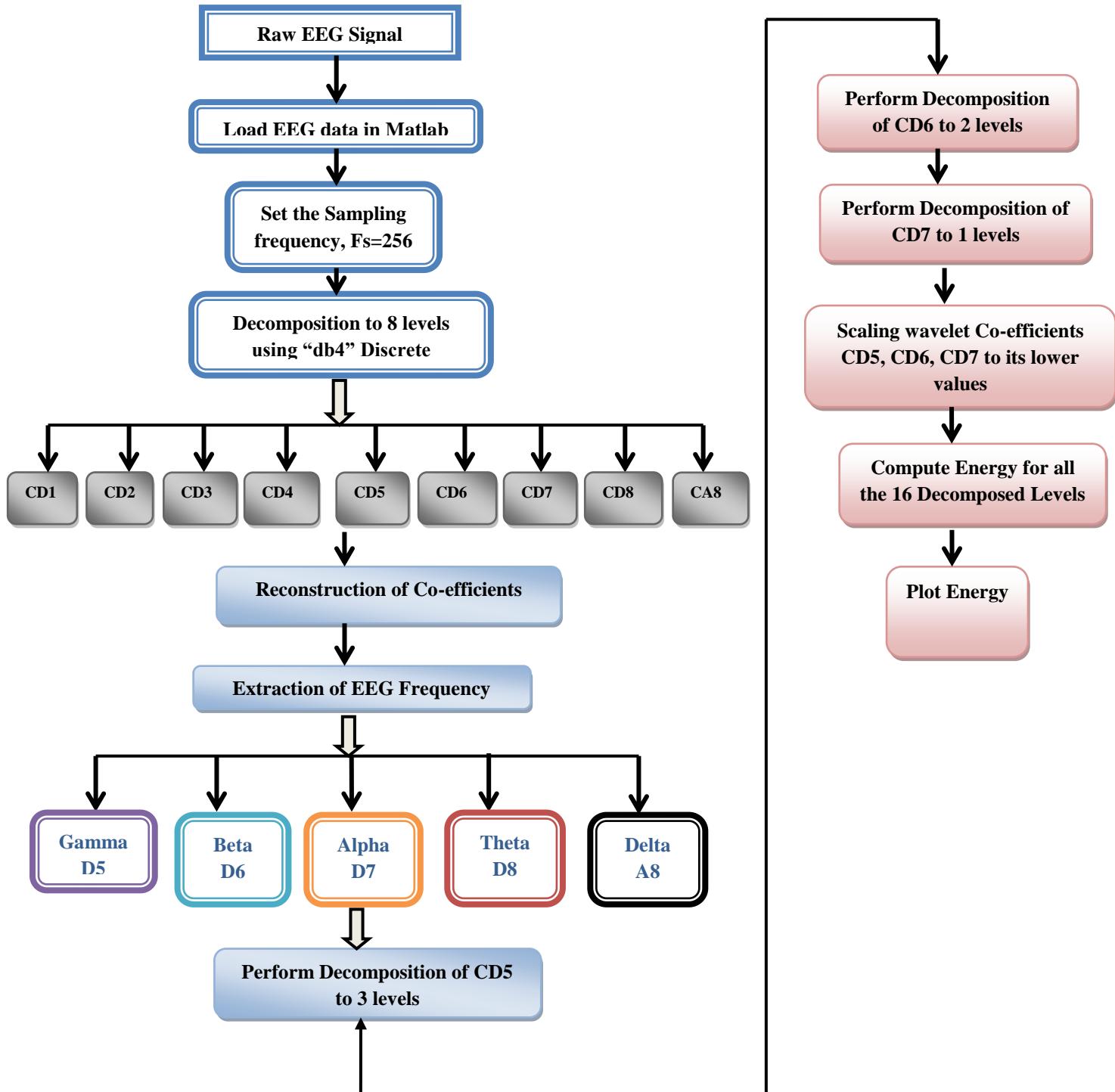


Figure 5. Flowchart of Feature Extraction using Matlab

6. Neural Network Classification

Neural Network is an information processing paradigm that is inspired by the way biological nervous systems, such as brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (Neurons) working in union to solve specific problems. Artificial neural networks(ANN) have been developed as generalizations of mathematical models of human cognition or neural biology, based on the assumptions that a typical ANN consists of large number of neurons, units, cells (or) nodes that are organized according to a particular arrangement. Each neuron is connected to other neuron by means of directed communication links, each with an associated weight. The weights represent information being used by the net to solve the problem. Each neuron has an internal state, called its activation (or) activity level, which is a function of the inputs it has received. Typically a neuron sends its activation as a signal to several other neurons. Feedforward Back Propagation Neural Network (FFBPNN) are appropriate for solving problems that involve learning the relationships between a set of inputs and known outputs. Classification of emotions is performed using FFBPNN training algorithm is implemented using neural network Toolbox. In this work, training is opted for considering two subjects namely normal and abnormal subjects. The performance of neural network is analyzed by considering the input values and the target values which are set. In this work, a topology of 16-10-16 is considered as the network topology. The performance graph, regression plot is achieved, which gives an optimal solution for better classification accuracy in terms of efficiency. The MATLAB software enables training with different convergence criteria, tolerance level, activation functions and number of epochs. The neural network models studied in this investigation uses transfer function = ‘TANSIG’ as activation function. After this the network model is ready for prediction of desired output. The plots namely plot Performance, Plot Regression are shown in Figure 6. The Plot Performance shows the best validation performance with 16 epochs. The plot train state shows the system state after training based on the Plot regression which shows the plot between and training samples, between output data and validation samples and between output data and test samples (R value shows the correlation between output and target values).

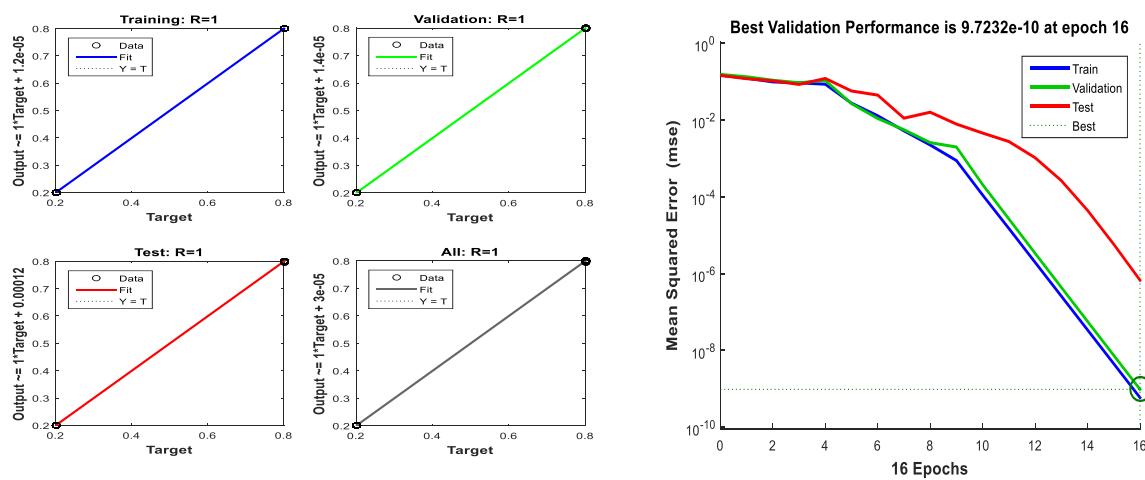


Figure 6. Snapshots of Best Validation Performance and Training States

7. Results and Discussion

Energy Graph of six different electrodes is shown in Figure 7, which represents the varying energy values of all the five EEG bands taken from a normal subject. From the analysis, P4-O2 is having a higher Energy Density, compared to other Electrodes. P4-O2 is a region which lies the Parietal and Occipital lobes of the brain. The emotions pertaining to these lobes generate signals which are in a relaxed state of mind and are active in the frontal regions of the brain. The comparison of Energy values is represented in the graph which shows the decomposition levels of six electrodes.

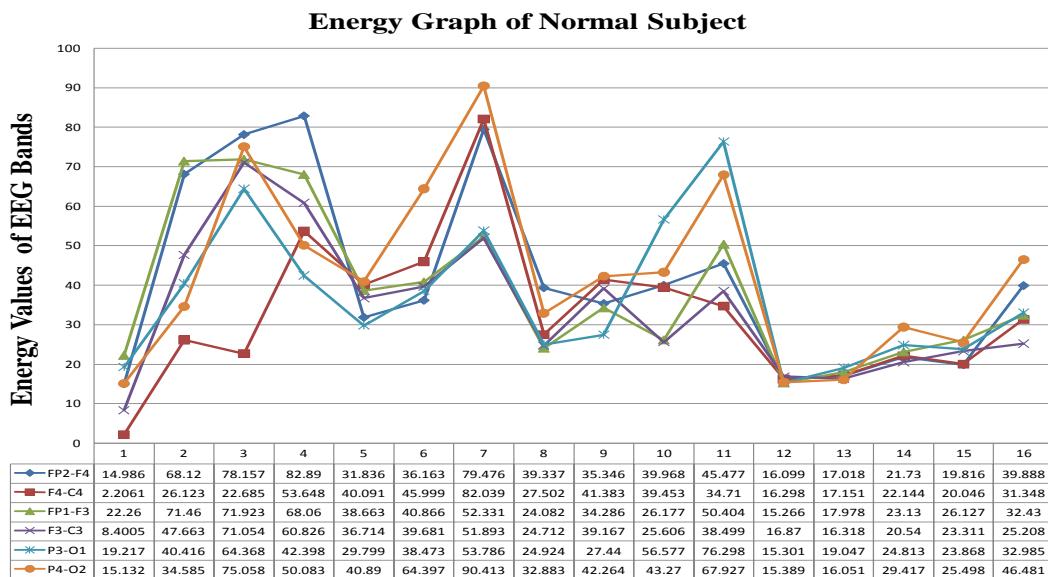


Figure 7. Energy Plot of Normal Subject considering six Electrodes

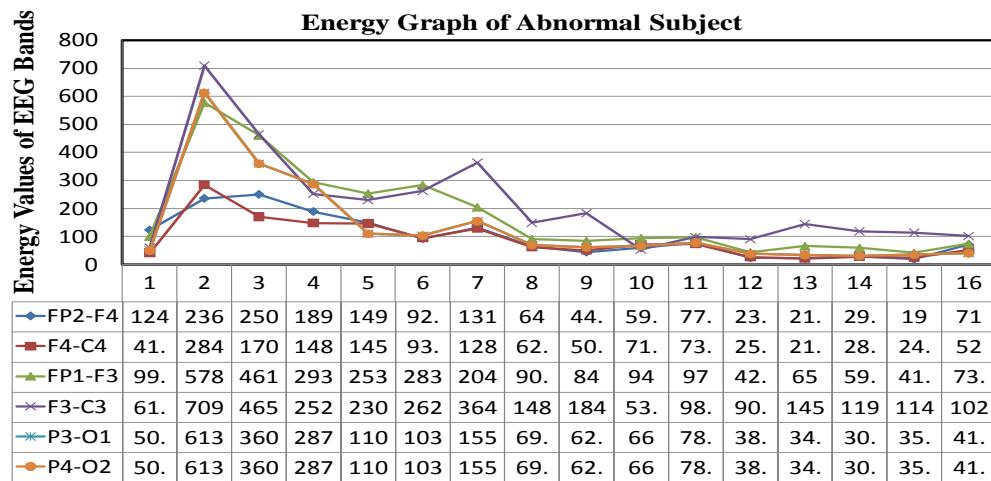


Figure 8. Energy Plot of Abnormal Subject considering six Electrodes

Figure 8, represents the varying energy values of abnormal subject. From the energy graph, F3-C3, shows a greater energy density value compared to other electrodes. F3-C3 is a region which lies in the Frontal and Central parts of the brain lobes. The frontal lobe is located at the front of each cerebral hemisphere and positioned in front of the parietal lobe and above and in front of the lobe. The emotions pertaining to frontal lobe experience frontal lobe trauma where an appropriate response to a situation is exhibited but displays an inappropriate response to those same situations in "real life", they experience unwarranted displays of emotion. The energy density of these two subjects is calculated and fed to the NN toolbox for classification to analyze its performance.

In the Neural network training stage, input data and sample data are fed to the neural network Classifier, where the targets are set as 0.2 for normal and 0.8 for abnormal subjects. A network topology of 16-10-16 is considered. The performance graph, regression plot is achieved, which gives an optimal solution for better classification accuracy in terms of efficiency. Table 2, represents the performance value, the number errors and the number of epochs for two different networks. The classification accuracy for each type of network is achieved which can be compared with one another. Network 1, gives an optimal accuracy of 88% compared to network 2.

Network Type	Performance	Epochs	Gradient	Mu	Errors	Classification Accuracy (%)	
						Normal Subject	Abnormal Subject
Network 1	0.00044	16	0.00096	8.3×10^{-7}	4	100%	88%
Network 2	0.00069	31	7.4×10^{-8}	1.1×10^{-7}	5	100%	86%

Table 2. Training and Simulated output results

8. Conclusion

The proposed method in this paper highlights the performance of ANN Classification. A novel method is implemented by choosing a better wavelet for feature extraction. The classification performance is performed by achieving an optimal accuracy of 88% for network 1 for abnormal subject and network 2 achieves an accuracy of 86%. In the future more number of emotional states can be implemented with different classification algorithms.

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Measuring The Quality of Object-Oriented Software Utilizing CK Metrics From Its Versions

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Abstract

There are many object-oriented software quality measurement techniques, one of them is CK metric. This paper utilizing CK metrics to measure qualities per version of an open source software. Measurements are done in each class in the software. The result of measurements used to analyze the quality of the software. This paper conclude that the quality of software has improved during its lifecycle, although its features increasing

Keywords: object-oriented software metric, chidamber-kemerer metric, software quality, Software measurement, Software Size

1. Introduction

In software engineering, at least two concept of developing software, which are traditional and object-oriented. Software development using Object Oriented concept became popular and facilitated the developers to build and maintain their software products easily, because it is reusable, secure, and efficient as it decrease the size of system and number of logical constructs [1].

The more complex the software is developed, the harder it is to measure the quality. Software metrics are required to measuring the quality of the developed software and also for estimating the cost and effort of software projects [2]. Radjenović, et. al. conclude that object-oriented metrics 49% were used compared to traditional source code metrics in 27% or process metrics in 24% [3]. There are many existing object-oriented software metrics [4]. One of measurement metrics developed by Chidamber and Kemerer [5], which is often called as CK metrics suite [6]. This is called as metric because it is an indicator of system performance [7].

CK metrics suite were most widely referred and used by the researchers [1], [3]. It used in half of the 106 studies that Radjenović, et. al. did [3]. CK metrics has been recognized by numerous studies that these metrics are effective at measuring the concepts they represent [6], [7], [8], [9] and as the backbone for object-oriented design metric [10].

Today, open source software become popular and important in many applications, such as scientific and business. Many companies using this software in their own work. Open source software developed with different management style than the industrial, the quality and reliability of the code have to investigated [11].

One of open source software is Statcato, an opensource and Java-based application which is naturally Object-Oriented Software. It requires Java Runtime Environment (JRE) 1.6 or higher. Once any machine has Java installed, whether the computer runs Windows, Mac, Linux, or UNIX, it can be run [12]. The aim of this study is evaluating Statcato to investigate the quality of this software during

its lifecycle. The calculated metric values for various releases are used as a basis for evaluating the software quality of Statcato. We used Spinellis's tool namely CKJM for calculating CK metrics [13]. It is great tool for this purpose.

2. Related Works

Gupta, et. al. in [7] reviews some of metrics for measuring Object Oriented software and give conclusion that software metrics always needed to test the performance of the system. Malhotra & Khanna in [14], study the relationship between Object Oriented metrics and the vulnerability of open source software classes based on Java. Fereira, et. al. in [4] provides a threshold definition for a set of object-oriented software metrics. They argue that the use of metrics for software quality measurement is less effective because many studies do not specifically investigate the threshold for object-oriented software metrics. This threshold can be applied to other metric software. Benlarbi, et. al. in [15] provides a threshold on the CK metric to make it easier to interpret the measurements. They experimentally object-oriented in C++. Malhotra & Bansal in [9] build predictive models to identify software parts that have a high probability of generating errors. They calculate the threshold values of CK metrics used a statistical model derived from logistic regression. Shaik, et. al. in [1] did assessment in Object Oriented design and found there are many metrics to measure software quality, but CK metrics is the most widely used. Subramanyam & Khisan in [16] provide empirical evidence that supports the role of Object-Oriented complexity metrics in determining software defects particularly CK metrics. Yadav, et. al. [17] did an analyze CK metrics and their impact on object-oriented software. Suresh, et. al. in [6] argue that CK metrics use to compute the system reliability, also give an idea for future study about applying neural network for predicting system reliability using CK metrics. Shawky & Abd-El-Hafiz in [8] utilizing CK metric as one of their metric to study some metrics that related to the quality of the generated code affected by development methodology especially in agile approach. Suri and Singhal in [10] experimentally analyzes the influence of CK metric in object-oriented classes. Singh in [18] uses CK metrics as one of metrics to measure the quality per version of open-source software namely JFreeChart. Some study utilizing CKJM tool to calculate the CK metrics of the classes are in [9], [10], [13], [19], [20], [21].

3. Chidamber & Kemerer Metrics

CK metrics consist of 6 metrics that calculated for each class in Object-Oriented software, they are: WMC, DIT, NOC, CBO, RFC and LCOM.

3.1. WMC (Weighted Method per Class)

The more methods in class, the class become more specific and affects the derived class because it will inherit all of those methods. Keep WMC value is low since WMC value is high, the class is harder to reuse and maintain [6], [7], [11], [18], [20]. WMC value must be less than 25 and still acceptable if more than 25 but less than 40 [22]

3.2. DIT (Depth of Inheritance Tree)

The deeper the class hierarchy, the greater the number of methods inherited so that the class becomes more complex. But it also becomes increasingly potential for inherited reuse methods. It affects the quality of the software directly as it increase reusability and the complexity at the same time [6], [7], [11], [18], [20]. The value 0 of DIT shows "root". If the DIT value is 2 or 3, it indicates higher usage. The DIT value of less than 2 can be said to be less good, in terms of advantage using object-oriented design and inheritance. On the other hand, a DIT value greater than 5 will provide high complexity, but it is expected from object-oriented design [22]. But Suri & Singhal in [10] said that all classes must inherit from existing class, so the DIT value at least is 1.

3.3. NOC (Number Of Children)

Increasing children classes mean increasing reuse classes and it is mean the greater of

abstraction of the parent class, so more testing is required [6], [7], [11], [18], [20]. There is no "good" or "bad" value for the NOC, the value becomes important if the class has a high value for other metrics. The complexity of the class will be passed to all child classes and the entire system [22].

3.4. CBO (Coupling Between Object Classes)

An increase of CBO indicates decreasing of class reusability, so this values should be kept as low as possible [6], [7], [11], [18], [20]. CBO values should be less than 5. High values of CBO indicating classes are difficult to understand, reuse or maintain. The higher value of CBO, indicating classes more sensitive to changes in other section of design. So, this makes maintenance more difficult. Low CBO values make the class easier to understand, less prone to spawning errors, encourage encapsulation and increase modularity [22].

3.5. RFC (Response For a Class)

RFC measures the number of methods that are invoked to respond messages received by an object. It shows how many classes communicate with other classes. The greater the number of classes giving the method, the greater the complexity of the class [6], [7], [11], [18], [20]. RFC value should be less than 50. If the RFC is high, the complexity increases and class becomes elusive [22].

3.6. LCOM (Lack of Cohesion in Method)

Cohesion is the extent to which methods are interconnected with one another. High LCOM values imply that classes are better divided into two or more separate classes, so keep low LCOM value [6], [7], [11], [18], [20].

4. Analysis Metrics

CKJM tools used to collecting data from all classes in Statcato software and we calculate the mean of it as show in Table 1. By calculating the mean of data, we intend to show the movement of software development from version to version.

Table 1. Mean values of metrics for various releases of Statcato

Metric Version	WMC	DIT	NOC	CBO	RFC	LCOM
0.91	3.884	0.974	0.018	2.681	15.03	70.37
0.92	4.309	0.932	0.932	2.832	18.35	59.34
0.93	4.341	0.945	0.029	2.835	18.75	65.38
0.94	4.228	0.933	0.022	2.825	18.8	52.09
0.95	4.379	0.952	0.032	2.833	18.21	70.97
0.96	4.388	0.95	0.03	2.83	18.2	70.61
0.97	4.395	0.948	0.03	2.838	18.29	70.65
0.98	4.37	0.945	0.028	2.822	18.1	71.74
0.99	4.381	0.944	0.028	2.825	18.16	71.89
0.910	4.38	0.943	0.03	2.821	18.11	72.54
0.911	4.357	0.941	0.03	2.83	18.13	74.2
0.912	4.368	0.931	0.026	2.817	18.58	67.2
1.0	4.368	0.931	0.026	2.817	18.58	67.21
1.01	4.368	0.931	0.026	2.817	18.59	67.21
1.02	4.39	0.935	0.026	2.851	18.72	67.59

4.1. WMC (Weighted Method per Class)

Figure 1 shows that WMC is starting stable on version 0.95 upwards. In a negative view, the software have not significant development. Positively, the software is close to stable for further development. In [23], it does seem that not many new features are developed.

4.2. DIT (Depth of Inheritance Tree)

In the data that has been collected in Table 1, mean values of DIT are close to 1, in fact if mode and median are calculated and rounded then value of both of them is 1. So, it can conclude that DIT in this case is 1 and satisfies [10]. Figure 2 shows the changes internal software for DIT. It appears that the trend is decreasing which indicates the class is less complex. Less complex class means easier to maintenance but less reusable.

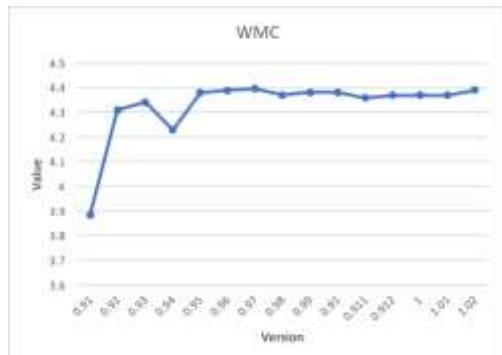


Figure 1. Graphic of WMC

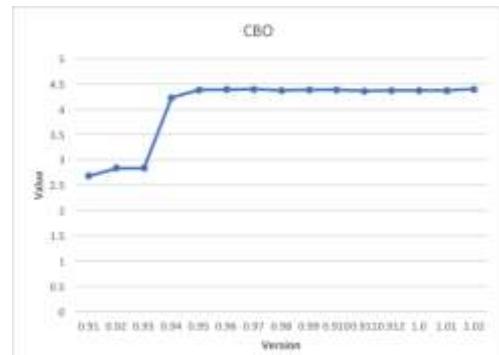


Figure 4. Graphic of CBO

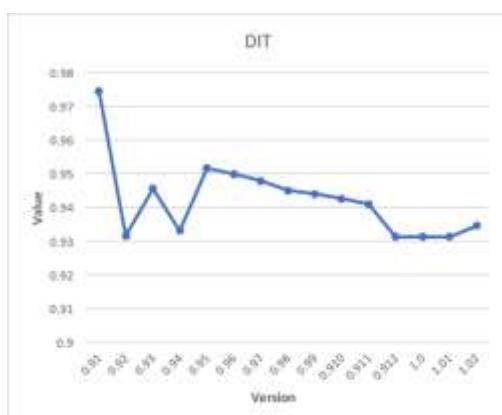


Figure 2. Graphic of DIT

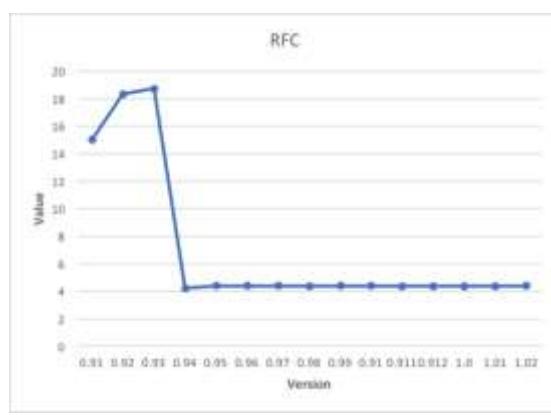


Figure 5. Graphic of RFC

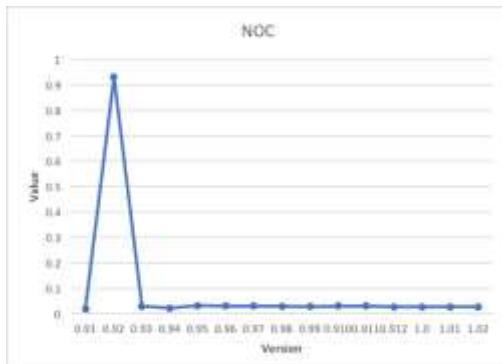


Figure 3. Graphic of NOC

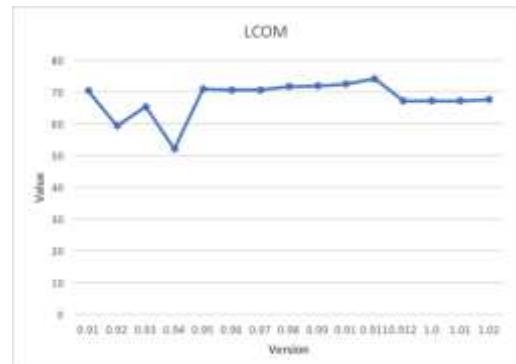


Figure 6. Graphic of LCOM

4.3. NOC (Number Of Children)

Figure 3 shows that NOC is starting stable on version 0.93 upwards. Referring to WMC metric above, in negative view, the software have not significant development. Or in positive view, the software is close to stable for further development.

4.4. CBO (Coupling Between Object Classes)

Figure 4 shows that CBO is starting stable on version 0.95 upwards. The highest value of CBO less than 4. It satisfies [22], so classes easy to understand and easy to maintain.

4.5. RFC (Response For a Class)

Figure 5 shows that CBO is starting stable on version 0.94 upwards. Referring to WMC and NOC metric above, in negative view, the software have not significant development, but positively, the software is close to stable for further development.

4.6. LCOM (Lack of Cohesion in Method)

Figure 6 shows that LCOM value is decreased since version 0.912. It means that developer care about cohesioness for a better development.

5. Conclusion

We can say that the quality of the latest version of Statcato is better than the predecessor, although the feature is increasing. It can be summarized that in positive view, the value of WMC, NOC, and RFC metrics is stable, this is a good condition. While DIT and CBO metrics shows ease to maintain and LCOM metric indicates developer concerns. So, it can be concluded that Statcato has good quality and have a good development to continue improving during its lifecycle, although its feature is increasing. For future works, we recommend to calculate the threshold per metric to better clarify the assessment of the metrics.

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A REVIEW ON CROSS MEDIA RECOVERY IDEAS AND PROCEDURES

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Abstract

Cross Media Recovery(CMR) is one of the active research area in the field of internet services and multimedia technology. Presently, the information contents such as text, video and audio are easily generated by everyone, due to the development of internet techniques and digital capturing system. So, the search for the required data in the large stored content increases the difficulty and consumes more time. Also, the number of digital images per day is also growing exponentially at an alarming rate with the help of digital cameras or other devices. In order to manage the large content of data, most of the researchers focus on the retrieval system and also develops new methodologies in CMR system. The review paper analysis the researches done on the CMR system and also examines the major issues faced by these techniques. This procedure helps the researchers to give better solution for the current concerns faced in the CMR system.

Keywords: Cross media retrieval, Digital capturing system, Internet services, Multimedia technology, Retrieval systems.

1. Introduction

CMR system is an important research topic in the field of computer vision, pattern recognition etc. and it has attained a great success in recent years [1]. CMR is a challenging topic, because the real world media data are formed by the interaction of multiple factors on the different conditions, including background interference, illumination changes, URLs, stop-words, etc. Most of the retrieval systems focused on single media such as text retrieval, image retrieval, video retrieval and audio retrieval [2], [3]. For instance, Content-based image retrieval used to retrieve the images from the database based on the query image is processed by the similarity measurement. For instance, Scale-Invariant Feature Transform (SIFT) method determines the histogram of location and orientation of the media images by quantizing the location into eight parts.

SIFT feature transforms the media image into coordinates, which helps to extract the features for image matching with text data [5], [6].The major disadvantage of using SIFT feature in CMR system is complexity of matching sets of key point descriptors. The problem faced by the LBP in CMR system is, if the threshold value is high there is a chance of losing information and also it does not consider the local contrast of the neighborhood [8].

Overview of CMR system

Generally, CMR system consists of four major steps such as, data acquisition, data preprocessing, feature extraction, and similarity measure. A general block diagram of CMR system is represented in the figure 1.

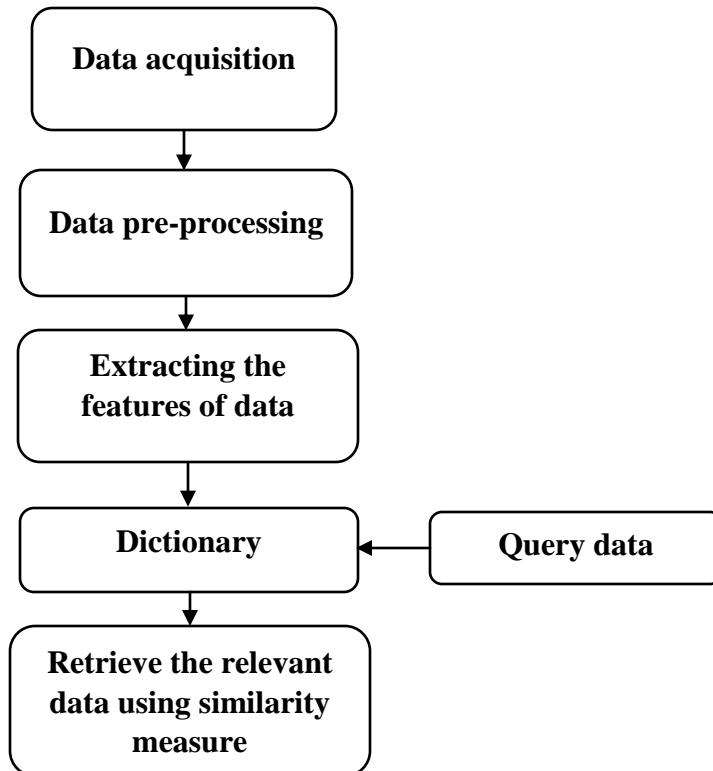


Figure 1. General block diagram of CMR system

1.1.Data acquisition and pre-processing

The initial stage of the CMR system is data acquisition, there are numerous databases available for CMR system. Some of the common publicly available databases are: Wikipedia dataset, X-Media dataset, flickr30k dataset, flickr8k dataset, Pascal sentence dataset, etc. [11]. Among these available datasets, Wikipedia dataset is the most widely used dataset for CMR system, which is based on Wikipedia “featured articles”, a continually updated article collection. There are totally 29 categories in “featured articles”, but only 10 most populated “featured articles” are actually considered [12]. The sample data collection of Wikipedia dataset is represented in the figure. 2.



Adam Craig Gilchrist, (born 14 November 1971), nicknamed "Gilly" or "Churchy", is a former Australian cricketer and former captain of all formats. Widely regarded as the greatest wicket-keeper–batsman in the history of the game, Gilchrist held the world record for the most dismissals by a wicket-keeper in One Day International (ODI) cricket until it was surpassed by Kumar Sangakkara in 2015 and the most by an Australian in Test cricket.



Test cricket is the longest form of the sport of cricket and is considered its highest standard. Test matches are played between national representative teams with "Test status", as determined and conferred by the International Cricket Council (ICC). The two teams of 11 players play a four-innings match, which may last up to five days (or longer in some historical cases). It is generally considered the most complete examination of teams' playing ability and endurance. The name Test stems from the long, gruelling match being both mentally and physically testing.



Marcus Edward Trescothick, MBE (born 25 December 1975) is an English cricketer and former Test and ODI captain. He plays first-class cricket for Somerset County Cricket Club, and represented England in 76 Test matches and 123 One Day Internationals. A left-handed opening batsman, he made his first-class debut for Somerset in 1993 and quickly established himself as a regular member of the team. Trescothick made his One Day International (ODI) debut seven years later, against Zimbabwe in July 2000.

Figure 2. Sample data of Wikipedia dataset

After the acquisition of media data, an important step in the CMR system is pre-processing of acquired data. Pre-processing methods helps to remove the unwanted artifacts like URLs, stop-words from the text data and also the pre-processing methodologies helps to reduce the noise or enhances the quality of image data.

1.2. Feature extraction

In CMR system, the feature extraction is performed on the pre-processed media data. Feature extraction is defined as the action of mapping the data from data space to the feature space [13]. Totally, two levels of feature extraction methodologies are available in CMR system such as, low-level features and high-level features.

- **Low level feature methodologies:** histogram features like shape, color and texture of the objects.
- **High-level feature methodologies:** Bags of features, Bag of words, histogram of oriented gradient, local binary pattern, scale-invariant feature transform, generic features [14],etc.

1.2.1. Bag of words

Bag-of-words is the simplified representation of sentence or words, mostly utilized in the information retrieval system. Bag-of-words considers text as the bag, which contains words irrespective of the grammar and order of words also it measures the repetition of the words. These text are used to retrieve the data similar to the query data [15].

Principal component analysis

Principal Component Analysis (PCA) is the statistical methodology used to decrease the dimension of media data and also utilized to extract the useful features from media images [16]. Various image feature extraction techniques are preferred in CMR system, but the performance

of PCA is very effective, because it factorize the target image and sparse noises effectively. Also, PCA gives more attention on covariance and variance structure of the new variables $x_1, x_2, x_3, \dots, x_p$. These variable magnitudes are much higher than the other variables, because these new variables receive heavy weights.

To avoid this reason, the variables are determined on scales with different ranges, otherwise the unit of the measurements are not equal. Let, R be the sample correlation matrix calculated from n observations on each principal component p of random variables. The Eigen-value and Eigen-vector pairs of R is represented as $(\varepsilon_1, e_1), (\varepsilon_2, e_2), (\varepsilon_3, e_3), \dots, (\varepsilon_p, e_p)$. The $i - th$ sample principal component of a vector $x = x_1, x_2, x_3, \dots, x_p$ variable is given in the equation (1).

$$e_i Z = e_{i1} Z_1 + e_{i2} Z_2 + \dots + e_{ip} Z_p, \quad i = 1, 2, 3, \dots, p \quad (1)$$

Where, $e_i Z = (e_{i1}, e_{i2}, e_{i3}, \dots, e_{ip})$ represents $i - th$ Eigen value and $Z = Z_1, Z_2, Z_3, \dots, Z_p$ is the standardized vector observation.

In principal component, the sample variance is represented as n_i and the sample covariance pairs are mentioned as zero. In addition, the total sample variance in all standardized variables is equal to the total sample variance in the principal component. Mathematically the standardized vector observation is expressed in the equation (2).

$$Z_k = \frac{x_k - \bar{x}_k}{\sqrt{v_{kk}}}, \quad k = 1, 2, 3, \dots, p \quad (2)$$

Where, x_k denotes sample mean and v_{kk} is the sample variance of the variable x_k .

1.2.2. Latent Dirichlet Allocation

The Latent Dirichlet Allocation (LDA) is a generative probabilistic topic model, where every document is represented as a random mixture of latent topics [7]. The every latent topic is described as a distribution over fixed set of words in LDA and used to identify the underlying latent topic structure based on the observed data. In LDA, a word is a distinct data from a vocabulary index $\{1, \dots, V\}$, a series of N words are represented as $w = (w_1, w_2, \dots, w_n)$ and a collection of M documents are denoted as $D = (w_1, w_2, \dots, w_M)$.

The LDA approach described as a three level Bayesian graphical model, where nodes are represented as random variables and the edges utilized for possible dependencies between the variables. In this representation, π refers to dirichlet parameter, \aleph refers to document-level topic variables, x refers to per-word topic assignment, y refers to the observed word and μ refers to the topics.

A joint distribution over random variable is represented as the generative process of LDA. The equation (3) calculates the probability density function of $k - dimensional$ dirichlet random variable. An equation (4) compute the joint distribution of a topic mixture and the probability of a corpus is determined by using the equation (5).

$$p(\aleph | \pi) = \frac{\Gamma(\sum_{i=1}^k \pi_i)}{\prod_{i=1}^k \Gamma(\pi_i)} \aleph_1^{\pi_1-1} \dots \aleph_k^{\pi_k-1} \quad (3)$$

$$p(\mathbf{x}, \mathbf{y} | \pi, \mu) = p(\mathbf{x} | \pi) \prod_{n=1}^N p(x_n | \mathbf{x}) p(y_n | x_n, \beta) \quad (4)$$

$$p(D | \pi, \mu) = \prod_{d=1}^M \int p(\mathbf{x}_d | \pi) (\prod_{n=1}^{N_d} \sum_{x_{dn}} p(x_{dn} | \mathbf{x}_d) p(y_{dn} | x_{dn}, \mu)) d\mathbf{x}_d \quad (5)$$

For an individual document, the calculation of the posterior distribution of the hidden variable is an important inferential task in LDA.

Speeded up robust features

The Speeded up robust features (SURF) methodology is extensively employed in pattern recognition applications. This approach consists of three phases: interest point description, localization, and integral image generation. In this scenario, the hessian matrix is determined for every pixel position of the media images I and it is statistically given in the equation (6),

$$H(X, \sigma) = \begin{cases} C_{xx}(X, \sigma) & C_{xy}(X, \sigma) \\ C_{yx}(X, \sigma) & C_{yy}(X, \sigma) \end{cases} \quad (6)$$

Where, X is denoted as the point of image, σ is stated as scale.

Generally, $C_{xx}(X, \sigma)$ is represented as the convolution of Gaussian Second Order Derivative (GSOD) of media image at the corresponding point with co-ordinates (x, y) . Gaussian second order derivative is denoted in the equation (7).

$\frac{\partial^2}{\partial x^2} g(\sigma), g(\sigma) = \frac{1}{2\pi\sigma^2} e^{-\frac{(x^2+y^2)}{2\sigma^2}}$ (7) Similarly, the second order Gaussian derivative for $C_{yy}(X, \sigma)$ and $C_{xy}(X, \sigma)$ are denoted in the equation (8).

$$\frac{\partial^2}{\partial y^2} g(\sigma) \text{ and } \frac{\partial^2}{\partial x\partial y} g(\sigma) \quad (8)$$

Then, a simple box filter is employed as the approximation of convolution-GSOD in smooth media image that makes the operation less computational complexity. Here, the box filters are computed in constant time by utilizing integral images and this integral images are employed to achieve convolution of box filters B_{xx} , B_{yy} , and B_{xy} . The approximate determinant of the hessian matrix is employed to identify the key-point, which is mentioned in the equation (9).

$$Det[H(X, \sigma)] = B_{xx}B_{yy} - (0.912B_{xy})^2 \quad (9)$$

Where, 0.912 is utilized to stable the hessian matrix determinant.

In order to attain scale invariance, SURF employs box filters on the media image to examine and match interest points. The approximate determinant of hessian matrix is determined at various scales and the non-maximum suppression in $3 \times 3 \times 3$ neighborhood is implemented to identify the maxima. With the reference of the maximum values, the SURF key point's location and scale σ are obtained. An orientation is allocated to the obtained key-point by determining the haar-wavelet response within its neighborhood radius $6s$, (s represents sampling steps).

The next step involved in the SURF feature is extracting the descriptor at the key-point. The orientation direction is allocated to the center of key-point with a square size of 20s. Respectively, the square size is partitioned into 4×4 sub-regions, each sub-region is further classified into 5×5 sampled space points, at each space point horizontal and vertical haar-wavelet response dx and dy are identified. Here, each sub-region generates four dimensional vector by employing haar-wavelet response and it is given in the equation (10).

$$v = (\sum dx, \sum dy, \sum |dx|, \sum |dy|) \quad (10)$$

Now, all the sub-regions are concatenated into vectors as $4 \times (4 \times 4)$, which results in 64 dimensional vector at each key-points. The following 64 dimensional vectors are employed to perform the matching procedure.

1.3.Similarity measures

After extracting the features, the extracted features are converted into row vector called template that consist of media data features. Then, the tested data template is matched with the dictionary to retrieve the relevant media data based on user query. Some of the commonly utilized similarity measures in CMR are represented below.

1.3.1. Euclidean distance

The Euclidean distance is used to determine whether the two templates are matching or not and it calculates the distance between the features in the two templates [18]. The Euclidean distance between the two templates are calculated by employing the formula given in the equation (11).

$$\text{Euclidean distance} = \sqrt{\sum_{i=1}^n (x_i - y_i)^2} \quad (11)$$

Where, x and y are represented as Euclidean vectors, and n is represented as the position of the Euclidean point.

1.3.2. Manhattan distance

Manhattan distance is also called as L_1 Distance or Manhattan length, If $u = (x_1, y_1)$ and $v = (x_2, y_2)$ are the two points, then the Manhattan distance between u and v is calculated by using the equation (12).

$$\text{Manhattan distance } (u, v) = |x_1 - x_2| + |y_1 - y_2| \quad (12)$$

In case, instead of two dimensions, if the points have n-dimensions such as $u = (x_1, x_2, \dots, x_n)$ and $v = (y_1, y_2, \dots, y_n)$. Then, the equation (12) is generalized by defining the Manhattan distance between u and v are analyzed using the equation (13).

$$\begin{aligned} \text{Manhattan distance } (u, v) &= |x_1 - y_1| + |x_2 - y_2| + \dots + |x_n - y_n| \\ &= \sum |x_i - y_i| \quad \text{for } i = 1, 2, \dots, n \end{aligned} \quad (13)$$

The distance between the two points on a grid is based on the horizontal and vertical path. The Manhattan distance is the simple sum of the vertical and horizontal components. Whereas, the diagonal distance is calculated by employing Pythagorean Theorem.

1.3.3. Minkowski distance

The Minkowski distance is defined as the distance between two points in a normed vector space. The general formula for Minkowski distance is denoted in the equation (14).

$$D(x, y) = (\sum_{i=0}^{n-1} |x_i - y_i|^p)^{1/p} \quad (14)$$

Special cases:

- When $P = 1$, the distance is known as Manhattan distance
- When $P = 2$, the distance is known as Euclidean distance.

2. Literature review

Several techniques are suggested by researchers in the CMR system. In this scenario, brief evaluations of some important contributions to the existing literatures are presented.

Author	Methodology Employed	Dataset	Advantage	Limitation	Performance measure
T. Yao, <i>et al.</i> [10]	Supervised hashing methodology	Wikipedia and NUS-WIDE datasets	The supervised hashing approach further improves the retrieval accuracy by reducing the quantization error.	In a few cases, the proposed method was not efficient in large scale database and also not robust in content interpretation from multimedia documents.	Mean Average Precision (MAP), precision and recall
X. Zhai, <i>et.al</i> [11]	Joint representation Learning	Wikipedia and X-Media dataset	The proposed methodology delivers an effective outcome in the both CMR and single media retrieval systems.	The proposed methodology have the concern of language risk.	MAP, precision and recall
Y. Peng, <i>et al.</i> [12]	Unified patch graph regularization	Wikipedia, NUS-WIDE and X-Media dataset	Compared to existing approaches, the proposed approach achieves MAP value of 0.332 in Wikipedia dataset, 0.273 in	The proposed approach was only applicable for datasets were written in well-organized language.	MAP, precision and recall

			NUS-WIDE dataset and 0.501XMedia dataset.	Otherwise, it leads to inconsistency with realistic applications.	
Y. He, <i>et al.</i> [13]	Deep and Bidirectional representation learning approach	Flickr30k, IAPRTC-12, and Flickr8k dataset	Proposed technique significantly increases the matched pairs and also dramatically reduces the unmatched pairs of media data.	Whereas, the learning algorithm utilized in this research was too sensitive to parameters.	Precision and recall
H. Zhang, <i>et al.</i> [14]	Semi-supervised correlation preserving mapping	Generated image-audio dataset	Proposed strategy not only enhances the multimedia retrieval rate and also have the potential to improve the performance of all media based applications.	While performing with semi supervised methodologies, the semantic gap was maximized between the feature values, which leads to poor retrieval rate.	Precision
J. Liu, <i>et al.</i> [15]	Machine learning techniques with interactive mapping	Corel and Pascal dataset	Machine learning techniques enables flexible exploration of training knowledge.	In this research, it was so difficult to compare the queries, due to lower level alignment.	Precision and recall
L. Huang, and Y. Peng, [16]	Fine-Grained Correlation at Entity Level	Wikipedia and PASCAL Sentence dataset	The proposed approach constructs an entity level with fine-grained semantics between low-level and high-level concepts that reduces the distance between media contents, a positive correlation entity level was achieved.	The correlation between the entity levels were not fully exploited and also delivers poor result for lower amount of data.	MAP, precision and recall
Y. Hu, <i>et al.</i> [17]	Optical character recognition based CMR approach	Wikipedia, NUS Wide and Flickr30k	The experimental outcome confirmed that the proposed methodology was more significant than existing	The proposed methodology achieves high retrieval rate even when the nature of the content	Average retrieval accuracy and mean rank

		dataset	approaches in terms of recognition rate.	changed, but it was only applicable for text images.	
Y. Xia, et al. [18]	Probabilistic model with K-Means algorithm	APR TC-12 and Wikipedia dataset	The clustering methods were domain independent, so it was easy to tune the parameters.	Computational time was bit high in proposed methodology compared to other existing approaches, while clustering the images in large dataset.	Average precision and average recall
J. Yan, et al. [19]	Joint graph regularization based modality-dependent CMR approach	Wikipedia, Pascal Sentence, INRIA-web-search dataset	The proposed approach learns dissimilar projection of matrices based on the intra and inter modality similarities for retrieving the different tasks.	This research work considers the both inter and intra modal similarities in a united frame work, so it increases the complexity of frame work	MAP, precision and recall
L. Xie, et al. [20]	Manifest and latent cross-modal semantic generation model	Wikipedia and MIR Flicker dataset	The content correlation was easily attained from the both multi-model web pages and documents using proposed approach	Proposed approach does not gave experimental results for Tri-Space and Ranking (TSR), TSR_{txt} and TSR_{img} in an acceptable time and also required high computational cost to implement.	Precision and recall
R. Ren, and J. Collomosse, [21]	Latent Dirichlet Allocation (LDA) approach	Core dataset	The ranking procedure delivers further precision and also introduces diversity, which stimulates the user discovery of content.	If the number of samples were low, the LDA algorithm was highly affected in the training set that decreases the performance in terms of retrieval rate.	Average precision, query time, precision and recall
			The graph based	Identifying the exact value of topic	

H. Zhang, et al. [22]	Kernel-based methodology, local linear regression and graph model	Corel image galleries and TRECVID Dataset	frameworks further optimize the ultimate performance iteratively.	portion from the visual feature was very hard, because sometimes concept regresses were inaccurate.	Precision
K. Liu, et al. [23]	Accumulated reconstruction error vector	Wikipedia and NUS-Wide dataset	The simulation result showed that the proposed method significantly improves the data retrieval rate by means of precision.	The proposed methodology retrieves only the text image from the database and it was less suitable for recognizing the inclined positioned images, because it took high response time and retrieval rate.	MAP and retrieval rate
B. Jiang, et al. [24]	Deep learning algorithm	Wiki text-image and NUSWIDE dataset	Deep learning method automatically sorts and eliminates the unnecessary feature vectors from the feature information that helps to achieve better retrieval rate.	In some cases, the training data were dependent evaluation or manual adjustment, which was needed to be automated.	MAP, F-measure, and mean reciprocal rank

3. Conclusion

CMR system is the most powerful and effective system for retrieving the relevant multimedia data compared to single media retrieval. CMR system offers an enormous variety of methodologies for achieving better retrieval rate. It is utilized in multiple applications like indexing and retrieval, digital watermarking, computer vision, pattern recognition and multimedia content analysis. This review paper gives an overview of CMR system and also evaluates the developed methodologies by means of advantage, limitation and performance measure. Additionally, reviews several commonly utilized multimodal datasets, and empirically evaluates the concerns faced by the methodologies. Still, there is much work to be done on CMR system for delivering better retrieval outcome. This review paper will help readers to understand the state-of-the-art in CMR system and motivate more meaningful works.

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FRAMEWORK OF COMPLIANCE OF SARBANES-OXLEY FOR IMPROVED PERFORMANCE OF STOCK OPERATIONAL BUSINESS IN REKSA DANA COMPANY

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Abstract

Indonesia's capital market has shown rapid growth seen from the increase of the main variables of capital market activity. One significant increase is the development of the number of Mutual Funds considered effective by Bapepam until the end of 2005 has increased to more than 322 (three hundred and twenty two) Reksa Dana managed by more than 103 (one hundred three) investment managers. To achieve a good portfolio performance, the Investment Manager must have access to all types of information related to investment activities, and the information must be precise and accurate. An important role is played by Information Technology in providing that information, so it can have a strategic position in the financial industry. The Sarbanes-Oxley compliance framework can be used to improve the performance of Reksa Dana companies by 33%, by optimizing the use of Information Technology in its operational processes. Due to the limitations of legislation, Sarbanes-Oxley's compliance framework can not be fully implemented, but it can be done gradually in order to produce a good financial report.

Keywords: Improved Operational Performance, Reksa Dana, Sarbanes-Oxley Compliance Framework.

1. Introduction

The purpose of this research is to map the business process of existing Reksa Dana companies by doing business process modeling, so that it can be simulated operational process that happened. In modeling the process will be studied using one of the business process modeling tools, namely ProVision 4.2.2 from Proforma Corp. by using the Sarbanes-Oxley approach to achieve compliance with applicable regulations, knowing whether the business processes that have been done so far have been running efficiently and business process improvement steps that can be done, know the points prone to business processes that are run and seek solutions to safeguard vulnerable points and better business processes based on existing company policies, by: (1) maximizing the function of each part of the business process based on existing theory (2) Redefining and simplifying some authority to make decisions, either authority possessed by employees and authority that exist in the Information System, so that decision-making can be done more quickly and accurately.

So far, the business process of Reksa Dana companies has made IT an important and integral part of daily operations. However, based on initial observations directly to the business process, it is still seen that the process is less effective in some parts of operations, especially in the back office / settlement after the transaction is done.

The problems and potentials identified at the beginning of the study are as follows:

1. The presence of three large data domains that are not integrated so that it needs to do the process of recurring data entry on the same information, ie data news info (in the form of stock information, bonds, NAV, etc.), custodian bank data (in the form of asset data managed by investors), and investor data.

2. Planning IT infrastructure that has not been able to meet all the needs of business processes that run, so that when there are new products need to be adjusted infrastructure that takes a long time. This is evident in Fig.1 which describes the condition of IT in the Reksa Dana industry.

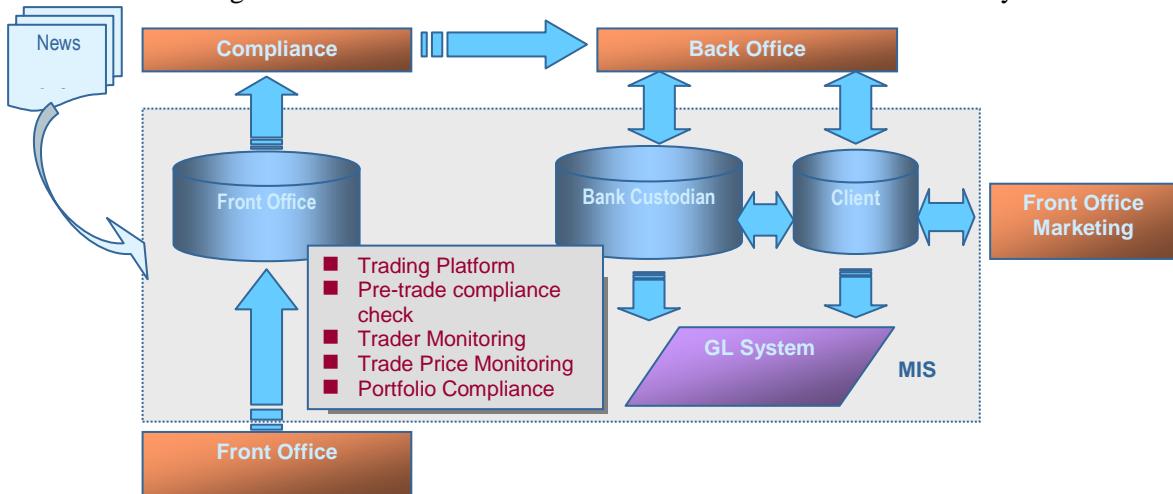


Fig.1 IT in the Mutual Fund Industry

From the above problem, the research question is: "What is the role of IT in improving the performance of operational business process of Reksa Dana industry?"

While the specific question will be answered to get a picture: How the IT needs for the Reksa Dana industry? How to model the business processes that exist in the Reksa Dana industry? Where are the vulnerable points on the business process in the Reksa Dana industry? How to improve operational performance both through the use of IT infrastructure in information management?

Based on data released by BAPEPAM in the Capital Market Statistics as of September 2005, there have been 170 securities companies that can manage Reksa Dana. All these companies do not have the same standard of Mutual Fund management as BAPEPAM continues to make improvements to existing regulations to protect investors from possible unpredictable and guaranteed losses. So the focus of this research include (1) Analyzing business operational process at PT XYZ with Reksa Dana product of 16 units. Data obtained through direct interviews with authorized employees in the operational period of one month normal circumstances (2) Mapping and improvement of business processes is limited to business process modeling and workflow as well as the results of current business process simulations, improved business processes and business processes ideal (3) The application of Burlon's business process management methodology (Burlon, 2001) uses only the second stage of Design Mode consisting of the Vision phase, Understand phase and Renew phase (4) Mapping and simulating using ProVision Version 4.2.2, for simulation using discrete method without using the distribution function on data (5) In the simulation of ideal business process using the assumption of validity and validity of data obtained reaches 99% (6) Conformity analysis techniques using Sarbanes-Oxley section 404, which emphasizes on internal control of business processes undertaken.

2. Related Works

The current consumption of products and services exceeds the world's natural resource capacity. According to WWF (2012), it is equivalent to 1.5 planets used to support human activities. Despite attempting to reduce global "unsustainability", resource consumption continues to grow, and consequently its disaster is easily predictable. There is an urgent need for a better understanding of dynamic adaptive behavior toward systems and their resilience in the face of distractions (Fiksel, 2006). Sustainability for an organization is about maintaining the differences between internal and external stakeholders (Freeman, 2010) and in particular, the triple bottom line of People, Planet and Profit (Fisk, 2010). Therefore, banking continuously refers to the delivery of financial products and services, developed to meet the needs of the community and protect the environment while

generating profits. This comes from things like banking ethics and ethical banking policies, illustrated by the case of the Bank Cooperative as a business communicator, and strict guidelines on who can do business, or not (Harvey, 1995). According to Lynch (1991), the banking code of ethics is about practice with a code of conduct - not just companies that give and invest in 'ethical' funds. In line with This, GABV (2012) defines a sustainable bank for not only doing the harm, but actively using the finances to 'do good'. The financial crisis in Indonesia 2008 is a crisis of vagueness where there is no balance of interests of various stakeholders, tending to focus on the personal use of senior management (Polonskaya and Babenko, 2012). The crisis reignited the 'unsustainable' thinking of business models adopted by banks (Stephens et al., 2012). Banks need to rebuild their image and cut costs to regain competitiveness after a crisis (Angus and Nancy, 2017).

2.1. Reksadana Industry

Reksa Dana is one option in investing that can be done easily in the capital market. Funds are collectively collected by issuing shares or units of participation to individuals and institutions which are then invested in portfolios consisting of capital market securities and or money markets selected and managed by Investment Managers professionally, as shown in Fig.2. The diversification in the portfolio in the Reksa Dana will minimize the risks faced by the investors, as well as obtain an optimal profit.

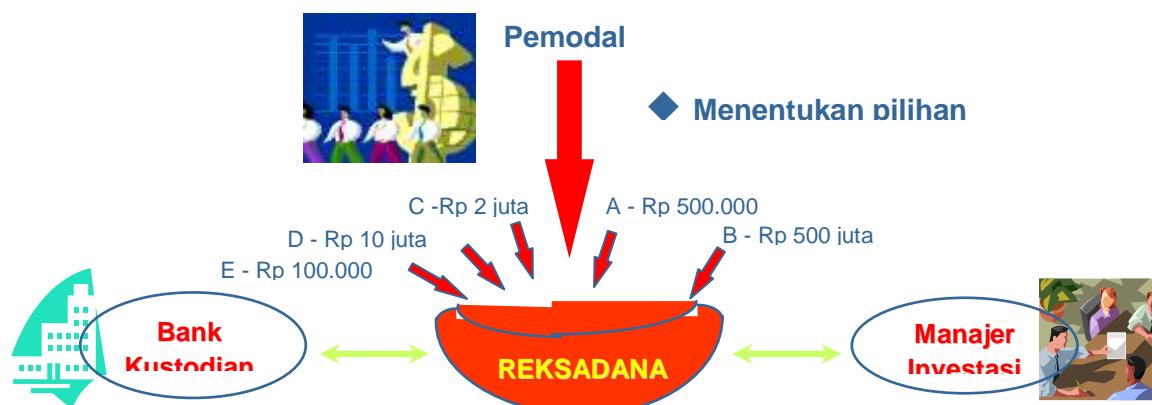


Fig. 2. Important Components in Reksa Dana

2.2. Sarbanes-Oxley (SOX) Act

Sarbanes-Oxley (SOX) Act is a regulation designed to increase confidence in equity markets and the integrity of a company's financial statements (Krieger, 2005). SOX consists of several parts designed to improve the quality of financial statements. Section 404 of SOX is very precise and is associated with improving operational IT functions without neglecting conformity factors in financial management companies such as Reksa Dana managers. In Fig.3, the internal control function of the overall conformity which forms part 404 of Sarbanes-Oxley is seen. Using the SOX approach, this thesis aims to analyze the operational process of the Reksa Dana management company which then determines the vulnerable points in the process. In the end to make improvements of prone points to improve the company's operational performance. (Brewer, 2006).

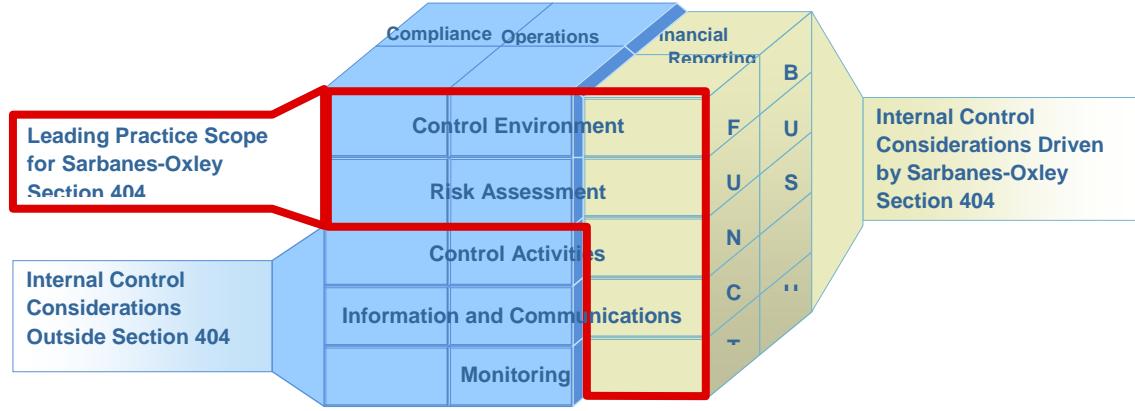


Fig. 3. Internal Controls in Sarbanes-Oxley

The internal control referred to in SOX is a process designed to increase assurance of acceptable beliefs about financial statements and the process of preparing them for outgoing purposes is in conformity with general accounting principles. Includes data on transaction records, historical data and acquisitions and the use and placement of assets to be reported. Included in other internal controls are special controls that directly affect the activity as well as the control known as pervasive control, which is about IT security. IT security is actually a common function and control not directly related to financial statements, but is still controlled to provide data integrity assurance (Kriegel et al., 2004).

Section 404 requires two related basic elements:

1. Internal control reports, signed by management and tested by external auditors.
2. The existence of internal control authority. Section 404 states that the framework of the internal control shall be appropriate and agreed upon by all parties.

2.3. Provision

Sarbanes-Oxley Pro uses ProVision EnterprisePro to be a one-stop modeling of financial operational processes, standard financial controls, internal and external audit procedures and modeling of financial reporting processes. (Brewer, 2006).



Fig.4. Business Process Modeling in ProVision

Information collected by Sarbanes-Oxley Pro in ProVision refers to the Committee of Sponsoring Organizations (COSO) Integrated Framework, which regulates aspects of internal control in operational, financial compliance and reporting.

3. Proposed work

In general, research activities undertaken adopt Burton's business process management methodology. Some of the activities of each phase are not done because of the availability of data from the company's internal research. The stages of the research are done starting with Data Collection, Identification of Current Business Process, Modeling, simulation and analysis of current business processes, Modeling, simulation and analysis of process improvement, Modeling, simulation and analysis of the ideal process and preparation of reports. Current investment styles and processes refer to the following fig.5 :

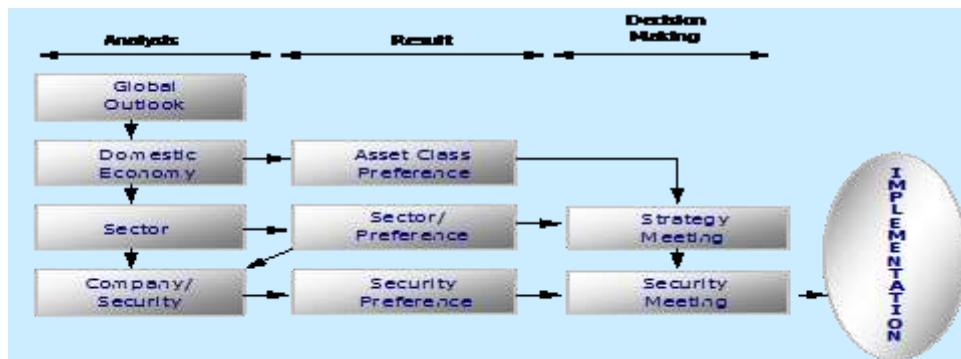


Fig.5. Style and Process of Investment

With the analysis model shown in Fig.6



Fig.6 Reksa Dana Analysis Model

From the data of simulation analysis result of business process of Reksa Dana company obtained efficiency calculated by the value of current process minus repair process value and result divided by current process value. Efficiency of each process can be seen in table.1 below.

Table.1 Efficiency of process improvement

Process	Currently	Improvements	Efficiency	Process	Currently	Improvements	Efficiency
Cost (month)				Delay Time			
Subscription	Rp54.126.733	Rp22.554.883	58%	Subscription	0,87	0,67	23%
Redemption	Rp331.024	Rp124.134	63%	Redemption	0,02	0,01	50%
Switching	Rp47.149.905	Rp38.294.269	19%	Switching	0,8	0,72	13%
Daily transactions	Rp131.253.146	Rp94.275.911	28%	Daily transactions	1,47	0,79	46%

Average	Rp58.215.20 2	Rp38.812.2 99	33%	Average	0,7975	0,5475	31%
Working Time (month)				Total Process Time			
Subscription	2,22	0,89	60%	Subscription	4,2	2,2	48%
Redemption	0,02	0,01	50%	Redemption	0,15	0,05	67%
Switching	3,25	1,13	65%	Switching	6,02	2,17	64%
Daily transactions	7,03	2,38	66%	Daily transactions	10,77	4,42	59%
Average	3,13	11,025	65%	Average	5,285	2,21	58%

Based on the comparative data of the current process and the improvement process can be made average value of each process because of the four processes performed analysis can run in parallel. Separation of the process is done to get more accurate time and cost calculation results.

1. Based on Cost Analysis, Redemption process is the process of improvement with the greatest efficiency of 68%. While the average efficiency of the overall cost is 33%.
2. Based on Work Time Analysis, Daily Transaction process is the process of improvement with the greatest efficiency of 66%. While the average efficiency of the overall cost is 65%.
3. Based on Time Delay Analysis (Delay), Redemption process is the process of improvement with the greatest efficiency of 50%. While the average efficiency of the overall cost is 31%.
4. Based on the Total Process Time Analysis, Redemption Process is the process of improvement with the greatest efficiency of 67%. While the average efficiency of the overall cost is 58%.

The calculation of the Cost and Time analysis as a whole is done by weighting method with the data in table.2 The magnitude of the weighted value is equal to the number of processes performed today.

Table.2 Cost efficiency and total time Improvement process

Total cost		% Efficiency	
	Currently	Improvements	
<i>Subscription</i>	Rp 54.126.733	Rp 22.554.883	58,329 %
<i>Switching</i>	Rp 47.149.905	Rp 38.294.269	18,782 %
<i>Redemption</i>	Rp 331.024	Rp 124.134	62,554 %
<i>Daily Deals</i>	Rp 131.253.146	Rp 94.275.911	28,172 %
Total Process Time			
	Currently	Improvements	
<i>Subscription</i>	4.20	2.20	47,619 %
<i>Switching</i>	6.02	2.34	61,130 %
<i>Redemption</i>	0.15	0.05	66,667 %
<i>Transaksi Harian</i>	10.77	4.42	58,961 %

Then the process that experienced the greatest efficiency of the whole process on Cost and Time is the Redemption Process.

4. Conclusion

Based on the research that has been done before, it can be concluded several things as follows:

1. The business process of Reksa Dana management in the operational section has not been efficiently seen from the point of view of time and cost, this is because of the total cost incurred an average of 33% larger than it should be able to do.
2. Based on simulation result done to 4 (four) process in operational part that is Subscription, Switching, Redemption and daily transaction, after process improvement then at redemption will get the biggest efficiency value, that is equal to 64,61%.
3. From the simulation result of business process of operational part of Reksa Dana management company that has been repaired, obtained data as follows:
 - cost efficiency 33%
 - work time efficiency 65%
 - time efficiency of delay 31%
 - efficiency of total working time 58%
4. Improvement steps of the business process of the operational part by using IT can be done by eliminating inefficient activities such as doubling the work of two system entries and replacing existing manual activities with the system so that it can be done automatically. In addition, redefinition can be done several activities so that decision-making by other work units can be done more quickly, for example by integrating the database of all systems used can eliminate the process of naming data between systems.
5. From the whole process analyzed obtained the average human resource efficiency 2 (two) people, thus optimization of human resources can be done by utilizing the human resources in other work unit.
6. To understand better business processes, it can be done by modeling the process and simultaneously simulating the cost and time to see the efficiency of the process model.
7. The Sarbanes-Oxley approach in its application has not been fully implemented in Indonesia, due to the lack of legislation governing the management of information systems and electronic data exchange.

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A Comprehensive Review on Security Attacks in Dynamic Wireless Sensor Networks based on RPL protocol

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Abstract – Routing Protocol is designed for Low Power and Lossy Networks (RPL) to support communication among thousands of devices. Internet of Things (IoT) comprised of smart devices like sensors and actuators using RPL protocol. RPL is applied over different applications as industries, smart environments and urban areas. In this paper, a review on security attacks in wireless sensor networks is presented. Several research works have been undergone for resolving vulnerable security threats. Due to the increase in millions and billions of connected devices all over the world, security is a major issue. Hence the deployment of IoT sensor devices in Wireless Sensor Network (WSN) involves mechanisms and algorithms for providing confidentiality, privacy, authentication, attack identification and prevention. Hereby this paper work projects out the major requirements of security in WSN Since the participation of different attacks have been tremendously increased. RPL in IoT is enabled for many real-time applications which also include sensitive data transmissions. The observation in previous research works under security are studied and suggested with future directions.

Index Terms – RPL, Security, attacks, Internet of Things, Low power and Lossy Networks (LLN)

1. Introduction

Developments in recent technologies have more importance to use internet in human's day-to-day life. Worldwide usage of IoT deals some challenges and limitations to be overwhelmed [1]. The traditional fundamentals used in IoT are IPv4, IPv6, WSN, IEEE 802.15.4, RPL and Low Power Wireless Personal Area Network (6LoWPAN). IoT is comprised of different objects as vehicles, buildings, smart devices, etc, [2]. Smart devices include mobile phones and different types of sensors. Sensor devices in WSN is deployed for data acquisition, collection and analyzing. WSN with IoT covers several application of monitoring that are in industries, human health, electrical equipment, natural disaster, city pollution, water quality, smart grid, smart home, intelligent transportation, etc,. The growth of IoT is also applicable for Radio Frequency Identification (RFID) and mobile communications. IoT is comprised of four significant layers as sensing layer, network layer, service layer and interface layer [3], [4]. Fig 1 depicts the IoT environment with the major categories of application in which it is being used. In IoT the providence of privacy and security are considered to be the two major challenges while applied on any type of application. To ensure privacy from different harmful attacks a strong secure protocol is required. Since dynamic movement of IoT devices, the cause of attacks will be wider and complex to detect a specific unauthorized IoT device. Hence security in IoT should be ensured in each layer for achieving better performances [5], [6]. IoT in WSN is supported to aggregate all private information periodically and transmit directly to move the life with advanced technologies. Attacks in IoT are broadly categorized into direct attack and indirect attack. WSN-IoT also focused to improve Quality of Service (QoS) by which more numbers of users are attracted towards these recent technologies [7]. Recent merging of WSN with IoT is designed for many novel possibilities and ideas for enhancing over different visions [8]. The application of sensors in IoT is ubiquitous for sharing information globally [9]. Increased demand on internet has introduced smart devices via which people share all information. All intelligent applications are constructed by enabling advanced features and novelty. Innovative ideas in

IoT were initiated from the evolution of Internet of Things [10]. Evolution of IoT shows growth in terms of technology, size, inter connection, data collection, system interaction and use of smart devices. The solution for privacy threats follows any one of the following; identification, profiling, localizing, tracking. Online Social Networks (OSN) is also a major category in IoT that deals with several harmful attacks and hence security protection in OSN is mandatory to safeguard data.

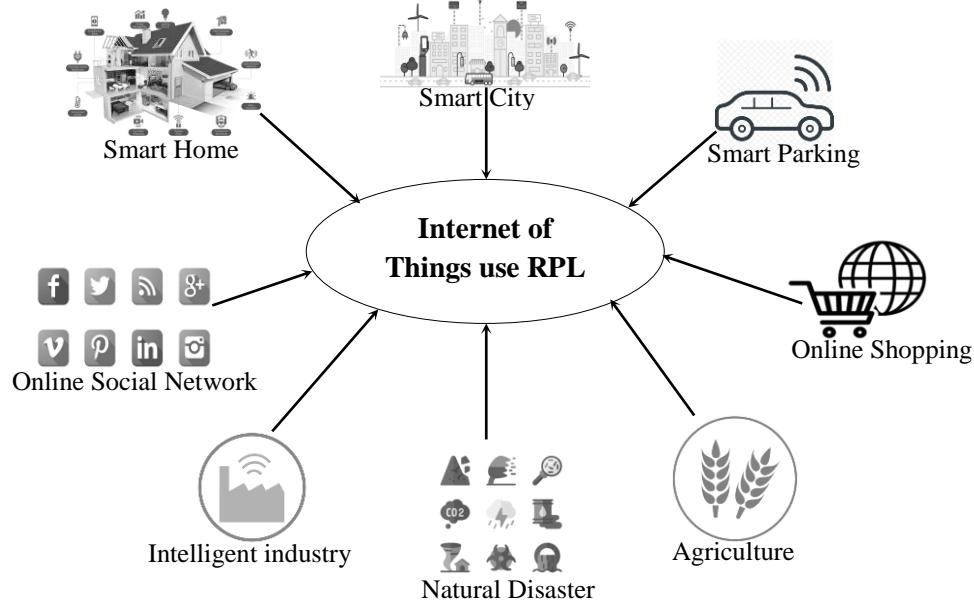


Figure. 1 IoT Environment

Security in IoT is supported by RPL, 6LoWPAN to minimize the impact of attacks [11]. Attacks that occur based on RPL topology are selective forwarding attack, sinkhole attack, Sybil attack, hello flooding attack, wormhole attack, Denial of Service (DoS) attack, blackhole attack, clone ID attack, spoofing attack and more. For the purpose of security IoT designs an Intrusion Detection System (IDS) that detects attack with respect to event, host, specifications and signature based. RPL routing in IoT is applied on different standards; IEEE 802.15.4 is used in WSN and IEEE 805.15.1 is for Bluetooth [12]. IDS are helpful to extensively provide counter measures for internal attacks in WSN [13]. In sensor network, each node is comprised with physical layer, datalink layer, network layer, transport layer and application layer. Each layer is subjected to different attacks; therefore security is needed to be provided in each layer. The major requirements of security are authentication, confidentiality, freshness, integrity, robustness and resiliency. Cryptography techniques were used for ensuring secure transmission of sensitive data. Firewall is involved for analyzing a packet in IDS to defend against dangerous attacks [14]. Use of IDS and firewall are considered to be light weight methods for resource constrained environment to filter out attackers. Expected Transmission (ETX) metric and rank are used in IDS for identifying malicious activities performed by nodes [15]. ETX metric is computed from probabilities of received packets and acknowledgements. IDS system is proposed based on geographical hints, since rank is also taken in account. The determined ETX metric represents the distance between root node and the neighboring node.

2. Background Overview

2.1 RPL routing

RPL supports various applications in recent trends, RPL uses IPv6 (i.e.) based on distance-vector proactive routing protocol. Traditional process followed in RPL is the construction of Destination-Oriented Directed Acyclic Graph (DODAG) in the network [16], [17]. DODAG is created from the root node (i.e.) sink which is responsible to aggregate information from nodes participating in this network. To build DODAG four significant control messages are used such

as DODAG Information Solicitation (DIS), DODAG Information Object (DIO), Destination Advertisement Object (DAO) and DODAG Advertisement Object Acknowledgement (DAO-ACK). Each control message is necessary for the construction of DODAG to perform routing in RPL. Unicast and multicast data dissemination is performed using the exchange of these control messages [18], [19].

Table .1 DODAG control Messages

Control Message	Purpose
DIO message	This control message is initiated by the root node i.e. sink. This message is broadcasted to all the nodes present in the root node's coverage range. DIO message is required to adopt as a node in DODAG.
DIS message	This message is necessary while a node joining the DODAG. DIS control message is unicasted towards the neighboring nodes.
DAO message	It is a multicast message that is sent in terms of point-to-multipoint. Using this control message the nodes transfer information in upward direction which reaches the root.
DAO-ACK message	DAO-ACK is an acknowledgement message that is transmitted by a node which have received DAO message.

On the exchanges of control messages as shown in table 1, a complete DODAG is constructed to perform routing. This is also applicable for dynamic work nature of nodes.

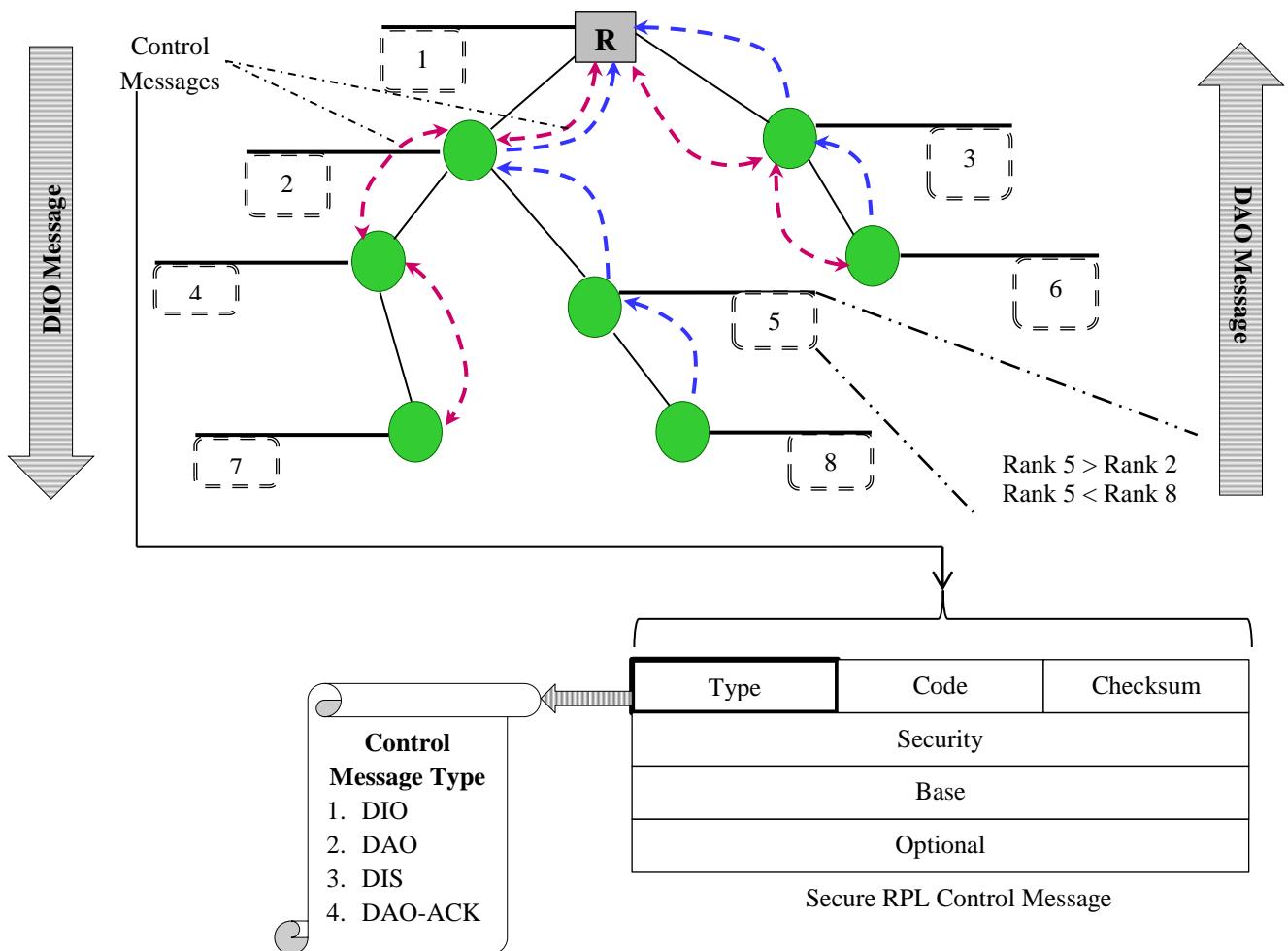


Figure.2. DODAG construction

Rank is provided for each node, on completion of DODAG construction. Ranking values are initiated from the root node and ends at the last node present in constructed DODAG. Node's rank value is provided based on the position of each node with respect to root node. Fig 2 shows the construction of DODAG from the root node and the corresponding rank values are given. For the purpose of security the control message format is included with a security field. The requirement of security is concentrated while constructing DODAG before routing is performed [20]. RPL follows two different topologies hierarchical and flat, this topology supports both static and dynamic nodes and achieves higher scalability [21]. RPL involves with two modes of operation such as storing and non-storing. It is enabled to support three types of communication that is point-to-point, point-to-multipoint and multipoint-to-point. Here DODAG is constructed using control messages, hence RPL does not exchanges any hello packets with its neighboring nodes for routing. RPL performs routing after construction of DODAG.

2.2 Challenges of RPL

RPL routing is performed with certain Objective Function (OF) that is selected for routing a packet between nodes [22]. The majorly used Objective Functions are hop count, ETX, energy, stability, distance, Signal to Noise Ratio (SNR), connectivity and others. To achieve better results of RPL routing, a best objective function is selected, which is challenging in RPL routing. Other major challenges in RPL are discussed by authors in [23]. Due to the reason of battery-assisted node's participating in the network load balancing is required. Load balancing is needed while the level of traffic is too high, which is caused when thousands of nodes involve in data transmission. Load balancing issue is discussed under heavier traffic scenario. Multicast routing is significant in RPL which serves data dissemination and data broadcasting in the network. Traditionally Trickle Multicast (TM) algorithm, Stateless Multicast RPL Forwarding (SMRF) algorithm, Bi-directional Multicast RPL Forwarding (BMRF) algorithm is used [24], [25], [26].

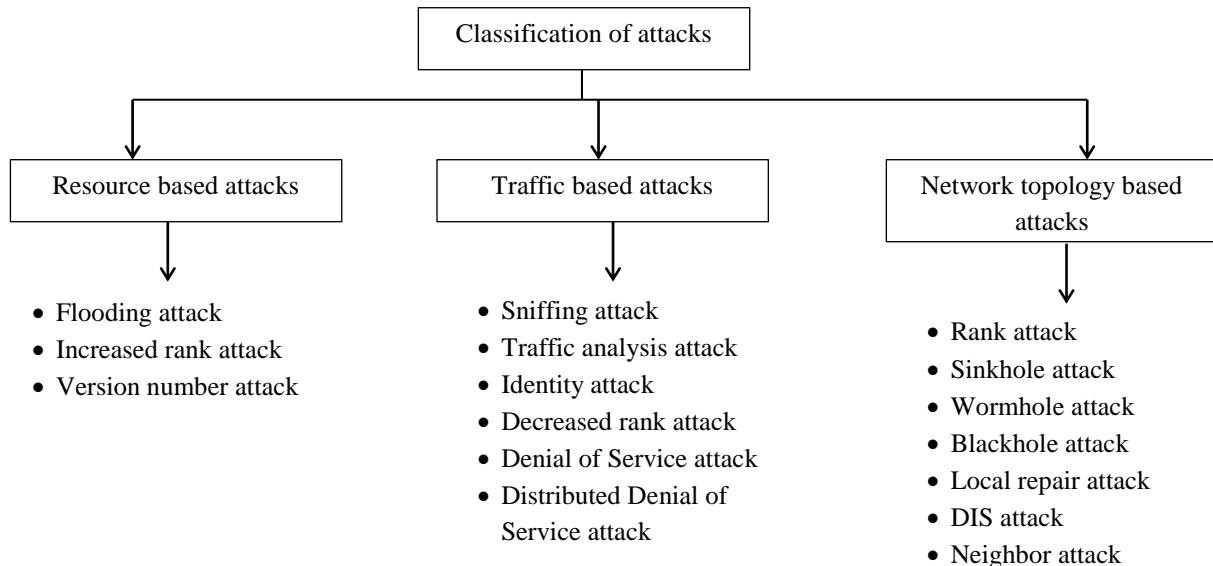


Figure.3. Attacks in RPL

Multicasting algorithms focused on suppression of re-broadcasted packets and also re-broadcasting causes overhead in the network. Data broadcasting using conventional algorithms also leads to a challenging process in RPL. One of the major challenge is security, even though security is optional. RPL used in different applications, each application involves with the participation of huge number of legitimate users and illegitimate users. Therefore security providence is required to ensure secure communication between users in the network. The challenging in ensuring security are trust management, bootstrapping, interoperability, mobility monitoring, legacy systems, resource provisioning, scalability, computation complexity and time maintenance [27]. As per the sensitivity of data sharing, the level of security has to be increased.

3. Common attacks against RPL

In RPL attacks are broadly classified into three categories as resource based, topology based and traffic based [28]. Each category of attack is sub classified into two other partitions. Fig 3 depicts the major classification of attacks that occur in RPL routing. Resource based RPL attack is further classified into direct and indirect attacks. Traffic plays a major role in RPL due to the increased number of user's participation, therefore attackers penetrate the network via traffic. Traffic based attacks in RPL are classified into Eavesdropping and misappropriation [29]. The Eavesdropping attackers perform malicious activities as listening to other packet transmission and extracting the routing information from packets. The third category is network topology based attacks which is sub classified into sub-optimization attacks and isolation attacks [30]. The goal of the attackers in sub-optimization attack is to minimize the performance of the entire network by involving into optimal path selection process.

Table 2 Attacks against RPL

Attack	Working	Attack detection	Impacts network parameters	Counter Measure
Sink hole attack [31]	Sends false information (i.e.) false rank value	Yes	Packet loss	Analyzing packets
Rank attack [32]	Provides poor route quality	Yes	Downgrade QoS parameters	Correlation of location
Sybil Mobile attack [33]	Compromises legitimate nodes	Yes	Packet delivery ratio	Trust based IDS
Sybil attack [34]	Steal identities	No	Message overhead, Energy consumption	Evaluating the effects of attack
Wormhole attack [35]	Creates tunnel between communicating nodes	Yes	Detection rate, Packets overhead	Use location information and neighbor information
DoS attack [36], [37]	Sending unusual set of data to a target node, also occurs in distributed manner all over the network	No	Received Signal Strength, Packet sending rate, Packet receiving rate, Packet delivery ratio, Packet dropping rate, Packet forwarding rate	IDS, IDS probe
Version Number attack [38], [39]	Alters the version number which is associated to topology	Yes	Control overhead, True positive rate, False positive rate, Packet delivery ratio	Monitoring architecture, Distributed and cooperative verification mechanism
Blackhole attack [40]	Huge packet loss, limits resources	Yes	Packet loss, Throughput	Trust based mechanism
Selective Forwarding attack [41]	Drop sensitive information contained in a packet, Compromises legitimate nodes	Yes	Detection probability, overhead	Sequential Probability Ratio Test (SPRT), determine dropped packets with respect to ETX

Isolate attackers participate in the network to segregate a particular node from the network and make it no longer to perform communication with other nodes. Since RPL enables the support of dynamic network environment, the attackers keeps moving from one part to another. However a particular attacker is detected, it can participate in some other location by varying its position and identity. Table 2 illustrates different attacks that participate in network which is involved to degrade the network performance over significant metrics. The attacks are not limited to this list, it is extensively increased as per the advancement in technology.

4. Requirement of Security in RPL

In this section, the requirements of security in RPL are discussed. All these requirements are raised only due to the involvement of different types of attacks that is discussed in previous sections. To attain these requirements, several authors have concentrated over security in RPL. Hence the requirements of security in RPL are listed in the following section;

a) Confidentiality

Confidentiality is referred to data security maintained from other unauthorized entities in the network. This is achieved only when the end users is enabled to access their own data. Therefore those data is not allowed to have privilege access by other entities.

b) Integrity

Integrity is defined to guarantee the transmitted data which will never have a chance to be corrupted. Integrity in security mechanism occurs in two ways such as (i) Malicious altering and (ii) Accidental altering. In malicious altering, the data is purposely corrupted whereas in accidental altering the data is corrupted due to technical error.

c) Identity Management

Identity is unique for each node, since the individuality and legitimacy of the node can be predicted. The possibility is that a malicious node can falsely use identity of legitimate node; hence identity management is a significant requirement. Legitimate nodes are detected using this unique identity.

d) Anonymity

Anonymity is defined as maintenance of security at user side. An owner's data is kept secure and it is not to any other entities participating in the network. User data is protected to survive anonymity.

e) Authentication

Verifying a user entity by means of their original identity or address is called authentication. This process is performed by the network administration before allowing the user to perform data transmission. Authentication is major requirement which is needed to identify a user's true behavior and this is performed before a end-user starts their data transmission.

f) Non-repudiation

For identification and isolation of unauthorized node, this non-repudiation is required. Node behavior is detected either as normal / abnormal, then the particular node is isolated. So without a good security mechanism it is complex to achieve this requirement.

g) Availability

Availability is defined as maintenance of available network services or network resources for the use of legitimate users. Availability ensures the survivability of entire network under the activities of attackers involved into the network.

h) Privacy

Privacy is required only when two end-users perform communication. Since an intruder may involve intermediately to capture the sensitive data that is shared between two entities. Privacy requirement in security is solved by providing a cryptography algorithm.

5. Previous research works

Many authors in their work have discussed with the solution of mitigating the attacks. In [42] wormhole attack detection method was proposed in IPv6 over LLN in WSN application. To detect wormhole attacks, a rank threshold is set by which the wormhole attackers are predicted from rank values. The DIO control message include rank threshold and rank difference value. Rank threshold is the different between ranking values of parent node and the child node. Here malicious node is detected if the rank different value obtained is grater than the rank threshold. Before computing the rank difference, blacklist of the node is verified. This work was able to achieve 100% accuracy in detection of wormhole attackers. Wormhole attacks are broadly classified into three types as closed wormhole, half-open wormhole and open wormhole [43]. Honeypot method also aims to minimize the forensics and other intrusions participating in the network. A Merkle tree based authentication protocol was proposed to ignore wormhole attackers [44]. This tree based approach provides authenticated communication which hashes the information. Merkle tree is constructed from the child nodes by using the Identity and key. Merkle tree is completely built only when it reaches root node. Authentication process is held by one way hashing pairs of identities and keys. In this work, the use of authentication process was enabled to prevent the wormhole attacker, but this was not focused to detect those attackers. In this case the prevented attackers participate in different location at next time period.

Vulnerabilities in routing are solved by providing node-to-node encryption based authentication [45]. This work was focused on two attacks as sinkhole attack and spoofing attack. Each node advertises for an encryption key before beginning data transmission. Requesting node's Identity / addressed is authenticated and then encryption key is provided. Further each new incoming node advertises for a secure encryption key. An Intrusion Detection and Response System (InDReS) was proposed to provide security [46]. Malicious node is detected based on the evidence followed by ranking algorithm. Evidence theory involves Dempster-Shaffer evidence theory which proceeds with basic probability assignment function, belief and Dempster combination Rules. Here a node is isolated, if the summed up ranking value is lesser than the parent node and also alert information is sent to other nodes in the network about the isolated node.

Specification based IDS were proposed for detecting RPL attacks especially rank and local repair attack [47]. A monitoring architecture is designed in which object identity, rank, parent identity, parent rank and topological changes are monitored. Finite state machine is applied on each monitoring node to predict the state. Rank attack is detected by monitoring node which identifies the forging rank of a node, since it has the knowledge of root node's rank. Local repair attack is identified based on the threshold value. Common attacks in RPL were analyzed using trust management scheme in WSN [48]. In this trust based model, two different trust values are computed as direct trust and indirect trust, further the trusted nodes are constructed into tree with respect to the trust management scheme. Internal and external attackers are overcome by this scheme. Internal attack includes DoS, sniffing and replay attack whereas external attack is an illegitimate node that compromises a legitimate node that includes blackhole attack, greyhole attack, sinkhole attack and wormhole attack. This trust mechanism is enabled to monitor the behavior of nodes, so that the malicious activities of illegitimate node. A sliding window is used for the estimation of trust values of nodes. Direct trust is computed from the predicted number of misbehaviors of a node and indirect trust is computed by the recommendation trust. After computing trust values tree is constructed, followed by key establishment and authentication. Therefore this scheme was applied for resolving both internal and external attackers.

A lightweight Identity Based Offline-Online Signature (IOOS) based scheme was proposed in solution of version number attack and rank spoofing attack [49]. A probabilistic key generation algorithm was used to generate private key and master secret key based on user's identity and system parameters. Usually in a version number attack the attacker increases DODAG version number and broadcast it towards the receiving nodes. If a global repair occurs, then DODAG generates new version number. Therefore this attack is performed repeatedly to downgrade the resource utilization. In this work signing of version number and rank value using the private key is enabled to overwhelm these two attacks and minimizes energy consumption and computation time in root node and also in other connect nodes.

Metric-based RPL Trustworthiness Scheme (MRTS) suggest in identifying the honest nodes according to the node's behavior [50]. In MRTS, Extended RPL Node Trustworthiness (ERNT) is computed to improve security in RPL. Direct trust is a weighted value of node's honesty, energy and unselfishness and indirect trust is the recommendation provided with respect to a node's trust. Security is sustained by using a trustworthiness scheme. Wormhole attack and flooding attack detection in RPL protocol was discussed by authors in [51]. Flooding attacks is also called as Denial of Service which sends continuous messages towards a targeted node. Wormhole attack is identified by the rank value of the node, if the rank value tends to be larger than the threshold value then that node is detected as wormhole attacker. Next flooding attack is identified by the node counting the number of router advertisement and neighbor advertisement messages. If the count of these two messages is greater than the threshold, then they are detected as flooding attacker. Initially the node checked whether it is present in the blacklist or not. If present in blacklist, then the presence of attacker node is alerted to neighboring node, else moves on for verification. Finally the detected attacker node is put into blacklist and also neighboring nodes are alerted

An malicious node detection and authentication by using standard 6LoWPAN Neighbor discovery and RPL protocol [52]. The additionally required control messages are minimized in this research work. A cryptography mechanism is used that is AES symmetric key algorithm, this mechanism guarantees node' authenticity and integrity. The solution of authentication is by data frame filtering function and distributed mechanism to identify the legitimate data frames. Data frame filtering process involves with a unique global key which is initially set in border router and it changes dynamically for new nodes participating in the network. A new node entering into the network is authorized by exchanging messages between new node and border router. The new node initiate with router solicitation to router and then router responses with router advertisement, further the new node sends neighbor solicitation with address registration option. In the next messages the node is authenticated by using one-way challenge authentication protocol. Challenge is based on generated random nonce, global key and AES encrypted pre-shared key. After validating this challenge, a MAC is generated with AES for message authentication.

Trusted Platform Module (TPM) was developed to provide secure communication in RPL network [53]. The problems like storage, key generation and message signing in a cryptography oriented security is resolved in TPM. Public and private key are generated using RSA algorithm. The design of trust establishment and key exchange in TPM was enabled to support integrity and authenticity of the messages transmitted from one node to another. In this work, security is provided but it was not tested under the participation of harmful attackers in the network.

Table 3 Layer based attacks and their countermeasures

Layer	Attacks performed	Countermeasures
Physical layer	<ul style="list-style-type: none"> • Jamming attack • Tampering attack • Eavesdropping attack 	<ul style="list-style-type: none"> • Monitoring architecture • Message Authentication Codes
Data link layer	<ul style="list-style-type: none"> • Sybil attack • Collisions attack • Exhaustion attack • Version Number attack 	<ul style="list-style-type: none"> • Multiple Channel Access Methods • Error detection schemes • Signature schemes • Authentication methods • Trustworthiness methods
Network layer	<ul style="list-style-type: none"> • Spoofing attack • Misdirection attack • Smurf attack • Wormhole attack • Sinkhole attack • Blackhole attack • Selective forwarding attack • Replay attack 	<ul style="list-style-type: none"> • Secure Routing • Cryptographic methods • Trust management schemes • Monitoring architecture • Localization verifying schemes • Radio Frequency Identification
Transport layer	<ul style="list-style-type: none"> • Flooding attack • De-synchronization attack 	<ul style="list-style-type: none"> • Deep Packet Inspection • Intrusion Detection system
Application layer	<ul style="list-style-type: none"> • DoS attack • DDoS attack • Reprogramming attack 	<ul style="list-style-type: none"> • Packet analysis • Intrusion Detection System

Attacks in RPL were participated according to processing of each layer. RPL oriented attacks involved in each layer are discussed [54], [55]. Attacks and their countermeasures are described in table 3, hereby it is clear that different attacks cannot be identified by using a single mechanism. Each attack varies in their characteristics and also in their goal to degrade a network performance. Data aggregation in WSN using a protocol also requires security [56]. Randomized multipath route was developed to solve the security constraints. In this work the authors have presented Purely Random Propagation (PRP), Directed Random Propagation (DRP), NonRepetitive Random Propagation (NRRP) and Multicast Tree assisted Ransom Propagation (MTRP). Shamir's algorithm is performed for secret sharing of data from sensor node to sink node. This secure data aggregation was tested under a limited number of blackhole attackers; hence it was not able to tolerate larger number of blackhole attackers. Lightweight authentication schemes as symmetric key cryptography or asymmetric key cryptography can be involved in RPL to provide security [57]. In RPL the nodes operate at in three different modes, first unsecured mode in which security field is absent in control message. Second is pre-installed mode in which key pairs are provided before deployment and third id authenticated mode in which the node is authenticated with the corresponding security process before joining the DODAG. Therefore, this section results with the vulnerabilities and attacks that participate in network while using RPL [58]. Due to dangerous attacks in IoT, mitigation of these attacks is mandatory. Attackers aim to gather sensitive data, abolish user's device, destroy network

performance and more. As per their goal, they participate in the network and communicate with legitimate nodes. A detailed survey on previous research works, on providence of security in RPL is discussed in this section.

5. Problems and Future Directions

The major security problems analyzed from previous research work is listed as follows;

- Privacy concerns
- Insecure integrated cloud / mobile interface
- Inadequate configurations for security
- Insecure web interface
- Lack of authentication
- Insufficient cryptographic techniques

The above mentioned problems of security are analyzed from the review gone over RPL used in WSN application. The problems in security are needed to be recognized and solved with novel solutions, so that in future IoT will be free of vulnerabilities and threats. IoT supports in many sensitive applications and for efficient use in particular application, IoT is integrated with mass storage services, social media, cloud, etc.,

In future IoT will be used in urban areas and which is required to be supported with secure connectivity. On taking into account of this security issue, IoT needs more analysis and novel security oriented algorithms. The use of recent development in the field of bio-metrics for security in IoT can be provided more concentration. Application based security can be provided, since it is sure that not all the data sharing is sensitive. The future requirements in IoT to solve different attacks are,

- Bio-metric based authentication
- Secret session establishment
- RFID based authentication
- Hybrid cryptography techniques
- Multi-factor authentication
- Face recognition / iris recognition
- QR code based authentication
- Cyber sensor to capture real time events

A best providence of security in IoT enables its use over private businesses, IT Companies, Organizations and Government authorities [59]. Whatever the application is used in IoT, the end-to-end security is suggested to be used. IoT is one of the developing trend among people all over the world, hence security providence will attract people in urban areas due to its widespread applications.

6. Conclusion

In this paper, we have reviewed all the aspects of security in RPL using over WSN. Security has become a major requirement in IoT-WSN due to participation of huge number of users under different applications worldwide. Recent research works that are published over 50 papers is discussed and the providence of security is descripted. The views of authors differ in solving different attacks and ensure higher level of security. The ubiquitous growth, in IoT supported billions of smart devices that in turn developed insecurity to participate in IoT. From this paper, we have analyzed the security risks that are associated to IoT and its supported applications. The requirements and common attacks that are held in RPL are detailed and also previous research works designed for security in RPL is also studied. The study of previous works insists the need of security to resolve different attacks that actively participate in the network. Hereby we conclude, this discussion is to promote security algorithms and techniques in all the sensitive applications.

Ubiquitous use of smart devices with advanced technology improved worldwide connectivity; however it has also increased the vulnerabilities and threats broadly. Harmful vulnerabilities should be mitigated to sustain the developments in IoT.

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NIGELLA SATIVA - BREAST CANCER THERAPEUTIC AGENT TO REPLACE ALLOPATHIC TREATMENTS WITH EXTENSIVE SIDE – EFFECTS

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Abstract

Cancer is a disease in which cells divide at an uncontrollable rate in certain parts of the body. Cell division is controllable in healthy people, and healthy cells divide in a controllable way in many tissues and copy themselves to create new healthy cells. Treating cancer is complicated. Many treatments are used to treat cancer; however, these treatments also kill healthy cells. Breast cancer occurs when abnormal cells from inside the milk ducts or lobules move into nearby breast tissue. Cancer cells can travel from the breast to other parts of the body through the blood stream or the immune system. As the cancerous cells grow and multiply, they form a malignant tumor within the breast. Several treatments for breast cancer, such as chemotherapy, surgery, radiation therapy, hormonal therapy, palliative care and others, also lead to severe side effects such as hair loss, infections, allergic reactions, bleeding, bladder problems, and others. These treatments may protect the patient and expand the lifespan for some years. However, these treatments may not be curative. Spice-based remedies are currently gaining in popularity in treating cancer patients and are used in Ayurvedic treatments (purely natural). Some spices, such as garlic, turmeric, and ginger, are commonly used for medical remedies because they have several medicinal properties. Our paper discusses the Ayurvedic treatment for breast cancer using *Nigella sativa* (commonly referred to as black cumin seeds). *Nigella sativa* is used to produce medicines and as an ingredient in several food items. Many scientists have researched *Nigella sativa* for cancer prevention and have concluded that black cumin stimulates neutrophil activity. Neutrophils are short-lived immune cells that are normally found in bone marrow but mobilize into action in cases of bacterial infection. Here, we describe the complete history of black cumin seeds and their properties. We also specify how black cumin seeds prevent breast cancer. Thus, our paper will help many researchers and physicians who are performing research using cumin seeds.

Keywords: Breast Cancer; Nigella Sativa; Black Cumin Seeds; Ayurveda treatment; Spices; Tumor Cells

1. Introduction

In the 20th century, worldwide reports indicate 6 million cancer cases per year. Cancer is one of the major causes of death. Cancer is the second largest cause of death after heart failure. People may be affected by various types of cancer [1], such as lung, prostate, lymphoma, bladder, stomach, breast cancer, and others. Breast Cancer is a common disease for women, whereas 1% of breast cancer cases affect men. Although the main cause of breast cancer is unclear, the most significant factors contributing to breast cancer are a family history of breast cancer and advancing age [2]. Breast cancer is the second leading cause of cancer-related death in women. In 1960, 1 in 20 women faced risks related to breast cancer. Today, this number is 1 in 8. Most harmful diseases, such as breast cancer, are associated with both genetic and environmental factors. Breast cancer development is associated with many lifestyle and environmental factors, such as obesity, child bearing, sudden changes in hormones, alcohol consumption, smoking, tobacco use, chemical compounds and ultraviolet radiation from the sun. Not all breast cancers are caused by inherited genetic factors; in some cases, breast cancer is acquired during a woman's lifetime by somatic mutation of the breast cells [3]. The breast is made up of several tissues that look like networks of lobes that contain milk

glands. The cancer cells develop when there is an uncontrollable growth of cells, which are collectively called a tumor. Tumors can be categorized into two types: malignant and benign. Malignant tumors grow and spread all over the body, whereas benign tumors grow and do not spread.

Breast cancer spreads when the cancer cells penetrate the lymph system or circulatory system, which may carry the cancer cells to several parts of the body, such as the bones, lungs, brain, and liver [4 and 5]. There are several symptoms for identifying breast cancers. These include skin irritation, skin dimpling, pain on the breast, and swelling on the breast areas [6]. In many cases, women with breast cancer do not have noticeable or similar symptoms that can be used in detection. In these cases, breast cancer screening tests, such as mammography and biopsy, are helpful in detecting breast cancer [7]. Current Ayurveda treatments are highly specialized and follow a long folk practice, primarily in the treatment of cardiovascular diseases and cancers. Ayurveda treatment concepts delineate three types of body control systems [8] 1) The nervous system (air or Vata), 2) The venous system (Pitta or fire), and 3) the arterial system (Kapha or water). Ayurveda treatment is a holistic approach that is used to treat the human according to their nature. This helps eliminate the toxins through Panchakarma and facilitates the digestive functions of the body. This natural treatment does not produce any side effects.

Ayurvedic remedies include effective lifestyle and diet advice [9], such as reducing sweets (sugary foods), ingesting several types of fruits, grains and vegetables, and avoiding smoking, alcohol, and fatty foods. In Ayurveda treatments, spices play a major role in recovering patients from several life-threatening diseases, specifically cumin seeds, cardamom, turmeric, ginger, limonene, neem leaves, cinnamon [10], and others. Cancer treatments are discussed in Ayurveda research books such as Charak Samhita, Sushruta Samhita, Ashtang Samhita [11, 12]. Ayurveda medicine is more efficient in the curative aspects of cancer treatments by improving healthy cells and controlling or killing cancer cells [13]. The spices involve several active constituents against several malignant types. Our paper focuses on *Nigella sativa*, which has many medicinal values and can be used in treatments for breast cancer [10, 14, 15, and 16]. This black cumin seed is different from the more popular cumin with the scientific name *Cuminum cyminum*. The seed is termed ‘black cumin’ in English. In Arabic, it is called ‘Habbah Sawda,’ which is translated as ‘seeds of blessing.’ In Latin, it was known as a ‘Panacea,’ meaning cure-all, while in Bangladesh it is called ‘Kalo jeera.’ In India, it is known as ‘Kalonji’ [17]. Before the 18th century, *Nigella sativa* was highly valued in Europe and then slowly lost its value. In recent decades, it has gained popularity as a remedy for many diseases, specifically in cancer treatment [18, 19, 20]. The thymoquinone (TQ) and crude oil are extracted from the seeds of *Nigella sativa*. These play a vital role in treating a variety of diseases, such as cancer, cardiovascular complications, diabetes, asthma and kidney disease. *Nigella sativa* is more effective against cancers in the breast, prostate, cervix, skin, lung and blood system. Many years ago, *Nigella sativa* was identified as having anti-cancer activity; however, scientific research on *Nigella sativa* is held as last 2-3 decades. *Nigella sativa* has many pharmacological properties, such as anti-tumor, anti-bacterial, anti-histamine and anti-inflammatory effects. It also strengthens the immune system [21].

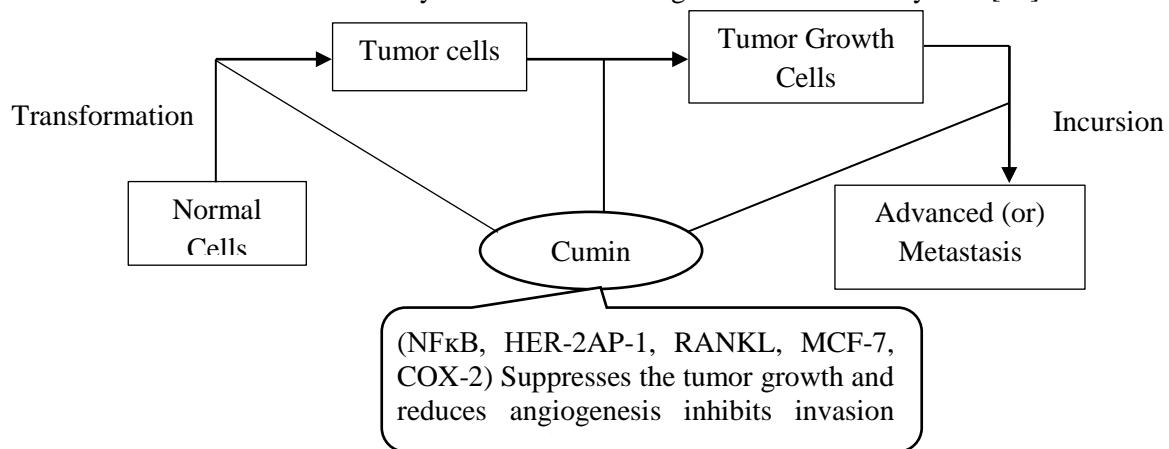


Figure.1. Anti-cancer activities of Cumin

2. About Black Cumin

2.1 Black Cumin Description

Black Cumin seeds represent an important traditional spice that is used in foods worldwide. These seeds are the dried and from the herb *Nigella sativa*. This plant is a thin herbaceous annual plant that grows to a height of 20-30 cm. The herbal plant is slim and has a main stem with five branches that rise from the ground. Each branch has up to two or three sub-branches with alternate dissected leaves with filiform segments. The stems of cumin plants are 3-5 cm in diameter and have a dark green or grey color. The leaves are finely divided and linear. The flowers are delicate and white or pink with 5-10 petals. They are harvested by hand and have white or pink flowers on the plant throughout hot summers [22].

Black cumin was previously called *Bunium persicum* and later called *Carum bulbocastanum*, which is nearer to extinction. *Nigella sativa* comes from the buttercup family, Ranunculaceae, which is cultivated in India from several areas and in many countries. Black cumin seeds are small dicotyledonous, regulose-tubercular, trigonus, and angular [23]. Black cumin seeds contain the compound thymoquinone, which is a bioactive compound with antioxidant, chemopreventive, anti-inflammatory, and other properties. Due to these properties, the black seeds are traditionally used for treating several diseases, such as fever, cancer, intestine, diabetes, asthma, and cancer [24]. Black cumin has thymoquinone or cumin seeds, which removes anticancer actions in animal models that are triple-negative for invasive breast cancers, such as estrogen receptor-negative (ER-), HER2/ neu-negative and progesterone receptor-negative (ER-) [25]. Other chemical compounds are present in addition to thymoquinone (30% - 48%), such as thymohydroquinone (7% - 15%), dithymoquinone (7% - 15%), p-cymene(7% - 15%), carvacrol (6% - 12%), 4-terpineol (2% - 7%), t-anethol (1% - 4%), sesquiterpene longifolene (1% - 8%), thymol, and others [26]. Several oils that are rich in unsaturated fatty acids are also stored in black cumin seeds. Some of these oils are linoleic acid, oleic acid, eicosadienoic acid, and dihomolinoleic acid. Some of the saturated fatty acids are palmitic and stearic acid.

These compounds play a major role in treating several diseases. Black cumin is also used as an anti-cancer agent for various cancers. The breast cancer cell line MCF-7 was inactivated with the help of melatonin acid and retinoic acid [27]. Cancer cells are abnormal due to changes in genes. Thymoquinone [28] has several actions for treating the genetic changes in cells, such as 1) inducing apoptotic cell death in cancerous tissues based on increasing the apoptotic gene expressions while decreasing anti-apoptotic gene expression; 2) this blocks the cancer cells previously present on the human body due to Akt activation; 3) deactivates the NF-kappa B pathway and controls oncogenic expression; 4) increases the activities of antioxidant enzymes and helps avoid cancer cell growth; 5) protects normal cells from various injuries; and 6) prevents CYP450 enzymes from damaging human cells.

3. Health Benefits for Preventing and Curing Breast Cancer

Breast cancers are common diseases in the United States, and approximately 12% of women in the US develop invasive breast cancer during their lifetime. Breast cancers may begin in various parts of the breast, such as the ducts (which carry milk and are affected by ductal cancers) and glands (which are affected by lobular cancers). A small number of cancers starting in other areas are called lymphomas and sarcomas. Breast tumors can form a lump that is not cancerous; these tumors are called benign. These tumors have abnormal growth and can increase a woman's risk of getting breast cancer. The American Cancer Society surveyed breast cancer patients in 2017 and found that 252,710 new cases of invasive breast cancer will be detected. Of these, an estimated 40,610 women will have serious disease that may result in death. This survey identified that 5% - 10% of breast cancer cases are acquired from hereditary (genetic) effects [29]. The survey evidence of Food and Drug

administration shows that the anti-cancer activity and anti-oxidant activity of *Nigella sativa* produces a reduction of cancer cells in the breast. *Nigella sativa* kills MCF-7 breast cancer cells and is a promising antitumor agent when combined with another anti-tumor agent (doxorubicin) to effectively kill MCF-7 breast cancer cells [30]. The aqueous substances extracted from *Nigella sativa* are effective in inactivating MCF-7 breast cancer cells. The US Food and Drug Administration (FDA) allowed patent rights for using the oil form of *Nigella sativa* as an immune system stimulant [31]. *Nigella sativa* contains many active ingredients such as proteins, alkaloids, saponin and essential oils, as well as pharmacological components such as thymol (THY), thymohydroquinone (THQ), dithymoquinone (DTQ) and thymoquinone (TQ) [32].

The black cumin expert Maria Hurairah specified that consuming 3 teaspoons of black seed oil or one teaspoon of powdered seeds daily reduces the size of breast cancer [33]. Nigella oil is massaged onto the breast cancer affected area to kill cancer cells. The regular consumption of black cumin seeds or massage treatments using black cumin oil involves protecting the woman from breast cancer as well as destroying breast cancer cells. A previous study [35] proved that black seed oil is a powerful oil in which the bio-compound thymoquinone has reduced the size of existing tumors in both rat and human experiments. Thus, the experimental results show several advantages against tumors such as,

- 1) 50% of tumor growth is inhibited
- 2) Increased growth of healthy bone marrow cells by approximately 250%
- 3) Produces natural interferon
- 4) Deactivated or killed cells from several cancer types
- 5) Helps reduce damage to the human body from radiation and chemotherapy

Thymoquinone is a major active chemical compound in *Nigella sativa*. Natural breast cancer treatments are primarily based on *Nigella sativa* and contain 30% thymoquinone in the extract form. Modern science has produced thymoquinone as an anti-cancer agent for curing breast cancer. LD50 of thymoquinone was administered to rats and mice orally, resulting in ten-fold greater results for curing cancerous diseases comparing to other treatment. Thymoquinone combined with several monoterpenes, sesquiterpenes, and the cytotoxic triterpene betulinic acid promotes the inactivity of cancer cells [36, 37]. Long-term treatment with thymoquinone inhibits the proliferation of breast cancer cells. The size of the thymoquinone determines the length of the inhibition. Greater inhibition is produced by larger doses. Thymoquinone increased the effectiveness of Cisplatin, Taxotere, Adriamycin and Taxol in both ER-/PR- HER2 and ER+/PR+ breast cancer models [38]. *Nigella sativa* has the potent ability to cure breast cancer based on its bioactive compounds and chemical composition. The anticancer active derivatives of thymoquinone involve inducing cell death, which is associated with DNA laddering and a decrease in the mitochondrial membrane potential with an increase of reactive oxygen species; thus, the activity of *Nigella sativa* reduces the carcinogenic effects of DMBA carcinogen in mammary carcinoma [39]. The Ayurvedic treatment uses several anticancer agents from several spices, especially *Nigella sativa*, which has effective activity against all types of cancers [40, 41].

4. Nutritional Profiles

Nutritional components are highly present in all spices, which are added to treat several health problems because a balanced diet is important for good health. Indian cuisines usually have a large number of spices, which add not only flavors but also higher nutrition. *Nigella sativa* has several nutrient contents such as water (4.2%), lipids (37%), ash (4%), total protein (20%), water soluble protein (4.5%), crude fiber (5.1%), sugar (30%), starch (4.1%) and carbohydrates (33.7%). Minerals are also important for improving human health [42]. The black seed oil also contains several nutrients such as beta-carotene, ascorbic acid, arginine, vitamin B1, vitamin B2, vitamin B3, calcium (311 mg), iron (10.8 mg), sodium (280 mg), and zinc (6.4 mg), manganese (1.4 mg), copper (3.8 mg), magnesium (85.2%), and phosphorous (108 mg). These substances act as essential cofactors in various enzyme functions of the human body. Fatty acids in *Nigella sativa* provide numerous health benefits. *Nigella sativa* contains many fatty acids, such as myristic acid (1.7%), palmitic acid (16%), stearic acid (4%), oleic acid (23.5%), linoleic acid (52.6%) and linolenic acid (2.3%). Black cumin

contains fifteen amino acids, which are the building blocks of cells. These substances cannot be manufactured by the human body and thus must be taken in through foods that are high in essential fatty acids (EFA). Black cumin seeds are also the source of monosaccharides such as arabinose, rhamnose, glucose and xylose [43]. These compounds can be used as anticancer agents and anti-oxidant agents. Black seeds always have a large therapeutic effect and are used to cure several diseases. Thymoquinone is the effective component which with anticancer effects [44] and induces a strong anti-proliferation effect in breast cancer cells. Thymoquinone combined with doxorubicin increases cytotoxicity. The migration and invasive properties of MDA-MB-231 cells are reduced based on the presence of thymoquinone. In this context, thymoquinone decreases the expression of genes for Bcl-xL, Bcl-2, and survivin in breast cancer cells and thus represents an effective treatment for breast cancer cells with the modification of PPAR- γ activity. 30% of Thymoquinone is extracted based on supercritical carbon dioxide, introducing the 16 chemical compounds in *Nigella sativa* that can be used for cancer treatments [45]. We specify the structure of Thymoquinone in Figure 2.

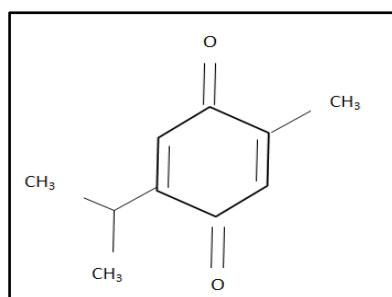


Figure 2. Structure of thymoquinone [24]

5. Clinical Trials

Nigella sativa plays an effective role in medical remedies and several clinical conditions. Many cancers are caused by hormone receptor genes, angiogenesis processes, and metabolic processes. In the US, many women are affected by invasive breast cancer based on hereditary factors according to a survey in 2017 [46]. Treatments using synthetic drugs are effective cures for breast cancer; however, these treatments lead to several adverse effects. Drug-based disease treatments are unsafe in terms of their dosing patterns. Medical plants have lower toxicity for maintaining both human and animal health, especially *Nigella sativa*. Many surveys found that oral and intraperitoneal doses were safely applied in mouse and rat models. Thymoquinone for reducing breast cancer in humans can be consumed at 0.6 mg/kg per day or 0.05 mg/kg of *Nigella sativa* for postmenopausal women [47]. Many experimental results via MTT assay measuring growth after 12, 24, and 48 hours in MCF-7/DOX cells found 25, 50 or 100 micrometers of growth, demonstrating cancer cell growth inhibition following treatment with thymoquinone. This shows that thymoquinone-treated cells had reduced cell growth. Treating the MCF-7/DOX involves DNA fragmentation by increasing the death of cancer cells, which was examined by cytometric assay and showed a 25.6% reduced G1 population in the thymoquinone-treated cells [48].

Black cumin seed oil is prepared by many companies in the USA maintaining both the immune and inflammatory responses. Black cumin seed oil helps in promoting optimal immune system functions and maintaining a healthy aging immune system. This oil is unique for inflammation control due to a wide range of active compounds benefitting human health [49, 50]. The black seed oil has thymoquinone, which is used to modulate the pro-apoptotic and anti-apoptotic proteins on MCF7/DOX cells, which is represented by the Bax/Bcl2 ratio. This also specifies a critical balance ratio for regulating pro-apoptotic and anti-apoptotic proteins in normal cells in humans. An increase in this ratio results in the release of cytochromes from mitochondria, which creates issues for apoptotic pathways. Treating MCF-7/DOX cells based on thymoquinone results in a significant reduction of Bcl2 and an increase in the Bax protein level and thus the growth reduction of cancer cells in the

human body. Thus, thymoquinone increases p53-dependent apoptosis by reducing Bcl2 protein levels [51]. Black seeds are introduced via skin creams to maintain beauty; for example, Cleopatra was an Egyptian queen who used black cumin seed oil to enhance her beauty through its anti-fungal and anti-bacterial agents [52, 53]. Several antioxidant activities of *Nigella sativa* essential oil exert an anti-tumor activity. Some unsaturated fatty acids, such as linoleic acid (ω -6), docosahexaenoic acid (DHA, ω -3) and α -linoleic acid (ω -3), are known to exhibit a weak antitumor activity based on relative tumor receptors. The conjugation of DHA with other clinically established treatments has effective therapeutic indices based on selective accumulation in tumor tissues. Nigella's fatty acids have antitumor effects, which are combined with relative conjugates of thymoquinone with varying chain lengths, branching, and degrees of unsaturation. This anticancer drug involves the anti-proliferation activity of MCF-7/Topo cancer cells to increase cellular levels of reactive oxygen species (ROS) [54].

Various studies on human chronic myeloid leukemia cells (KBM-5) demonstrated that thymoquinone defeats tumor necrosis factors with increased NF-KB activation in a time-dependent manner in dosages. This identification involves the possible role of *Nigella sativa* to cure breast cancer. The cancer cells are seeded on fresh complete medium for 24 h before treatment. The viability assay specifies via trypan blue dye that interacts with membrane-damaged cells to be relevant for treating cancer cells. Here, MCF-7 cells are treated with thymoquinone at 25, 50, or 100 micrometers and incubated for various durations. The results verified an effective difference between the untreated cells and treated cells at several concentrations; additionally, the cytotoxicity was also reduced, which decreased cell growth by 80% for up to 50 micrometers of thymoquinone for 24 hours [55]. Thymoquinone is a known anticancer agent that bio-evaluated conjugates of TQ with various monoterpenes, sesquiterpenes, and the cytotoxic triterpene betulinic acid to identify the structural parameters of anticancer activities. Triterpene betulinic acid can also be conjugated with terpene, which is also a constituent of black seed oil. Three derivatives of terpene were tested to inhibit the growth of human cancer cells, such as 518A2 melanoma, KB-V1/Vbl cervix carcinoma, MCF-7/Topo breast adenocarcinoma, HL-60 leukemia, and non-malignant foreskin fibroblasts. These resulted in a reduction of the mitochondrial membrane potential and an increase in the cellular levels of ROS [56]. Tumor inoculation is performed on 66cl-4-GFP (mouse mammary tumor cells), which are centrifuged, washed, and re-suspended in MEM-F12 media at a density of 1 X 10⁶/100 microliters. Six tumor-bearing mice were treated for 14 days with 10 mg/kg, showing a significant reduction in tumor growth and analyzed by the size of the tumor compared with untreated mice. A tumor reduction is observed in mice when treated with a combination of TQ and CB 1954; this also reduced the body weight of the mice [57].

6. Discussion

Nigella sativa is one of the best spices to prepare food and is comprised of several minerals and vitamins, which help in curing several human diseases. A book named *The Black Cumin Cancer Protocol* specifies that the raw consumption of a few black cumin seeds cures several cancers in humans [58].

Nigella Sativa is an amazing plant with many medicinal and nutritional benefits. The plant has been attracting increasing attention from nutrition and pharmacological researchers. Many cancer research institutes specify that *Nigella sativa* is a powerful spice for curing breast cancer by reducing the growth of cancer cells. In South Indian culture, for preventing breast cancer and increasing the amount of breast milk, a water decoction is prepared with nigella which is provided to women after their delivery from the 2nd to 10th day. After the delivery period, every woman must consume 15 ml of syrup in the early morning with an empty stomach, which helps strengthen the woman's internal system [59]. Due to the presence of several nutrients, such as sterols and beta-sitosterol, which have effective anti-carcinogenic properties, the FDA and Dr. Michael Tierra recommend *Nigella sativa* for curing all types of cancer treatments [60]. *Nigella sativa* oil contains thymoquinone, which is considered a potent anti-oxidant, anti-mutagenic agent and anti-carcinogenic agent that induces apoptosis in cancer cells without compromising immunity. It has a cytotoxic property that helps kill cancer cells without affecting normal tissues [61]. Pentacyclic triterpene saponin and Alpha-hederin

are extracted from *Nigella sativa* seeds, which exert an anti-tumor activity in the human body [62]. Thus, breast cancer can be reduced by consuming *Nigella sativa* daily. *Nigella sativa* also reduces or stops tumor growth in affected breast cancer patients. Due to the increasing rate of breast cancer among women, many treatments, such as radiotherapy, chemotherapy, surgery and immunotherapy, have been developed to cure the disease. In radiotherapy, normal tissues near the cancer cells are affected by radiation [63]. In this situation, black cumin oil is effective to heal the negative effects of the rays. This effect is due to the ability of *Nigella sativa* to hunt for free radicals via its antioxidant properties [64]. Cancer patients who take chemotherapy treatment can also intake black cumin to reduce the side effects caused by chemotherapy. This also improves the immunity of the body. Surgery is an effective treatment to remove cancer cells and the surrounding tissues from the body. After surgery, patients are recommended to take *Nigella sativa* with honey, which has anti-inflammatory, anti-bacterial and anti-fungal properties that can help the patient recover quickly [65]. *Nigella sativa* with H₂O₂ (an oxidative stressor) provides promising results for breast cancer by acting against MCF-7 cells. The melatonin and retinoic acids of *Nigella sativa* effectively reduced the carcinogenic effects of DMBA. Supercritical – CO₂ extracts from the black cumin, which has anti-cancer activity against MCF-7 breast cancer cells. This extract reduces the growth of cancer cells by inhibiting nucleic acid synthesis and inducing apoptosis and thus promoting cancer cell death [66]. This survey provides effective research about *Nigella sativa* for treating breast cancer and proves that the consumption of natural herbs and spices can cure several life-threatening diseases due to the several nutrients in it.

7. Conclusion

Among several natural spices, *Nigella sativa* is a special spice that is used in various recipes. Due to the higher medicinal values present in it, natural treatments such as Ayurveda and Siddha focus on treating life-threatening diseases. The intake of raw *Nigella sativa* bolsters the immune system of the body. We have focused on several remedies for curing breast cancer using its higher nutritional contents and chemical compositions. This study concludes that *Nigella sativa* must be included in all food recipes to prevent human beings from contracting breast cancer. There are many ways to prevent cancer; however, some treatments have several side effects, which are always painful, whereas natural remedies using spices for treating cancer are free from pain. Ayurvedic treatment with *Nigella sativa* allows people with breast cancer to maintain a diet that helps control the growth of cancer cells because cancer cells need higher intake large amount of meat, poultry and dairy products, grilled foods etc., for cell migration, which are available in common foods. This treatment enables an effective diet that has more nutrients and minerals that reduce cancer risks. While this paper only examined the effects of cumin on breast cancer, future papers will be extended to describe other herbs and spices which will provide substantial beneficial information for reducing breast cancer.

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Authors Biography

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Neha Vutakuri is currently a junior studying at McLean High School, Virginia. She is the founder and CEO of the nonprofit organization Breast Cancer Prevention with Herbs and Spices (BCPHAS), which was founded to research and increase awareness on the prevention of breast cancer using herbs and spices. She has created and released an app to promote herb and spice consumption to decrease breast cancer diagnosis rates. She has also developed a tool for early breast cancer diagnosis using the Minkowski Distance method based Mutual Information and Genetic Algorithm. She is currently working on developing a HIGH PERFORMANCE MACHINE LEARNING TOOL FOR THE PREDICTION OF BREAST CANCER STAGE, REOCCURRENCE AND SURVIVAL RATE. She presently has articles under review by her professor about how herbs and spices can be useful for breast cancer prevention. After these have been released, she is planning on publishing a book with these articles along with recipes featuring various herbs and spices. After this book is published, she will distribute the book to as many people as possible to spread the importance of incorporating herbs and spices into one's diet.

Second Author



Sita Somara is a biomedical research scientist with specialization in regenerative medicine advanced therapies. Dr. Somara is Product Development Lead Scientist at Regenerative Medicine Clinical Center of Wake Forest Institute of Regenerative Medicine. She is passionate about translating innovative products and technologies from research lab to clinics to deliver a new era of medicine to the world. Dr. Somara's areas of expertise include preclinical studies and clinical product development processes pertaining to cell therapy, tissue engineered products, and medical devices. She is also a strong advocate for

regulating the regenerative medicine therapies worldwide. She is a Committee member of North America Legal and Regulatory Affairs of International Society of Cell Therapy (ISCT) and chairs Labeling Project Proposal of CTLM Working Group with a goal to standardize, harmonize and improve the safety of prospective labeling systems in Clinical setting. Her other passion is exploring herbs/spices as an alternate therapeutic agents. Dr. Somara is interested in understanding the medicinal properties of spices/herbs to apply for prevention of diseases or as a potential alternate treatment or their use as an aid during the treatment. The effectiveness of this innovative alternative medicine will also help in providing cost-effective remedies for many diseases.

A STUDY ON RECYCLED CONCRETE AGGREGATES

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Abstract

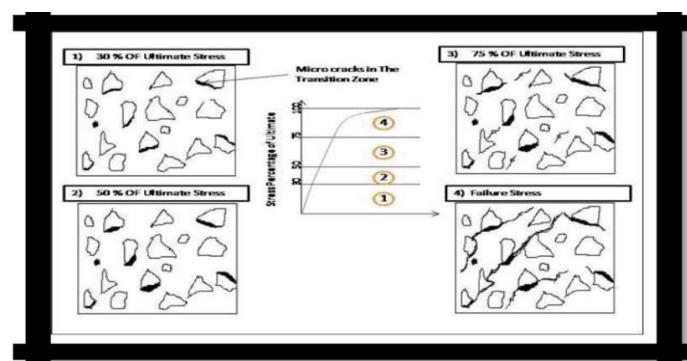
The amount of construction waste has been dramatically increased in the last decade, and social and environmental concerns on the recycling of the waste have consequently been increased. Many researchers state that recycled concrete aggregates (RCA) are only suitable for non-structural concrete application. This research, however, shows that the recycled aggregates that are obtained from concrete specimen make good quality concrete. Concrete waste from demolished structure has been collected and coarse aggregate of different percentages is used for preparing fresh concrete. In this study, for the 28th day cube compressive strength using OPC; the strength for 25%, 50%, 75% and 100% RCA mixes were 23.5%, 33.5%, 32.4% and 10.7%, respectively less than 0% RCA mix whereas for PSC, were 17.8%, 36.7%, 40.6% and 19.1% respectively less than normal concrete. The cylinder compressive strengths at 28 days for 25%, 50%, 75% and 100% RCA mixes, using OPC were 37.7%, 32.0%, 33.7% & 28.4% and using PSC were 20.5%, 27.5%, 25.1% & 30.3% respectively less than that of normal concrete mix. However, in split tensile strength, a continuous decrease in strength was observed with addition of RCA. The values obtained for 25%, 50%, 75% & 100% RCA, for OPC, were 20.6%, 33.0%, 34.9% & 42.5% respectively less than 0% RCA concrete while for PSC, were 1.1%, 16.3%, 26.1% & 27.2% less correspondingly. This study proves that, though the strength of concrete is affected by addition of RCA, the cost saving is upto 16% by 100% substitution of natural aggregates. Moreover, the use of PSC instead of OPC leads upto 29% reduction in cost.

Keywords: Recycled concrete aggregates, natural aggregates, compressive strength, split tensile strength, Ordinary Portland cement, Portland Slag cement.

Introduction

Concrete is globally the most widely used material in the construction industry. Basically, concrete is a manufactured product consisting of cement, aggregates, water and admixture. The composition of aggregates forms a major portion of the mixture consisting of sand, crushed stones and gravel which are inert granular materials. Construction aggregates make up more than 80 percent of the total aggregate market and are used mainly for building constructions and pavements. The word concrete comes from the Latin word “concretus” (meaning compact or condensed), the perfect passive participle of “concrescere”, from the words “con” (together) and “crescere” (to grow). [1] **Fig. 1.1: Stress-Strain Relationship of Ordinary Concrete**

S



RECYCLED CONCRETE AGGREGATES

Recycled aggregates are aggregates derived from the processing of materials previously used in construction. Examples include recycled concrete from construction and demolition waste material (C&D), reclaimed aggregate from asphalt pavement and scrap tyres. Coarse Recycled Concrete Aggregate (RCA) is produced by crushing sound, clean demolition waste of at least 95% by weight of concrete, and having a total contaminant level typically lower than 1% of the bulk mass. Other materials that may be present in RCA are gravel, crushed stone, hydraulic-cement concrete or a combination deemed suitable for pre-mix concrete production.

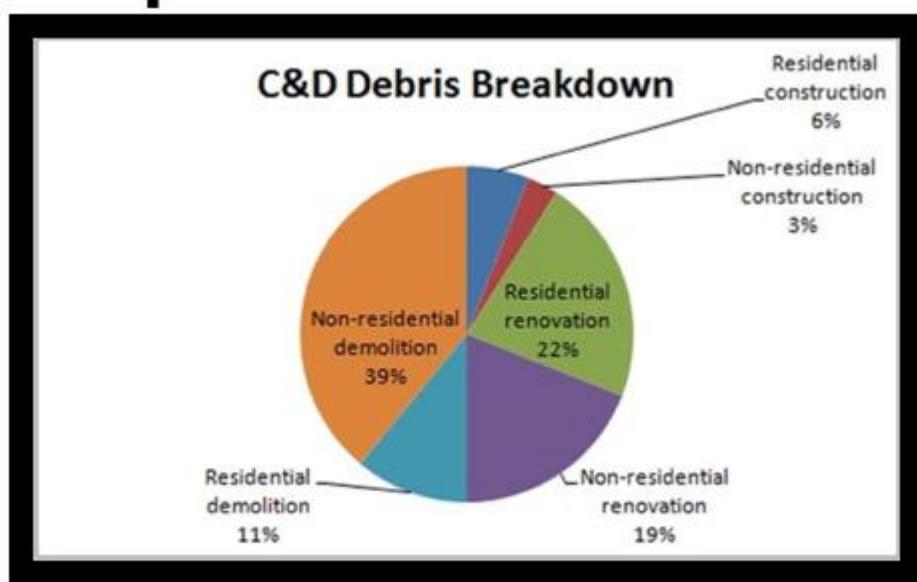


Fig. 1.2: Worldwide Estimates of Construction and Demolition Waste

LITERATURE REVIEW

Sowmya.et.al. (2000), some tests were conducted using the recycled aggregates to study and compare the results with the naturally available aggregates. The tests were conducted on the aggregates which weren't subjected to any prior treatment. The impact value for recycled aggregate was obtained as 35% and that for natural aggregate as 29.9%. The abrasion value for recycled aggregate was obtained as 47.4% and that for natural aggregate as 29.6%. Water absorption of recycled aggregate (4.2%) was found to be higher when compared to the natural aggregate (0.4%). It was found that compressive strength of concrete made from the recycled aggregate is about 76% of the strength of concrete made from natural aggregate for normal strength concrete (M20). Flexural strength of the recycled aggregate concrete is almost 85% and 80% of natural aggregate concrete. **Amnon.et.al (2002)**, concrete having a 28-day compressive strength of 28 MPa was crushed at ages 1, 3 and 28 days to serve as a source of aggregate for new concrete, simulating the situation prevailing in precast concrete plants. The properties of the recycled aggregate and of the new concrete made from it, with nearly 100% of aggregate replacement, were tested. The properties of

the concrete made with recycled aggregates were inferior to those of concrete made with virgin aggregates. Effects of crushing age were moderate: concrete made with aggregates crushed at age 3 days exhibited better properties than those made with aggregates of the other crushing ages. **Shailendrakumar.et.al. (2004)**, in this paper, the author found the relationship between split tensile strength and compressive strength for RCA concrete as well as controlled concrete. The recycled concrete aggregate used was that passing through IS sieve 40mm and retained on IS sieve 4.75mm. For controlled concrete the natural stone chips of same nominal size was used in making concrete. If required a dose of superplasticizer [Conplast SP 430 (M)] was also added to ordinary tap water to obtain desired degree of workability. In this study, 3 mixes were prepared i.e. replacement of natural aggregates by 0%, 50% and 100% RCA. The strength was tested at 28 days maturity of casted concrete. It was observed that recycled concrete aggregate has lower value of specific gravity and moderately high values of water absorption, crushing value, impact value and abrasion value. Furthermore, similar to concrete containing natural aggregate, tensile strength of recycled aggregate concrete containing recycled concrete aggregate, mainly depends on compressive strength. **Chaurpagar.et.al. (2004)**, the author investigated physical and mechanical properties of RCA with and without steel fibres and polymer against controlled concrete. Specimens (cubes/beams/cylinders) were prepared by varying the parameters like water cement ratio and volume of polymer (2.5%, 5.0%, and 10% by parts weight of cement) and constant 0.5% steel fibre by volume of concrete. Recycled Aggregate and Natural Aggregate shows that the former has high specific gravity, high absorption capacity and low fineness modulus. Resistance to mechanical actions such as crushing strength, impact value and abrasion value of recycled aggregates are significantly higher than that of conventional aggregates. There is a marginal increase in the compressive strength due to the addition of polymer-steel fiber in recycled concrete. There is significant increase in split tensile strength and flexure strength at 90 days in polymer steel fiber recycled aggregate concrete as compared to conventional as well as recycled aggregate concrete. Area under stress strain curve is higher, shows the high toughness properties of concrete that it indicates that polymer concrete is more suitable for the earthquake resisting structures. It is observed that there is an improvement in the ductility with addition of 10% polymer & 0.5% steel fiber in the concrete as compared to recycled aggregate concrete as well as conventional concrete. **Limbachiya.et.al. (2004)**, the report aimed at examining the performance of Portland Cement Concrete produced with natural and coarse aggregates. The study showed that because of attached cement paste in RCA, the density of these materials is about 3-10% lower and water absorption is about 3-5 times higher than the corresponding natural aggregates. The results also indicate that for RCA samples obtained from four different sources, there was no significant variation in strength of concrete at a given RCA content. **Natesan.et.al. (2005)**, an experimental investigation was conducted to study the mechanical properties of concrete where natural coarse

aggregate is partially replaced with recycled coarse aggregate. It was concluded that RCA increases the mechanical properties of conventional concrete and it was observed that a mix of 75% RCA and 25% Natural Aggregates has good mechanical properties. RCA with rough surface allows better bonding with cement mix. **Naik.et.al. (2006)**, this paper throws some light on the production of recycled aggregates, their properties and their suitability in the production of concrete. Also, the properties and the application of recycled aggregate concrete are discussed in detail along with bringing out the limitations of recycled aggregate concrete. This study showed that recycled aggregates had higher water absorption value than natural aggregates but less density and strength. **Choudary.et.al. (2006)**, the author investigated workability and strength properties of RCA. The recycled aggregate concrete is made by mixing 60% of recycled aggregates with 40% of crushed stone chips. The aggregates used for concrete batching are maintained at *saturated surface dry condition*. The workability of the recycled aggregate concrete is slightly lower than that of the conventional concrete. The compressive strength of the recycled aggregate concrete is slightly lower than that of the conventional concrete and recycled concrete aggregate or recycled with conventional concrete can be used in normal plain and reinforced concrete construction. The recycled and conventional concrete containing 60% of recycled aggregate and 40% of crushed natural stone chips occupies almost an intermediate position in terms of workability and strength consideration between the others types of concrete. So from economy and performance point of view, this type of concrete is suitable only next to conventional concrete. **Osei.et.al. (2013)**, in this study, the compressive strength properties of concrete were investigated by completely replacing Natural Aggregate (NA) with recycled concrete aggregate (RCA). Densities of both RCA concrete and NA concrete were within the range of normal weight concrete. Both RCA concrete and NA concrete showed the similar trends in the variation of strength and density with time. Reduction in the 28-day compressive strength of concrete due to complete replacement of natural aggregates with recycled concrete aggregate ranges from 11% to 33%. RCA can replace NA in the production of both non-structural and structural concrete. **Patil.et.al. (2013)**, this study aimed to evaluate physical properties of concrete using recycled coarse aggregate. In this research, concrete waste from demolished structure has been collected and coarse aggregate of different percentages is used for preparing fresh concrete (0%, 25%, 50%, 75% & 100%). The compressive strength of recycled coarse aggregate (RCA) is found to be higher than the compressive strength of normal concrete when used upto a certain percentage. Recycled aggregate concrete is in close proximity to normal concrete in terms of split tensile strength. The slump of recycled aggregate concrete is more than the normal concrete. At the end, it can be said that the RCA upto 50 % can be used for obtaining good quality concrete.

MATERIALS

Concrete is a composite material composed of water, coarse granular material (fine and coarse aggregate) embedded in a hard matrix (cement or binder) that fills the space among the aggregate particles and glues them together.

AGGREGATES: Aggregates used in concrete are divided into three categories:

Fine Aggregates: These aggregates passes through 4.75 mm I.S. sieve and retained on 150 micron. **Coarse sand,** it contains 90% of particles of size greater than 0.6 mm and less than 2 mm .**Medium sand,** it contains 90% of particles size greater than 0.2 mm and less than 0.6 mm, **Fine sand,** it contains 90% of particles of size greater than 0.06 mm and less than 0.2 mm. Proper selection of sand is critical in the durability and performance of concrete mixture

Coarse Aggregates: These aggregates passes through 63 mm I.S. sieve and retained on 4.75 micron. Coarse aggregates are particles greater than 4.75 mm, but generally range between 9.5 mm to 37.5 mm in diameter. They can either be from Primary, Secondary or Recycled sources.

Mixed Aggregate: Mixed aggregate is sometimes used for unimportant work without separating into different sizes.

CEMENT: Another important material in concrete manufacture is cement. Cement is a fine ground material consisting of compound of lime, silica, alumina and iron.

Discussions: The specific gravity of aggregates normally used in road construction ranges from about 2.5 to 3.0 with an average of about 2.68. Though high specific gravity is considered as an indication of high strength, it is not possible to judge the suitability of a sample road aggregate without finding the mechanical properties such as aggregate crushing, impact and abrasion values. Water absorption shall not be more than 0.6 per unit by weight. From the above experiment, it is found that the specific gravity of RCA is smaller than that of normal aggregate. Hence, RCA can be said to have less density than normal aggregate and hence RCA is lighter. And also, it is found that water absorption is higher in RCA than that of normal aggregates.

Fine Aggregates observations and Results

Determination of Moisture Content of Fine Aggregates by Pycnometer Method

Observations and Results:		Trial No.	
Sl. No.	Observations and Calculations	1	2
1	<i>Mass of empty pycnometer (M1 g)</i>	684 g	654 g
2	<i>Mass of pycnometer + fine aggregates (M2 g)</i>	1184 g	1185 g
3	<i>Mass of pycnometer + fine aggregates, filled with water (M3 g)</i>	1869 g	1871 g
4	<i>Mass of pycnometer filled with water only (M4 g)</i> <i>Specific Gravity of Sand, G</i>		
5	<i>Mass of fine aggregates, (M2 - M1)g</i>	500 g	500 g
6	<i>M3 - M4</i>	328 g	
7	<i>(G - 1) / G</i>	0.67	
8	<i>Moisture Content, w = {(((M2-M1)/(M3-M4))((G-1)/G))-1} x 100</i>	1.28 %	1.28 %
9	<i>Average Moisture Content, wavg</i>	1.28	

Discussion: For fine aggregate, it is important to determine its moisture content because if its water content is high, there will be an excess amount of water in the mixture. The water-cement ratio used in the mixture is 0.5 and if the fine aggregates contain a certain amount of water, this will have a considerable impact on the mixture and this may lead to bleeding of concrete afterwards. Therefore, there is a need to ensure that the fine aggregate is dry or if it is not the case, then the water content of the fine aggregates needs to be reduced.

Coarse Aggregates - Oven Dry Method:**Observations and Graph:**

Table : Determination of Moisture Content of Coarse Aggregates by Oven Dry Method		
Observations and Results:	Conventional	Recycled Concrete
	Aggregates	Aggregates
<i>Original sample weight (M1 g)</i>	880 g	780 g
<i>Oven dried sample weight (M2 g)</i>	874 g	754 g
<i>Moisture content, w = [(M1-M2) / M2] × 100%</i>	0.68%	3.44%

Sieve Size(mm)	Weight Retained (Kg)	Percentage Retained (%)	Cumulative % Retained	Cumulative % Passing
4.75	0	0	0	0
2.36	0.014	1.4	1.4	98.6
1	0.302	30.2	31.6	68.4
0.0006	0.24	24	55.6	44.4
0.0003	0.354	35.4	91	9
0.00015	0.062	6.2	97.2	2.8
Pan	0.028	2.8	100	N/A
TOTAL			376.8	

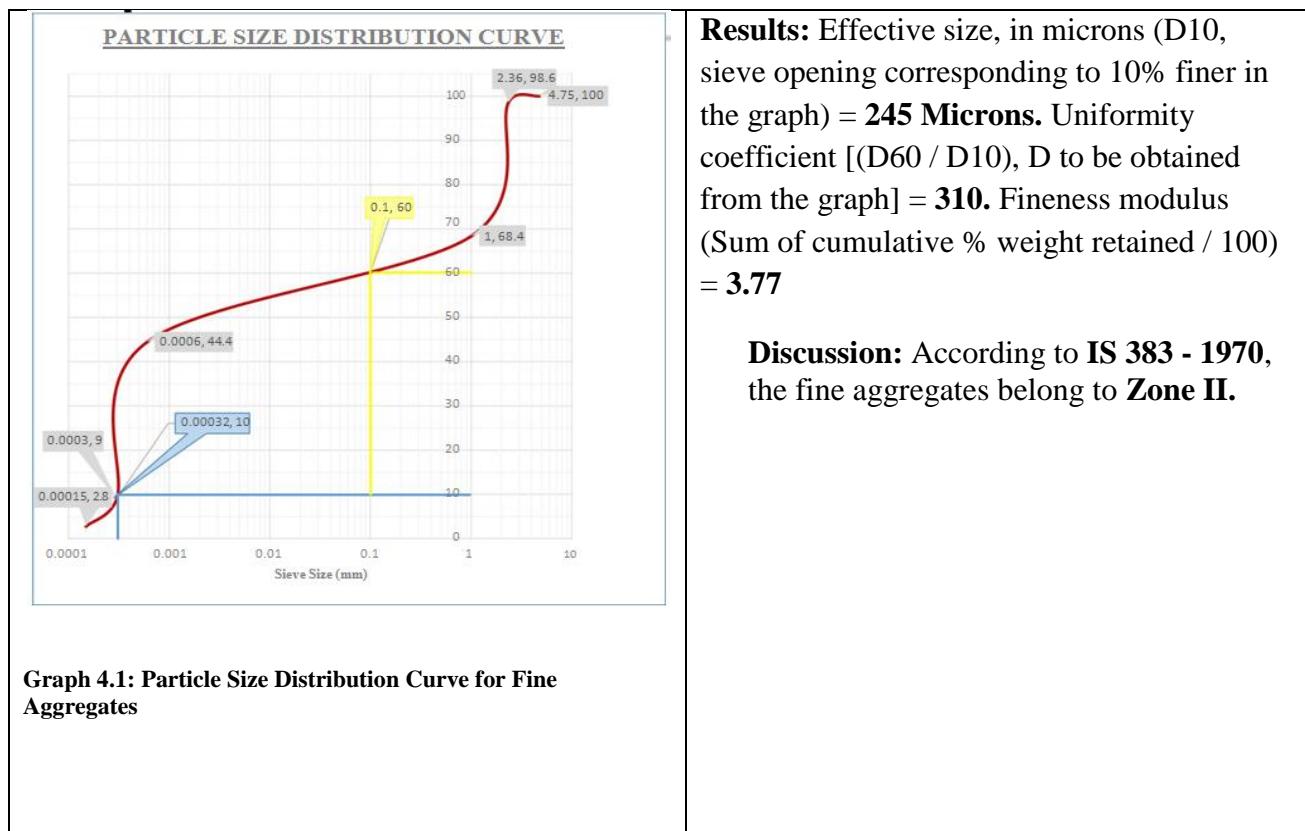
Table : Sieve Analysis of Fine Aggregates

Table : Results for Effective Size, Uniformity Coefficient and Fineness Modulus of Conventional and Recycled Concrete Aggregates

Results:		
	Conventional Aggregates	Recycled Concrete Aggregates
<i>Effective Size (D10)</i>	7.6 mm	5.1 mm
<i>Uniformity Coefficient (D60/D10)</i>	1.84	2.51
<i>Fineness Modulus</i>	2.78	2.53

Discussion: The D refers to the size or apparent diameter of the soil particles while the subscript (10, 30 and 60) denotes the percent that is smaller than that diameter, e.g. D10 = 0.16 mm means that 10% of the sample grains have diameter smaller than 0.16 mm. A large value of Cu indicates that the D10 and D60 sizes differ appreciably.

SHAPE TESTS: Flakiness Index and Elongation Index of Coarse Aggregates

Conventional Coarse Aggregates

Size of aggregates	Weight of	Thickness	Weight of	Length	Weight of
Passing	Retained	Fraction	gauge size,	gauge	Aggregates
through	on IS	Consisting	mm	in each	size,
IS Sieve,	Sieve,		of at least	Fraction	mm
mm	mm	200 pieces, g		Thickness gauge, mm	On length gauge, mm
1	2				
63	50				
1	2	3	4	5	6
50	40	0	23.90	0	-
40	31.5	0	19.50	0	58.00
31.5	25	0	16.95	0	-
25	20	0	13.50	0	40.5
20	16	2000	10.80	550	32.4
16	12.5	850	8.55	69	25.5
12.5	10	500	6.75	150	20.2
10	6.6	110	4.89	22	14.7
TOTAL		3457		791	493

Table 4.9: Determination of Flakiness Index and Elongation Index of Conventional Coarse Aggregates*Recycled Concrete Aggregates*

Size of aggregates		Weight of	Thickness	Weight of	Length	Weight of
Passing	Retained	Fraction	gauge	aggregates	gauge	aggregates
through	on IS	Consisting	size, mm	in each	size,	in each
IS Sieve,	Sieve,	of at least	-	fraction	mm	fraction
Mm	Mm	200 pieces, g	-	Passing gauge, mm	-	Retained on gauge, mm
1	2	3	4	5	6	7
63	50	0	23.90	0	-	-
50	40	0	27.00	0	81.00	0
40	31.5	0	19.50	0	58.00	0
31.5	25	0	16.95	0	-	-
25	20	0	13.5	0	40.50	0
20	16	1540	10.80	26	32.4	72
16	12.5	920	8.55	16	25.5	159
12.5	10	420	6.75	11	20.2	85
10	6.3	400	4.89	0	14.7	113
TOTAL		W=3280		X=53		Y=429

Table : Determination of Moisture Content of Fine Aggregates by Pycnometer Method

Discussion: For fine aggregate, it is important to determine its moisture content because if its water content is high, there will be an excess amount of water in the mixture. The water-cement ratio used in the mixture is 0.5 and if the fine aggregates contain a certain amount of water, this will have a considerable impact on the mixture and this may lead to bleeding of concrete afterwards. Therefore, there is a need to ensure that the fine aggregate is dry or if it is not the case, then the water content of the fine aggregates needs to be reduced.

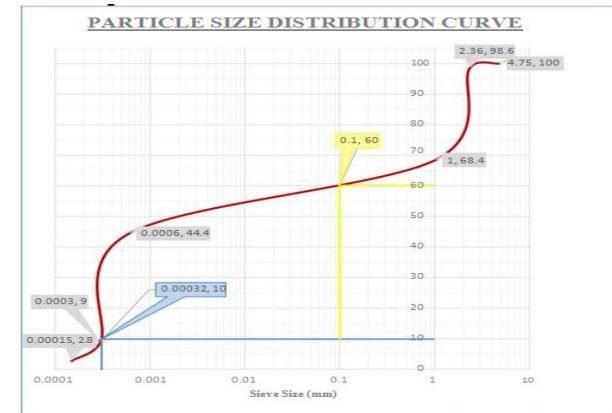
Coarse Aggregates - Oven Dry Method:

Table 4.4: Determination of Moisture Content of Coarse Aggregates by Oven Dry Method		
Observations and Results:		
	Conventional	Recycled Concrete
	Aggregates	Aggregates
Original sample weight (M1 g)	880 g	780 g
Oven dried sample weight (M2 g)	874g	754g
Moisture content,	874 g	754 g
$w = [(M1-M2) / M2] \times 100\%$	0.68%	3.44%

Discussion: From the above results, it is found that RCA contains more water than that of conventional aggregates because RCA has a higher amount of cement and thus absorbs more water than normal aggregates due to larger pore sizes and hence, there is a need to encounter for water absorption. Due to this, RCA will absorb the water during mixing of concrete and this will lead to a bad mixture as there will be a lack of water and thus there will be a need to add more and more water.

Fine Aggregates:**Observations and Graph:**

Sieve Size (mm)	Weight Retained (Kg)	Percentage Retained (%)	Cumulative % Retained	Cumulative % Passing
4.75	0	0	0	100
2.36	0.014	1.4	1.4	98.6
1	0.302	30.2	31.6	68.4
0.0006	0.24	24	55.6	44.4
0.0003	0.354	35.4	91	9
0.00015	0.062	6.2	97.2	2.8
Pan	0.028	2.8	100	N/A
TOTAL		376.8		

Table : Sieve Analysis of Fine Aggregates**Graph : Particle Size Distribution Curve for Fine Aggregates**

Results: Effective size, in microns (D10, sieve opening corresponding to 10% finer in the graph) = **245 Microns**. Uniformity coefficient [(D60 / D10), D to be obtained from the graph] = **310**. Fineness modulus (Sum of cumulative % weight retained / 100) = **3.77** **Discussion:** According to **IS 383 - 1970**, the fine aggregates belong to **Zone II**.

Table : Results for Effective Size, Uniformity Coefficient and Fineness Modulus of Conventional and Recycled Concrete Aggregates

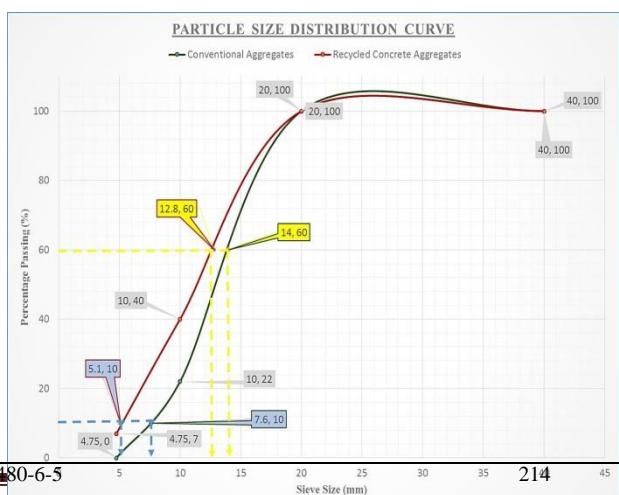
Results:		
	Conventional	Recycled Concrete
	Aggregates	Aggregates
<i>Effective Size (D10)</i>	7.6 mm	5.1 mm
<i>Uniformity Coefficient (D60/D10)</i>	1.84	2.51
<i>Fineness Modulus</i>	2.78	2.53

**Coarse Aggregates, Observations and Graph:
Sieve Analysis on Conventional Coarse Aggregates**

Sieve Size (mm)	Weight Retained (Kg)	Percentage Retained (%)	Cumulative % Retained	Cumulative % Passing
40	0	0	0	100
20	0	0	0	100
10	1.56	78	78	22
4.75	0.44	22	100	0
Pan	0	0	100	N/A

Graph : Particle Size Distribution Curve for Conventional Aggregates And Recycled Concrete Aggregates**Table : Sieve Analysis on Conventional Coarse Aggregates**

<i>Sieve Analysis on Recycled Concrete Aggregates</i>				
Sieve Size	Weight	Percentage	Cumulative %	Cumulative %
(mm)	Retained (Kg)	Retained (%)	Retained	Passing
40	0	0	0	100
20	0	0	0	100
10	1.2	60	60	40
4.75	0.66	33	93	7



Pan	0.14	7	100	N/A		
	TOTAL		253			

Discussion: The D refers to the size or apparent diameter of the soil particles while the subscript (10, 30 and 60) denotes the percent that is smaller than that diameter, e.g. D10 = 0.16 mm means that 10% of the sample grains have diameter smaller than 0.16 mm. A large value of Cu indicates that the D10 and D60 sizes differ appreciably.

Table 4.1: Determination of Specific Gravity and Water Absorption of Coarse Aggregates *Conventional Coarse Aggregates*

Size of aggregates		Weight of	Thickness	Weight of	Length	Weight of
		fraction	gauge size, mm	aggregates	gauge	aggregates
Passing	Retained					
through	on IS	consisting	mm	in each	size,	in each
IS Sieve, mm	Sieve, mm	of at least 200 pieces,	-	Fraction passing thickness gauge, mm	mm	Fraction retained on length gauge, mm
63	50	0	23.90	0	-	-
50	40	0	27.00	0	81.00	0
40	31.5	0	19.50	0	58.00	0
31.5	25	0	16.95	0	-	-
25	20	0	13.50	0	40.5	0
20	16	2000	10.80	550	32.4	220
16	12.5	850	8.55	69	25.5	175
12.5	10	500	6.75	150	20.2	98
10	6.3	110	4.89	22	14.7	0
TOTAL		3457	-	791	-	493

Table : Determination of Flakiness Index and Elongation Index of Conventional Coarse Aggregates *Recycled Concrete Aggregates*

Size of aggregates		Weight of	Thickness	Weight of	Length	Weight of
Passing	Retained	fraction	gauge	aggregates	gauge	Aggregates
through	on IS	consisting	size, mm	in each	size, mm	in each

IS Sieve, mm	Sieve, mm	of at least 200 pieces, g	-	Fraction passing thickness gauge, mm		fraction retained on length gauge, mm
1	2	3	4	5	6	7
63	50	0	23.90	0	-	-
50	40	0	27.00	0	81.00	0
40	31.5	0	19.50	0	58.00	0
31.5	25	0	16.95	0	-	-
25	20	0	13.50	0	40.5	0
20	16	1540	10.80	26	32.4	72
16	12.5	920	8.55	16	25.5	159
12.5	10	420	6075	11	20.22	85
10	6.3	400	4.89	0	14.7	113
TOTAL		W = 3280	-	X = 53	-	Y = 429

Table 4.10: Determination of Flakiness Index and Elongation Index of Recycled Concrete Aggregates

Results:		
	Conventional	Recycled Concrete
	Aggregates	Aggregates
<i>Flakiness Index = [(X1 + X2 +) / (W1 + W2 +)] × 100</i>	22.88%	1.62%
<i>Elongation Index = [(Y1 + Y2 + ...) / (W1 + W2 +)] × 100</i>	14.26%	13.10%

Discussions: Flaky and elongated particles should be avoided in pavement construction, particularly in surface course. If such particles are present in appreciable proportions, the strength of pavement layer would be adversely affected due to possibility of breaking under loads. Workability is reduced for cement concrete. As per IRC recommendations, the conventional aggregates tested proved to be within permissible limits for use in all types of pavements except for bituminous macadam and WBM base course and surface course ones. The recycled concrete aggregates are within limits for all types of pavements and may be used for anyone based on its flakiness index.

**Results for Flakiness Index and Elongation Index of
Conventional and Recycled Concrete Aggregates
Angularity Number**

Observations and Results :	Conventional	Recycled Concrete
	Aggregates	Aggregates
<i>W = Mean weight of aggregates in the cylinder, g</i>	4310 g	4225 g
<i>C = Weight of water required to fill the cylinder, g</i>	3000 g	3000 g
<i>G = Specific gravity of aggregate</i>	2.73	2.46
<i>Angularity number = 67-100 W/CG</i>	14	10

Discussion: From the values obtained above, it is found that the angularity number of conventional aggregates is higher than that of RCA. Thus, higher the angularity number, more angular and less workable is the aggregate mix. In cement concrete mix, rounded aggregates may be preferred because of better workability, lesser specific surface and higher strength for particular cement content. In addition, the more angular shape of the RCA and its rougher surface texture are also what contribute

AGGREGATE IMPACT TEST

Table : Determination of Aggregate Impact Value for Conventional and Recycled Concrete Aggregates

Results:	Conventional	Recycled Concrete
	Aggregates	Aggregates
<i>Original weight of aggregates, W1 g</i>	320 g	300 g
<i>Weight of fraction passing through 2.36mm IS sieve, W2 g</i>	100 g	100 g
<i>Aggregate Impact Value = (W2 / W1) × 100%</i>	31.30%	33.30%

Discussion: 10% → Exceptionally strong. 10–20% → Strong. 20–30% → Satisfactory for road surfacing. > 35% → Weak for road surfacing.

SPECIFIC GRAVITY OF A CEMENT

	Portland Cement (OPC)	Slag Cement (PSC)
<i>Weight of empty dry bottle, W1 g</i>	66.3 g	80.3 g
<i>Weight of empty bottle + water, W2 g</i>	176.9 g	178.8 g
<i>Weight of empty bottle + kerosene, W3 g</i>	153.4 g	157.6 g
<i>Weight of cement, W4 g</i>	57.6 g	49.3 g
<i>Weight of bottle + cement + kerosene, W5 g</i>	196.5 g	193.9 g
<i>Specific gravity of kerosene, 'g'</i>	0.79	0.79
<i>Specific gravity of cement, G = {W4 (W3-W1)} / {(W4+W3-W5)(W2-W1)}</i>	3.15	3.00

Discussion :

The specific gravity of Ordinary Portland Cement (OPC) varies from 3.1 to 3.15 and that of Portland Blast Furnace Slag Cement varies from 3.0 to 3.05.

STANDARD CONSISTENCY OF CEMENT

Observations and Results:	Ordinary Portland	Portland Slag
	Cement (OPC)	Cement (PSC)
Weight of cement taken (W1 g)	400 g	400 g
Quantity of water added to cement (W2 ml)	150 ml	116 ml
Depth of penetration (mm)	5 mm	8 mm
Normal Consistency = $(W2/W1) \times 100\%$	37.5 %	29.0 %
Table : Determination of Normal Consistency of Cement		

Discussion:

The basic aim is to find out the water content required to produce a cement paste of standard consistency as specified by the **IS: 4031 (Part 4) – 1988**. From the above results, normal consistency of OPC is more than that of PSC. It is seen that more water is required to produce a cement paste in OPC and hence OPC requires more water to be able to produce a reliable cement paste whereas with lesser amount of water in PSC, depth of penetration is more and thus, more workable is the paste.

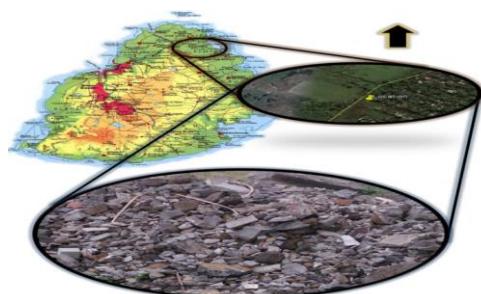
INITIAL AND FINAL SETTING TIME OF CEMENT

Results :	Ordinary Portland Cement	Portland Slag Cement
	(OPC)	(PSC)
Initial Setting Time	156 mins	160 mins
Final Setting Time	194 mins	215 mins

Discussion: From the above values, OPC takes lesser time than PSC to set. Hence, once the mixing is done, the concrete has to be used quickly compared to PSC which takes more time to set.

METHODOLOGY**SOURCES OF MATERIALS**

Different materials were obtained from different sources and the laboratory tests were performed. The recycled aggregates were obtained from a demolished house which was about 30 years old. The concrete used in Mauritius is usually M20 grade one. The slab, columns and beams of the demolished building were made of this grade of concrete and the walls were made of concrete hollow blocks.



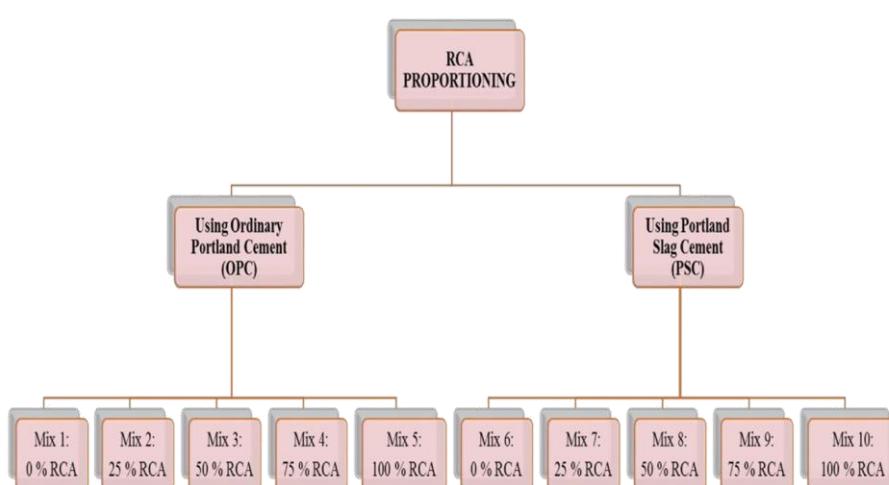
SCHEDULE OF WORK

The time plan prepared for casting of concrete and also for testing of the concrete cubes and cylinders after acquiring all the required materials is as shown below

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
17-Mar	18-Mar	19-Mar	3/27/2014 - 75%	3/28/2014 - 0%	22-Mar	23-Mar
3/24/2014	3/25/2014	3/26/2014 - 50%			3/29/2014	
4 - 100% RPC (OPC)	25% RCA 4/1/2014	RCA (OPC) 4/2/2014 - 50% RCA (PSC) +	RCA (OPC) 4/3/2014 - 25% RCA (PSC) +	RPC (OPC) 4/4/2014 - 75% RCA (PSC) +	RPC (OPC) 4/5/2014 - TEST 0% RCA	30-Mar 6-Apr
31-Mar	(PSC) + TEST 100% RCA	4/9/2014 - TEST OPC)	TEST 50%	TEST 75%	(PSC)	-
7-Apr	8-Apr	100% RCA (PSC)	TEST 50% RCA (PSC)	TEST 25% RCA (PSC)	TEST 75% RCA (PSC)	13-Apr
14-Apr	15-Apr	16-Apr	17-Apr	18-Apr	4/19/2014 TEST 0% OPC	20-Apr
21-Apr	4/22/2014 - TEST 100% RCA (OPC)	4/23/2014 - TEST 25% RCA (OPC)	4/24/2014 – TEST 50% RCA (OPC)	4/25/2014 – TEST 865 % RCA (OPC)	TEST 0% RCA (PSC)	27-Apr
28-Apr	29-Apr	4/30/2014 – TEST 100% RCA (PSC)	5/01/2014 – TEST 50% RCA (PSC)	5/02/2014 – TEST 25% RCA (PSC)	5/03/2014 – TEST 75% RCA (PSC)	4-May



- Casting of Concrete
- 7th Day Test on Cubes and Cylinders
- 28th Day Test on Cubes and Cylinders

Table 5.1: Work Schedule**MIX DESIGN AND CALCULATIONS**

For each mix specimen, the quantity of materials required for concrete mixing has been calculated and tabulated. The water/cement ratio is kept constant but however, the water content may vary for

the slag cement due to its property to improve workability. For each mix specimen, the following are to be cast for the basic tests:

- 6 cubes for compressive strength test
 - 3 at the age of 7 days
 - 3 at the age of 28 days
- 6 cylinders for compressive strength test
 - 3 at the age of 7 days
 - 3 at the age of 28 days
- 6 cylinders for split-tensile strength test
 - 3 at the age of 7 days
 - 3 at the age of 28 days

Quantity of Materials								
Type of Cement	Ratio	Mix Specimen	Cement (kg)	Water (L)	Fine Aggregates (kg)	Coarse Aggregates (kg)		W/C Ratio
						RCA	Conventional	
	Mix1	0% RCA	38.2	19.1	76.4	0	112.6	0.5
Ordinary	Mix 2	25% RCA	38.2	19.1	76.4	28.1	84.4	0.5
Portland	Mix 3	50% RCA	38.2	19.1	76.4	56.3	56.3	0.5
Cement (OPC)	Mix 4	75% RCA	38.2	19.1	76.4	84.4	28.1	0.5
Cement (OPC)	Mix 5	100% RCA	38.2	19.1	76.4	112.6	0	0.5
Portland	Mix 6	0% RCA	38.2	19.1	76.4	0	112.6	0.5
Slag	Mix 7	25% RCA	38.2	19.1	76.4	28.1	84.4	0.5
Cement (PSC)	Mix 8	50% RCA	38.2	19.1	76.4	56.3	56.3	0.5
Cement (PSC)	Mix 9	75% RCA	38.2	19.1	76.4	84.4	28.1	0.5
Total for 6 cubes and 12		OPC	191	95.5	382	281.4	281.4	
Cylinders		PSC	191	95.5	382	281.4	281.4	

Table : Determination of Slump Values of Concrete using OPC and PSC**Table : Quantity of Materials Required Slump Values for Concrete with Water Cement Ratio = 0.5**

	0 % RCA	25 % RCA	50 % RCA	75 % RCA	100 % RCA
Using OPC	100 mm	110 mm	115 mm	110 mm	110 mm
Using PSC	100 mm	100 mm	90 mm	115 mm	100 mm

Results: Compaction Factor for Concrete with Water Cement Ratio = 0.5 Using OPC

	0 %	25 %	50 %	75 %	100 %
	RCA	RCA	RCA	RCA	RCA
Weight of empty cylinder (W _g)	11,980	11,980	11,980	11,980	11,980
Weight of cylinder with partially compacted concrete (W _{1g})	23,180	23,320	23,420	23,160	23,200
Weight of cylinder with fully compacted concrete (W _{2g})	24,520	24,140	23,960	23,900	24,110
Compaction Factor = (W ₁ -W / W ₂ -W)	0.89	0.93	0.95	0.93	0.92

Discussion: The standard slump values for normal RCC work ranges from 80-150 mm. If the concrete mixture is too wet, it will have a greater slump and the coarse aggregates will settle at the bottom of concrete mass, i.e. it will collapse and as a result concrete becomes a non-uniform composition. If the concrete mixture is too dry, it will have a lesser slump value

Compaction Factor for Concrete with Water Cement Ratio= 0.5 Using PSC

	0 %	25 %	50 %	75 %	100 %
	RCA	RCA	RCA	RCA	RCA
Weight of empty cylinder (W _g)	11,980	11,980	11,980	11,980	11,980 g
Weight of cylinder with partially compacted concrete (W _{1g})	23,440	23,480	22,700	23,480	22,660 g
Weight of cylinder with fully compacted concrete (W _{2g})	24,700	24,460	24,260	24,160	23,780g
Compaction Factor = (W ₁ -W / W ₂ -W)	0.9	0.92	0.87	0.94	0.91

Discussion: Following is a table showing the standard limits for compaction factor of concrete:

Table : Standard Values for Compaction Factor

Degree of workability	Compacting factor	
	Small apparatus	Large apparatus
Very low	0.78	0.80
Low	0.85	0.87
Medium	0.92	0.935
High	0.95	0.96
Very high	-	-

Vee-Bee Degrees for Concrete with Water Cement Ratio = 0.5
Table : Determination of Vee-Bee Degrees for Concrete with Different Percentage of RCA using OPC and PSC

	0 %	25 %	50 %	75 %	100 %
	RCA	RCA	RCA	RCA	RCA
Using	9.3	7.1	6.8	7.2	7.0
OPC	VB-degrees	VB	degrees	VB	Degrees
Using	9.1	9.5	11.3	6.9	8.9
PSC	VB-degrees	VB-degrees	VB-degrees	VB-degrees	VB-degrees

Discussion:Following is a table showing the standard limits of Vee-Bee test on concrete:

Workability description	Vee-Bee time, in seconds
Extremely dry	32-18
Very stiff	18-10
Stiff	10-5
Stiff plastic	5-3
Plastic	3-0
Flowing	-

Table : Standard limits for Vee - Bee test on concrete

RESULTS AND DISCUSSIONS In this chapter, the results obtained by performing tests on hardened concrete are displayed and explained. These tests have been explained in detail in . Firstly, compressive strength tests were performed on concrete cubes and cylinders after 7 and 28 days of curing. Secondly, split tensile strength test was performed on concrete cylinders at 7 and 28 days of curing as well. The tests were done on concrete with RCA proportions using both Ordinary Portland Cement (OPC) and Portland Slag Cement (PSC).

COMPRESSIVE STRENGTH OF CONCRETE CYLINDERS (USING OPC)								
Trial Mix Designation	RCA Proportions	Compaction Factor	7 DAYS			28 DAYS		
			Ultimate Load / KN	Ultimate Strength / MPa	Average Strength / MPa	Ultimate Load / KN	Ultimate Strength / MPa	Average Strength / MPa
MIX 1	0%	0.89	575	32.5	33.3	695.4	39.4	40.9
			601.2	34.0		746.4	42.2	
			589.3	33.3		726.3	41.1	
MIX 2	25%	0.93	335	19.0	19.3	475.9	26.9	25.5
			339.2	19.2		450.6	25.5	
			350.6	19.8		425.3	24.1	
MIX 3	50%	0.95	349	19.7	19.7	475.3	26.9	27.8
			362.5	20.5		497.4	28.1	
			332.8	18.8		501.2	28.4	
MIX 4	75%	0.93	385.5	21.8	23.3	474.4	26.8	27.1
			401	22.7		486.7	27.5	
			448.5	25.4		475.6	26.9	
MIX 5	100%	0.92	485.6	27.5	27.9	537.1	30.4	29.3
			510.5	28.9		526.8	29.8	
			482.9	27.3		489.5	27.7	

SPLIT TENSILE STRENGTH OF CONCRETE CYLINDERS (USING OPC)								
Trial Mix Designation	RCA Proportions	Compaction Factor	7 DAYS			28 DAYS		
			Ultimate Load / KN	Ultimate Strength / MPa	Average Strength / MPa	Ultimate Load / KN	Ultimate Strength / MPa	Average Strength / MPa
MIX 1	0%	0.89	235.8	3.34	3.47	317	4.48	4.33
			254.8	3.60		316	4.47	
			245.3	3.47		285	4.03	
MIX 2	25%	0.93	169.6	2.40	2.41	227	3.21	3.44
			165.8	2.35		258.2	3.65	
			175.8	2.49		243.8	3.45	
MIX 3	50%	0.95	155.6	2.20	2.22	206	2.91	2.90
			149.8	2.12		215	3.04	
			165.3	2.34		193.7	2.74	
MIX 4	75%	0.93	135.9	1.92	2.04	201	2.84	2.82
			145.8	2.06		199.3	2.82	
			150.9	2.13		197.3	2.79	
MIX 5	100%	0.92	99.8	1.41	1.46	177.5	2.51	2.49
			105.6	1.49		175.8	2.49	
			104.2	1.47		174.1	2.46	

COMPRESSIVE STRENGTH OF CONCRETE CUBES (USING PSC)								
Trial Mix Designation	RCA Proportions	Compaction Factor	7 DAYS			28 DAYS		
			Ultimate Load / KN	Ultimate Strength / MPa	Average Strength / MPa	Ultimate Load / KN	Ultimate Strength / MPa	Average Strength / MPa
MIX 6	0%	0.9	801	35.6	34.5	1050	46.7	46.1
			749	33.3		1150	51.1	
			778.9	34.6		911.9	40.5	
MIX 7	25%	0.92	691	30.7	31.0	918.4	40.8	37.9
			700	31.1		850	37.8	
			703	31.2		790	35.1	
MIX 8	50%	0.87	598	26.6	26.7	650	28.9	29.2
			603	26.8		646	28.7	
			601.4	26.7		675	30.0	
MIX 9	75%	0.94	563	25.0	25.2	674.9	30.0	27.4
			572	25.4		575	25.6	
			566	25.2		600	26.7	
MIX 10	100%	0.91	703	31.2	31.1	757.9	33.7	37.3
			697	31.0		850	37.8	
			699.4	31.1		910	40.4	

COMPRESSIVE STRENGTH OF CONCRETE CYLINDERS (USING PSC)								
Trial Mix Designation	RCA Proportions	Compaction Factor	7 DAYS			28 DAYS		
			Ultimate Load / KN	Ultimate Strength / MPa	Average Strength / MPa	Ultimate Load / KN	Ultimate Strength / MPa	Average Strength / MPa
MIX 6	0%	0.9	493.5	27.9	28.5	582.9	33.0	35.6
			515.3	29.2		639.3	36.2	
			502	28.4		665.1	37.6	
MIX 7	25%	0.92	375.6	21.3	21.7	515.1	29.1	28.3
			386	21.8		495.8	28.1	
			388.9	22.0		489.4	27.7	
MIX 8	50%	0.87	352	19.9	20.5	468.3	26.5	25.8
			368.5	20.9		465.6	26.3	
			366.4	20.7		433.8	24.5	
MIX 9	75%	0.94	403	22.8	22.2	468.6	26.5	26.7
			375.8	21.3		481.8	27.3	
			398.1	22.5		465	26.3	
MIX 10	100%	0.91	345.6	19.6	19.9	441.4	25.0	24.8
			354.5	20.1		448.3	25.4	
			355	20.1		425.2	24.1	

Trial Mix Designation	RCA Proportions	Compaction Factor	SPLIT TENSILE STRENGTH OF CONCRETE CYLINDERS (USING PSC) (ASTM C 39)					
			7 DAYS			28 DAYS		
			Ultimate Load / KN	Ultimate Strength / MPa	Average Strength / MPa	Ultimate Load / KN	Ultimate Strength / MPa	Average Strength / MPa
MIX 6	0%	0.9	175.6	2.48	2.68	240.2	3.40	3.56
			189.4	2.68		253.2	3.58	
			203.2	2.87		261.4	3.70	
MIX 7	25%	0.92	186.8	2.64	2.68	245	3.47	3.52
			190.8	2.70		248.8	3.52	
			190.6	2.70		252.6	3.57	
MIX 8	50%	0.87	159.7	2.26	2.30	201.2	2.85	2.98
			176.8	2.50		215.2	3.04	
			151.3	2.14		215.4	3.05	
MIX 9	75%	0.94	143.8	2.03	2.07	175	2.48	2.63
			150.6	2.13		185.9	2.63	
			144.5	2.04		196.8	2.78	
MIX 10	100%	0.91	146.8	2.08	2.03	180	2.55	2.59
			141.6	2.00		189.5	2.68	
			142.1	2.01		179.8	2.54	

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Performance Evaluation of Vedic Multiplier Using 180nm Technology and FinFET Technology

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Abstract: This paper deals with the Performance evaluation of vedic multiplier using 180nm technology and FinFET technology. In arithmetic operations multiplication is the fundamental function. The fast and low power multipliers required in DSP applications and small size wireless sensor networks. Multiplier is the basic functional block of microprocessor because multiplication is need to performed repeatedly in most of the scientific calculations. To improve the execution speed of the multiplier ancient vedic mathematics can be used. The proposed vedic multiplier operates at high speed and low power dissipation. The vedic multiplier in this paper followed Urdhva Tiryakbhyam sutra which is one of the sutra in vedic mathematics. It can be observe that the proposed paper consists of two bit, four bit and eight bit vedic multiplier architectures. The existing vedic multipliers designed using 180nm technology in Cadence Virtuoso. The circuits in this paper were verified and simulated in Cadence virtuoso tool with 20nm FinFET technology and compared with 180nm technology. The proposed design exhibited better power and delay compared with existing multipliers. It consumes less power than existed multipliers and it is fast because of less number of steps in multiplication process of Urdhva Tiryakbhyam.

Keyword- Adders, Cadence virtuso tool, GDI logic, PTL logic, Urdhva Tiryakbhyam, Vedic multiplier. .

1. INTRODUCTION

Vedic mathematics is the ancient process of problem solving. Vedic mathematics was introduced by Jagadguru Swami Sri Bharathi Krishna Trithaji Maharaja who is a scholar in mathematics. He introduced some sutras and sub sutras. In this proposed design Urdhva Tiryakbhyam sutra was used. By using this Vedic mathematics, we can solve the problem so easy and fast compared with the existed methods. It can be used in conventional mathematics and it is very easy to understand. By comparing with the existed multipliers Vedic multiplier is fast [1] and easy to understand. Currently, research has been made on devices to work with less power [2]dissipation. Design of low power dissipation circuits can be done in two ways, either by using less number of transistors or by using the advanced [3] technologies. For 8- bit Vedic multiplier design, needs three blocks. Those are partial product row, carry save adder block and carry propagate adder block. The multiplier cell designed using AND gate, half adder and Full adder . The proposed 2 transistor AND gate designed using GDI(Gate Diffusion Input) logic which is used for partial product row, In this work the adders used in the multiplier are GDI logic based 5T half adders and PTL(Pass Transistor Logic) based 6T full adders.

AND GATE:

To design Vedic multiplier 2T AND gates was used. This 2T AND gate [1] designed on the basis of GDI logic. GDI means gate diffusion input. This helps in low power construction of AND gate. To generate the partial product in the first row of carry save arrangement these 2T AND was used. It provides least delay while partial product generation. It has inputs a,b and output y. The 2T AND structure using GDI logic is shown in Fig.1.

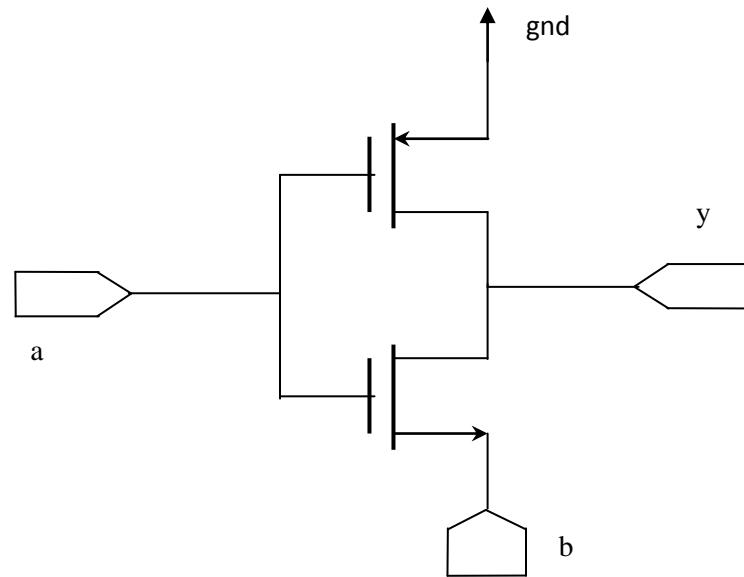


Fig. 1 Two transistor AND gate

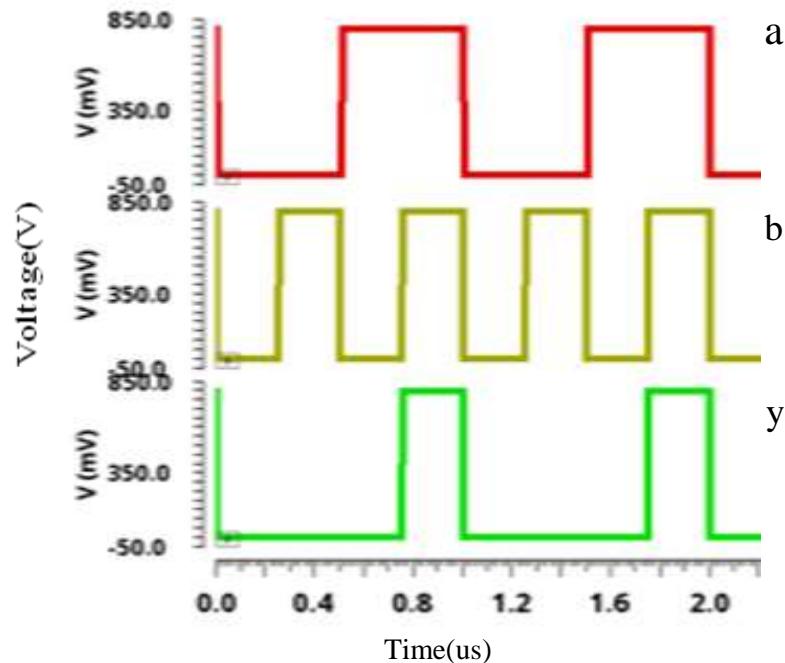


Fig. 2. Output Waveform of AND gate

HALF ADDER:

The half adder was designed [3] with 5 transistors. In the proposed 5T half adder AND gate using GDI logic and 3T XOR gate structure was used. For the carry generation of half adder 2T AND gate and for the sum generation 3T XOR was used. It helps to get high speed. It has inputs a,b and outputs s,ca. The Half Adder structure and output waveforms are shown in Fig.3 and Fig.4 respectively.

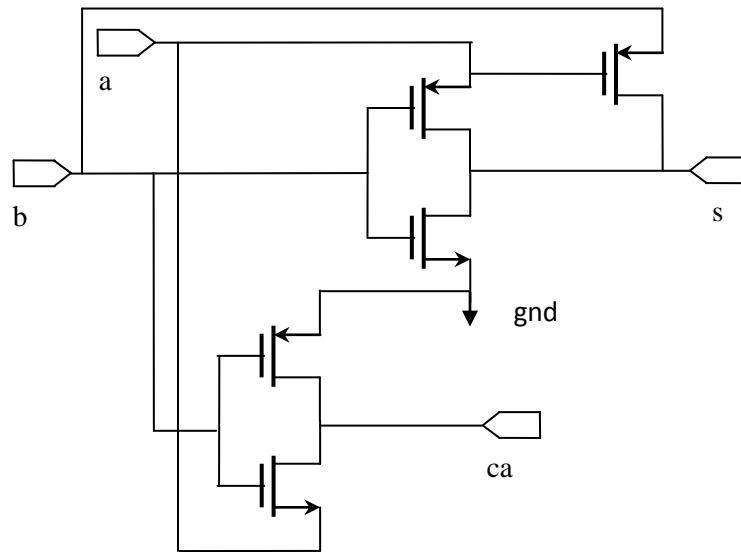


Fig .3. 5Transistor Half Adder

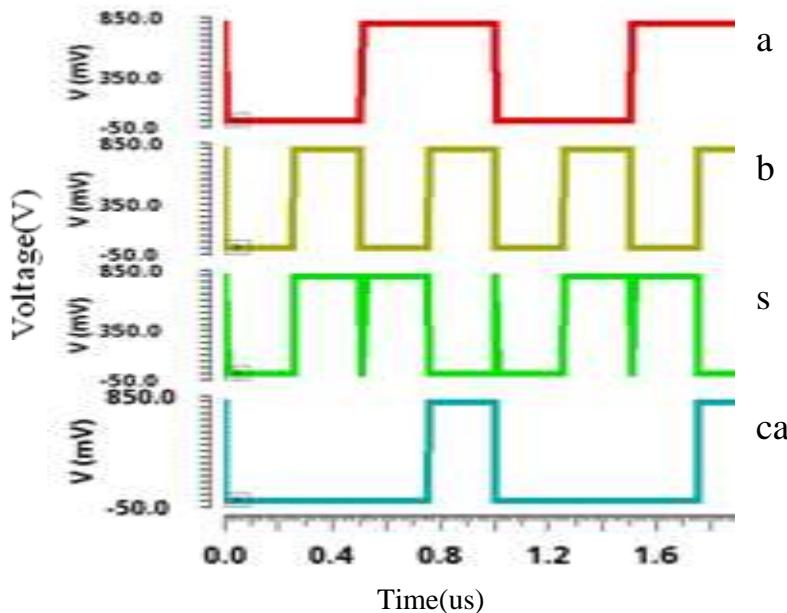


Fig. 4. Output Waveform of Half adder

FULL ADDER:

The multiplication time and power dissipation of a multiplier mostly depends on propagation delay and the power dissipation of full adder used in the multiplier. To get the less delay and power 6T full adder designed with PTL(Pass Transistor Logic) logic. Adder circuit mainly used to add up the partial products generated by the chain of AND gates. By using GDI and PTL logic the number of transistors used in this 8 bit Vedic multiplier was reduced. It helps to reduce the power dissipation. The 6T full adder has sum and carry as the outputs. The sum is made with XOR module twice with 2 transistors, PMOS and NMOS for the carry. The sum is generated by the XOR operation among 3 inputs (a XOR b XOR C). Carry is generated using $((a.b) + (b.c) + (c.a))$. It has inputs a,b,c and outputs s,ca. The Full Adder structure and output waveforms are shown in Fig.5 and Fig.6 respectively.

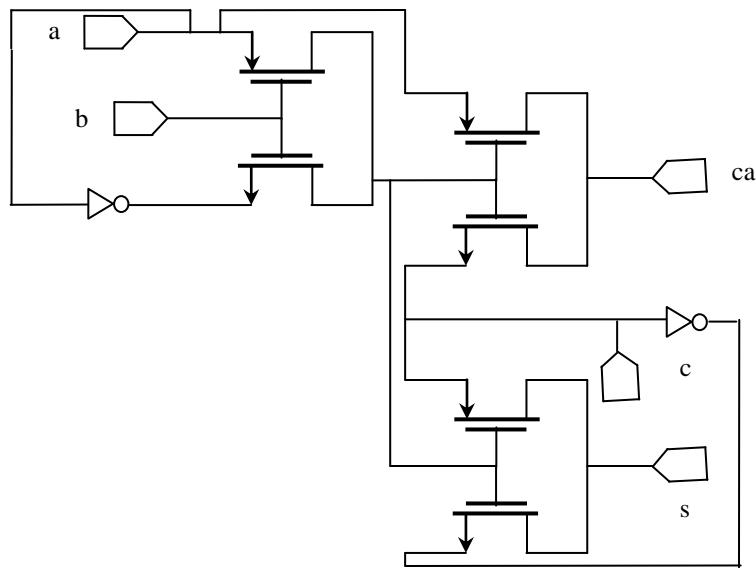


Fig. 5. 6Transistor Full Adder

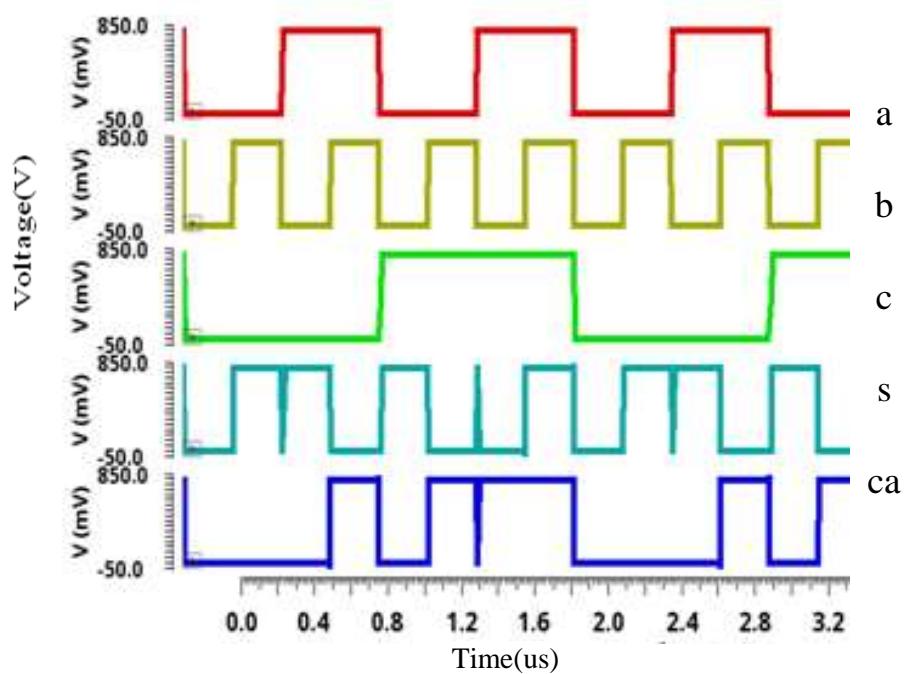


Fig. 6. Output Waveform of Full Adder

2 BIT VEDIC MULTIPLIER:

The proposed Vedic multiplier based on UT sutra designed using AND gates and two half adders. In 2- bit Vedic multiplication we have inputs as a_0 , a_1 , b_0 and b_1 and outputs as p_0 , p_1 , p_2 and p_3 . The 2- Bit Vedic multiplier structure and waveforms are shown in Fig.7 and Fig.8 respectively.

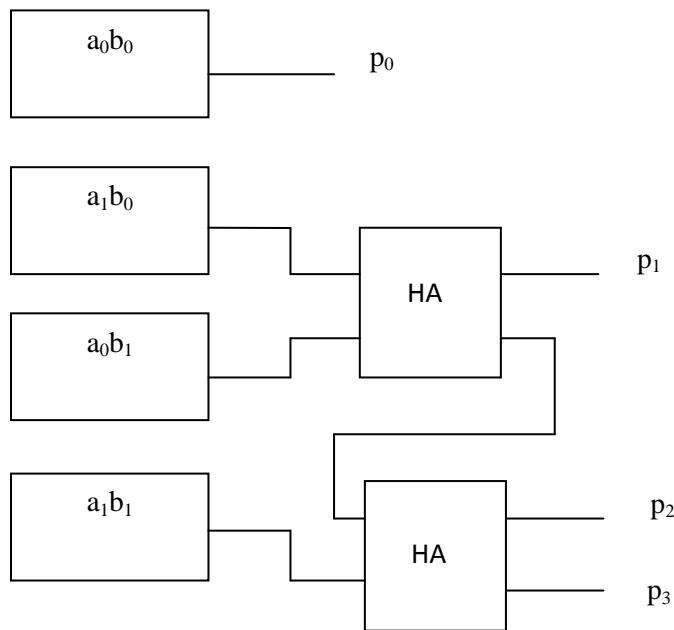


Fig. 7. 2 Bit Vedic multiplier

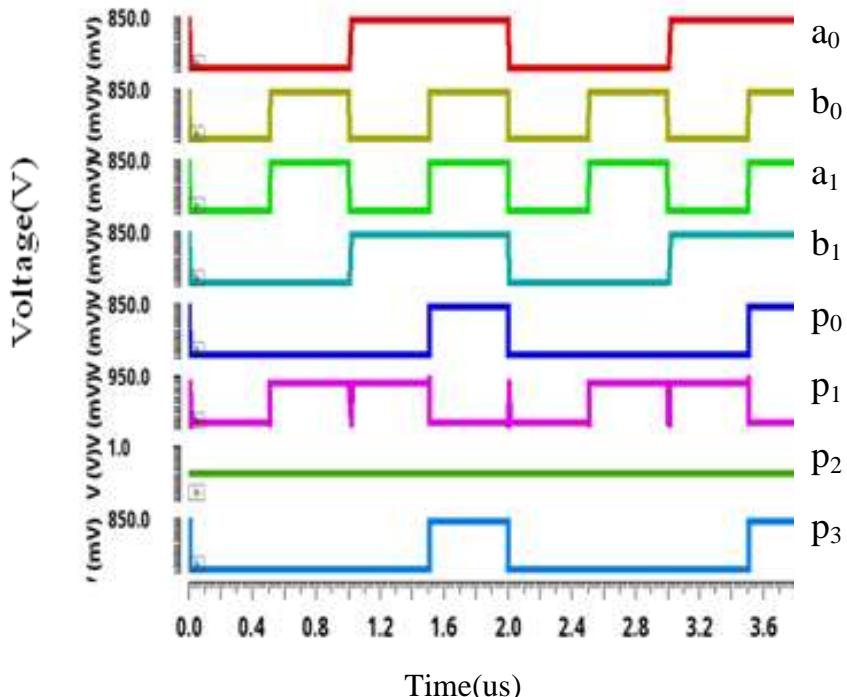


Fig. 8. Output waveform of 2 Bit Vedic Multiplier

4-BIT VEDIC MULTIPLIER:

The proposed 4-bit Vedic multiplier designed using 4 two bit Vedic multipliers[5], two 4 bit ripple carry adder. Chain of full adders used for carry save adder block. In 4-bit Vedic multiplication inputs as $a[0-3]$, $b[0-3]$ and outputs as $p[0-7]$. The carry out is linked as carry in to another adder in carry save arrangement, using half adders and full adders. Due to less number of transistors and good carry propagation arrangement, it has less power dissipation. The 4-Bit Vedic multiplier structure and waveforms are shown in Fig.9 and Fig.10 respectively.

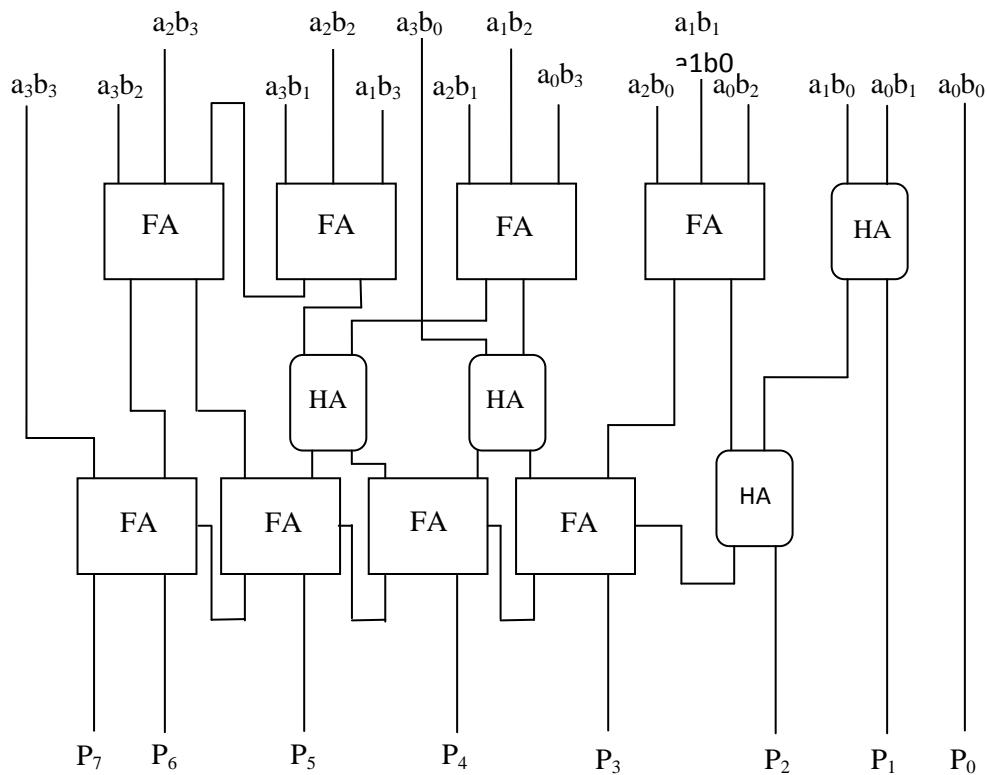


Fig. 9. 4 Bit Vedic Multiplier

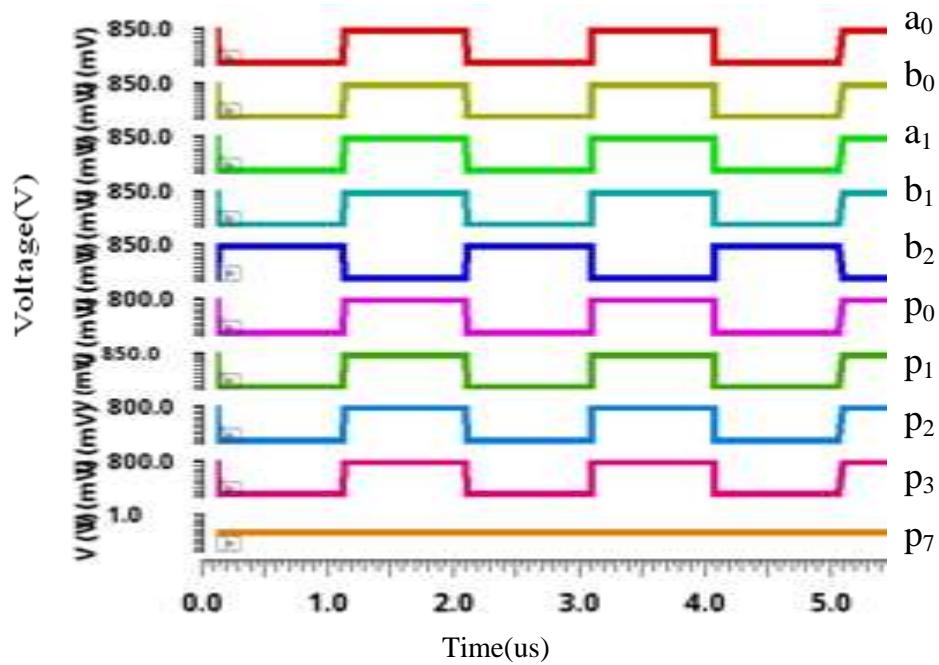


Fig. 10. Output Waveform of 4 Bit Vedic Multiplier

8-BIT VEDIC MULTIPLIER:

The proposed 8-bit vedic multiplier designed using four 4 bit multiplier blocks , carry save adder block and a ripple carry adder block. It has inputs as $a[0-7]$ and $b[0-7]$. The two 8-bit input sets multiplied by UT sutra and generate

outputs as p[0-15]. To get, the less delay it has a carry save arrangement. The adders and AND gate used for this multiplier design followed by GDI and PTL logic. Due to these logics it has less number of transistors and it has less power expenditure and delay [7] compared with existing multipliers. The 8-bit multiplier architectures and output waveforms are shown in Fig .11 and Fig. 12 respectively.

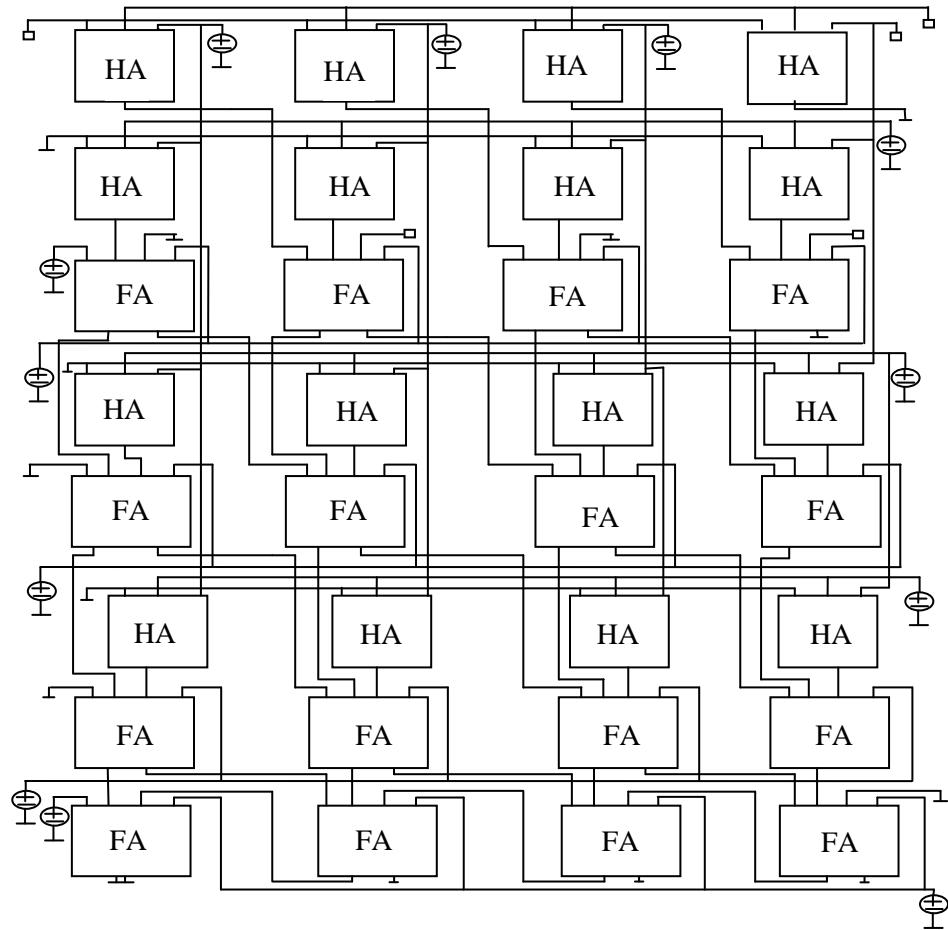


Fig 11.8 Bit Vedic Multiplier

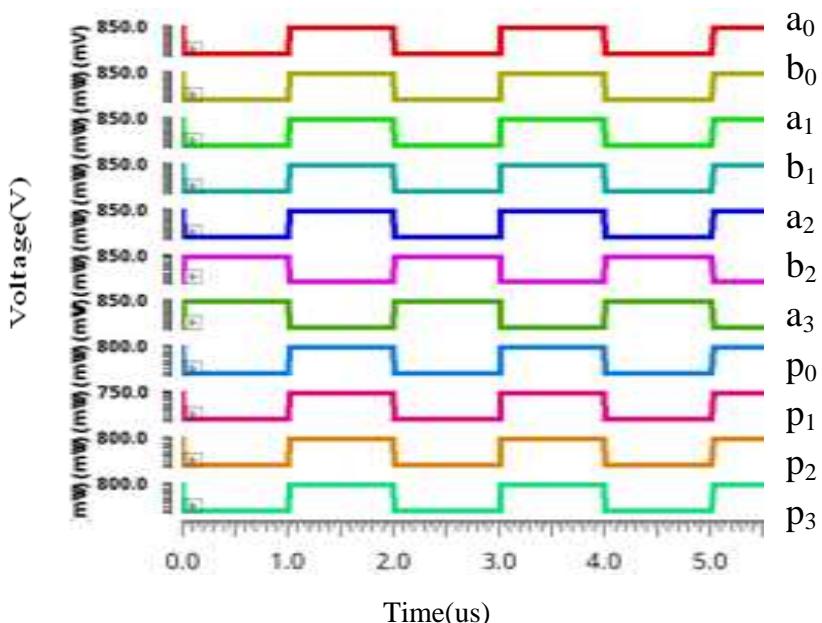


Fig. 12. Output Waveform of 8 Bit Vedic Multiplier

Performance Comparision:

The delay and Power analysis of proposed vedic multiplier and existed vedic multiplier using 180nm technology and FinFET are shown in Table.1 and Table.2 at various stages of input voltage. The proposed vedic multiplier using FinFET technology gives better power and delay compared with existing multiplier.

2-Bit Vedic multiplier using 180nm technology has higher delay of 54.4% and higher power dissipation of 38.6% compared to FinFET based 2-Bit Vedic multiplier at supply voltage of 0.6V. 4-Bit Vedic multiplier using 180nm technology has higher delay of 31.2% and higher power dissipation of 33% compared to FinFET based 4-Bit Vedic multiplier at supply voltage of 0.6V. 8-Bit Vedic multiplier using 180nm technology has higher delay of 20% and higher power dissipation of 17.9% compared to FinFET based 8-Bit Vedic multiplier at supply voltage of 0.6V.

2-Bit Vedic multiplier using 180nm technology has higher delay of 30% and higher power dissipation of 41.8% compared to FinFET based 2-Bit Vedic multiplier at supply voltage of 0.8V. 4-Bit Vedic multiplier using 180nm technology has higher delay of 23.2% and higher power dissipation of 27.6% compared to FinFET based 4-Bit Vedic multiplier at supply voltage of 0.8V. 8-Bit Vedic multiplier using 180nm technology has higher delay of 10% and higher power dissipation of 10% compared to FinFET based 8-Bit Vedic multiplier at supply voltage of 0.8V.

2-Bit Vedic multiplier using 180nm technology has higher delay of 44% and higher power dissipation of 52.9% compared to FinFET based 2-Bit Vedic multiplier at supply voltage of 1.0V. 4-Bit Vedic multiplier using 180nm technology has higher delay of 26.5% and higher power dissipation of 28% compared to FinFET based 4-Bit Vedic multiplier at supply voltage of 1.0V. 8-Bit Vedic multiplier using 180nm technology has higher delay of 5% and higher power dissipation of 13.4% compared to FinFET based 8-Bit Vedic multiplier at supply voltage of 1.0V.

voltage (V)	2 bit vedic multiplier			4 bit vedic multiplier			8 bit vedic multiplier		
	Delay (μs)	Avg power (μW)	PDP (pJ)	Delay (μs)	Avg power (μW)	PDP (pJ)	Delay (μs)	Avg power (μW)	PDP (pJ)
1.8	1.921	2.29	4.40	50.9	4.938	251.3	76.7	9.32	714.8
1.5	1.846	2.01	3.69	56.89	4.25	241.8	63.43	7.55	478.9
1.2	1.567	1.89	2.96	51.59	3.901	201.2	53.86	6.765	364.3
1.0	1.71	1.72	2.94	50.08	3.71	185.8	54.9	6.65	365
0.9	1.52	1.54	2.34	51.1	3.65	186.5	55.71	6.49	361.5
0.8	1.602	1.203	1.92	46.28	3.51	162.4	55.66	6.014	334.6
0.7	1.5	1.15	1.72	46.1	3.32	153	54.8	5.91	323.8
0.6	1.85	1.01	1.85	45.39	3.195	145	56.58	5.8	328.1

Table.1. SIMULATION RESULTS FOR VEDIC MULTIPLIER IN 180nm TECHNOLOGY

voltage (V)	2 bit vedic multiplier			4 bit vedic multiplier			8 bit vedic multiplier		
	Delay (μs)	Avg power (μW)	PDP (pJ)	Delay (μs)	Avg power (μW)	PDP (pJ)	Delay (μs)	Avg power (μW)	PDP (pJ)
1.0	0.95	0.81	0.76	36.8	2.65	97.5	53.15	5.76	306.1
0.9	0.98	0.78	0.76	34.6	2.6	89.9	51.98	5.51	286.4
0.8	1.12	0.7	0.78	35.5	2.54	90.2	50.5	5.42	273.7
0.7	1.45	0.65	0.94	32.9	2.47	81.3	50.1	5.01	251
0.6	1.3	0.62	0.8	31.2	2.14	66.8	49.8	4.76	237
0.5	1.09	0.59	0.64	29.9	2.09	62.5	48.6	4.5	218.7
0.4	1.43	0.5	0.71	30.7	2.01	61.7	49.1	4.12	202.9
0.3	1.05	0.46	0.48	31.1	1.9	59	49.9	3.95	197.1
0.2	1.1	0.42	0.46	27.8	1.83	50.9	48.5	3.68	178.5

Table.2. SIMULATION RESULTS FOR VEDIC MULTIPLIER IN FinFET TECHNOLOGY

CONCLUSION

In signal processing systems multiplier is the fundamental and essential building block. The proposed 8- bit Vedic multiplier using Fin FET technology yields very less power dissipation and delay compared with existing multiplier structures. It has been proved that the proposed design can have better performance than conventional multipliers. As, It has best result only because of technologies used in this structure. Those are GDI logic, PTL and FinFET technology. By using FinFET technology can have low size for the transistors. By using PTL and GDI logic can have less number of transistors. Therefore, it has less power dissipation and delay as the best result. The proposed circuits can exhibit complex and high performance in VLSI design and fast at very low voltage.

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Proactive model based testing and evaluation for component-based systems for biomedical Applications

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Abstract

Embedded software systems are getting more and more complex. The demand for new features and functions led to an increasing complexity in the design and development of these systems. There are frequent reports in the media about software systems crashing and damages occurring due to software errors. One reason for this is that there are many software testing methods and techniques but they are often non-practical and difficult to use. The aim of the study was to improve existing testing methods and their practicality especially from the integrator viewpoint. Component-based system development, components of different granularities must be tested. Furthermore, an optimization approach based on simulated annealing is presented which is used to derive an integration order with respect to the proposed parameters in a powerful and reliable manner. The paper discusses explicit properties and the requirements that are to be verified, imposed upon software-intensive systems by their environment and by their users.

Keywords: *Embedded systems, component based systems.*

1. Introduction

The aim of the study was to improve existing testing methods and their practicality especially from the integrator viewpoint. The objective was to improve interoperability between applications, and familiarize software companies and their customers with conformance testing. The integration of software components is an important aspect of embedded system development. Component-based technology has been extensively used for many years to develop software systems in desktop environments, office applications, and web-based distributed application. The advantages are achieved by facilitating the reuse of components and their architecture, raising the level of abstraction for software construction, and sharing standardized services. The use of components has partly shifted the designers' attention from algorithms to the interaction of algorithms (and their collections). This is because any component may comprise more than one algorithm, whereas precise description of algorithms used in a component and component's inner structure are very seldom known to the designer.

2. Software quality

We mean by a software developer a software organization that develops software for the use of end users. An integrator acquires software parts from the developers and also develops own components. The integrator integrates components into a system and tests it as a whole before delivering it to a customer. A software customer buys software from developers or integrators and carries out acceptance tests. A software integration strategy is needed to provide software testers a guideline to perform software integration testing activities in a rational way. It usually describes an order in which components are integrated and tested. The search for efficient information representation and encapsulation methods that would lead to natural software structuring, has been a driving force for software engineering. The evolution of information encapsulation methods started from modular programming, followed by object-oriented programming and design, and eventually reached the era of component-based software. A component is usually, but not necessarily always, a collection of objects that has limited autonomy, i.e. a component can exist, and to certain extent operate in a stand-alone mode. For its full-scale operation a component usually requires a specific supporting infrastructure.

3. Oriental software engineering

The object-oriented approach has different characteristics when compared with procedural programs, such as inheritance, polymorphism, message passing, state-based behavior, encapsulation, and information hiding. Furthermore, the execution order of the methods is not necessarily predefined, and the structure of the object-oriented programs is different from that of procedural programs. The advantages of a component-based approach are the possibility to master development and deployment complexity, modularity, decreased time to market, the quality and reusability of software and its components, the composed services of components, and the scalability and adaptability of software systems. Furthermore, software suppliers can specialize in their strategic competitive edge and buy other properties as ready-made COTS (commercial-off-the-shelf) components. Among many other challenges in component-based software development, components must be put together to form the entire software system. Therefore components must be integrated which can be illustrated as a mechanical process of wiring components together. In software integration is defined as the process of combining software components, hardware components, or both into an overall system. To interact with each other, the interfaces of components are connected by dependencies. If a component C2 uses one or more service(s) of another component C1, the formulation C2 "depends" on C1 is used. The testing of these dependencies, called integration testing, insures the consistency of component interfaces and whether the components pass data and control correctly, which results in successful integration of dependent components. In other words, integration testing ensures the correct interaction between already tested components. Software integration and integration testing are often used synonymous and are not distinguishable in literature.

4. Concepts of computing models

Ubiquitous (and pervasive) computing is based on the expansion of the principles applied in real-time systems and plug-and-play experiments. Computationally new concepts have emerged from the domain of ubiquitous computing in relation with autonomic computing. Considering the time issue, each autonomous component may have its own time counting system and each of those time counting systems may apply its own metrics. Strictly speaking, the time instants and intervals defined in different time counting systems (time models) can only be compared within known uncertainty limits. Hence, one time dimension for the whole computing system – that so far has been the conventional approach in computer science and software engineering – cannot solve the time awareness problem. A component-based system is not monolithic: it contains components of different granularities (e.g. lowest level components, business components, and component based systems), which are integrated with other components and into legacy systems with interfaces. In such situations, testing and documentation are even more important than in conventional software projects with monolithic applications. When moving from legacy systems to component-based systems, interfaces and interface testing are needed. The components do not have to know each other's implementation, only the content of the interfaces, i.e. syntax, semantics, and instructions for using the interface.

5. Taxonomy of computations

For systematic progress in developing the time-aware interaction-centered model it would be desirable to categorise the variety of models of computation according to their characteristic features. The earlier used dimensions of the feature spaces applied for taxonomy could not explicitly emphasise the specific properties of context-aware, proactive computing systems. Therefore we suggest the following three dimensional approximation of the feature space–action, interaction, and time-awareness. Further we demonstrate that this feature space clearly distinguishes the conventional models of computation based on the Church-Turing algorithm theory, models of interactive computation, and models for context-aware, interactive computing. Taxonomy in Figure 3 fixes relative positions of conventional models for algorithmic computing, models for interactive computing, and models for time-aware interactive computing. On such a generic level the taxonomy is of little practical use, but if the same taxonomy be used to position more specific products–e.g. Persistent Turing Machines, Abstract State Machines, π -calculus, the Q-model– some useful hints might be extracted for guiding the further research into models for time-aware, proactive, interactive computing. The suggested feature space stems from the expected properties and requirements of the rapidly spreading new classes of computer applications–such as ubiquitous computing that includes autonomic and proactive components, computing systems with dynamic ad hoc architecture, multi-agent systems, time- and location aware computing systems etc.

6. Software integration

In order to evaluate the proposed parameters, two reference systems are introduced. These real-life examples are taken from the automotive industry. The first one represents an embedded data logger for battery management and consists of 16 components and 23 dependencies. The most common used criteria for evaluating an integration order is called test effort and describes the effort for creating stubs needed during integration testing. There are several approaches presented in literature to compute the test effort. Code-based testing techniques (or white-box testing techniques) study the source code and describe the code coverage: for example, whether all the statements/branches of the program are executed at least once. They do not tell whether the program is doing what the requirement specification says it is supposed to do. Code-based testing uses either control-flow criteria or data-flow criteria for test case generation. Control-flow-based testing techniques select test cases on the basis of the program's control flow. Examples of control-flow-based testing techniques are sentence coverage, branch coverage, condition coverage, and path coverage. Dataflow-based testing techniques explore the events related to the status of data objects (variables) during the program's execution. The essential events are the assignments of value and the uses of value, i.e. where the variables are defined and where they are used. Examples of data-flow testing techniques are all-definitions, all-c-uses, all-puses, and all-du-paths (c means computation, p predicate, and du definition-use pair). However, these techniques are quite theoretical and complex to use in practice. Furthermore, the customer and the integrator cannot usually use any of the code-based testing techniques because the source code is not necessarily available and even if it were there would be an enormous amount of code lines to go through. A component-based system is not monolithic: it contains components of different granularities (e.g. lowest level components, business components, and component based systems), which are integrated with other components and into legacy systems with interfaces. In such situations, testing and documentation are even more important than in conventional software projects with monolithic applications.

7. Simulated annealing

Parameters and the corresponding metrics help system integrators to evaluate a certain integration order; they will not provide an order which meets the corresponding requirements. To overcome this restriction, a novel approach for deriving an integration order is presented. The approach described in the following section optimizes an integration order with respect to a single parameter as well as combinations of them. Since deriving an integration order is a NP-hard problem, a heuristic optimization approach based on simulated annealing (SA) was used. The method of simulated annealing is a suitable solution for large scale optimization problems. When adapted efficiently to optimization problems, simulated annealing is often characterized by fast convergence and ease of implementation for real-world problems. Simulated annealing is based on the analogy between finding a global minimum of a cost function for a combinatorial optimization problem and the slow cooling down of metal to its minimum energy state. The configuration represents a solution, including the initial solution, of the problem. The components are numbered $i=0\dots C-1$, where C represents the number of components of the software system. The configuration spaces denotes all possible permutations of C. Therefore a configuration is a permutation of the number $0\dots C-1$, interpreted as the order in which components are integrated. The initial solution is selected randomly. Rearrangement describes the mechanism for neighbor generation. An essential requirement for simulated annealing is that the rearrangement mechanism provides a move from the initial state to the optimal state in a sufficiently small number of steps. Based on the configuration definition, a rearrangement function that swaps two arbitrary components can get from any state (integration order) to any other state in $(C - 1)$ steps.

The results indicate that the proposed approach provides at least comparable results in comparison to the graph-based solutions in case of specific stubs. In case of realistic stubs, which denote the number of components to be stubbed, the simulated annealing approach obtains significantly better results on both reference systems.

8. Work model

Although a great deal of research has addressed the overall process of component-based software engineering (CBSE) on requirements engineering, design and evaluations, we do not have as much research on testing CBSE. Testing CBS is a challenging area of research. Existing knowledge in this field shows that CBSE introduces new problems for testing and maintaining software systems and we need new ways to validate software components, especially when they are integrated into new environments. There are a number of component-based testing methods and techniques which have different paradigms, characteristics and perspectives. The technique makes use of complete information from components for which source code is available and partial information from those for which source code is not available. Their approach separated

the testing of the component-provider from the testing of the component-user, so it presented two different techniques for each category. It models the behavior of each component, specifies component interactions, and annotates the state machines with test requirements to construct a global behavioral model of the composed state charts. Then, test cases are automatically derived from the annotated state charts and global behavioral model, and executed to verify component conformance behavior. Their results show that, in most cases, state-based testing techniques are not likely to be sufficient by themselves to detect most of the faults present in the code, and they need to be complemented with other testing methods. The above approaches use only one kind of behavioral UML model for test generation, either sequence diagrams or state machines. The approach in this dissertation is novel in that it combines the information from component level UML sequence diagrams and state charts to derive a graph-based test model for the purposes of test input generation. They presented a test model that depicts a generic infrastructure of component based systems and identified key test elements. A Component Interaction Graph is generated from the implementation, in which the interactions and the dependence relationships among components are illustrated. Test adequacy criteria were developed to cover context dependence relationship and content dependence relationship. While Wu's test elements and test criteria are useful to test component-based software, their work is in the stage of approach development. This paper does not discuss and give 20 practical ways on how to use their approach to generate actual test cases for component based testing. Their test model mainly illustrates the context/content-dependence relationships defined in the paper. Additional work is required to effectively drive test generation from the test model. In addition, the authors made several assumptions in their work, including: (i) assuming that each individual component has been adequately tested by the component providers when testing component-based software; (ii) assuming that each interface only includes one operation, and the references to the interfaces and to the operation are identical. These assumptions imply that their work considers only some simplified situations, which could have limitations in applying their approach to actual component-based testing practice. From the above survey, we note that different kinds of UML diagrams have been used for software testing from different perspectives. UML state charts have been widely used to test the state-based behavior of software. Similarly, UML interaction diagrams have been used for integration testing. However, existing approaches do not focus on exercising the composition behavior of interacting components. More specifically, none of the above papers discuss testing by integrating UML interaction and state chart diagrams to uncover component interaction faults. The goal is to check whether an extracted model satisfies a certain specification. My test method, in contrast, defines input data to the object program and observes the reactions of the program. The goal of my testing is to find cases where the software reactions do not meet its expected results. There has also been research on component-based software engineering for embedded systems such as [26], which focused on embedded software. There has been work on using informal specifications to test embedded systems focusing on the application layer. A common communication protocol provides support for implementing reusable test components. Especially in the case of embedded systems, a good host test environment enables efficient software testing. When this environment matches the target system as much as possible, efficient host testing is possible. One way to support testing is to use an operating system that is supported on both the target hardware and in a host-testing environment, as simulated on a desktop. Including support for test automation as a first-class feature allows more effective analysis of the system, including analysis of long running tests and deployed systems, and enables efficient field-testing. Effectively implementing this requires possibilities for dynamic configuration of test functionality during execution. Abstracting test cases from the implementation minimizes the effects of internal system changes to the 24 test cases. This mostly applies at the system testing level, as in earlier testing phases it is often necessary to observe more detailed properties of the system.

9. Results

The described testing procedure has been conducted for all software components of the Safety Platform that have inputs controllable and outputs observable from within the application program. Special and hardware dependent components, e.g. drivers for digital inputs and outputs, have been either manually tested or the testing has been performed indirectly through test cases of the respective hardware unit.

Table 1: Component Testing

Component	Variant	Defect	Analysis	Solution
CHKINC	CHKINC	Incorrect LDIFF for constant INPUT (255 instead of -1).	LDIFF is auxiliary output, not used in applications.	Simulink component modified.
Copy	COPY	Defines logical output instead of arithmetical.	Error in graphical library.	Corrected.
CRCCALC	all	ENABLE input not functional.	Input not used.	Simulink component modified.
GENINC	GENINC	CV output is never active.	A bug in element, but CV output is not used.	Simulink component modified.
Summation	DIFF	Negative overflow to -32767 instead to -32768.	A bug in element implementation.	Corrected.

In practice, mostly “hill climbing” methods are used, as advanced algorithms can be hard to implement due to computing requirements, while other types do not operate with adequate precision for modern systems, [136]. Tested algorithm is a “hill climbing” variation known as Incremental Conductance algorithm, [137]. The algorithm is based on assessment of the slope of powervoltage curve of the photovoltaic panel.

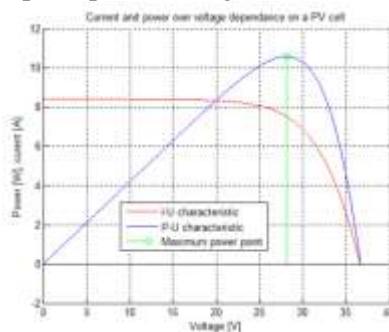


Figure 1: Model response

Execution time of the MPPT algorithm has been measured during open-loop real-time testing and is plotted against algorithm’s output. Execution time jumps to 408 CPU cycles at start of execution, oscillates between 395 and 404 cycles during transient, rises to 406 cycles at end of transient and finally stabilizes on 395 cycles in steady state. This kind of measurement can be a starting point for in-depth analysis of SUT real-time behaviour.

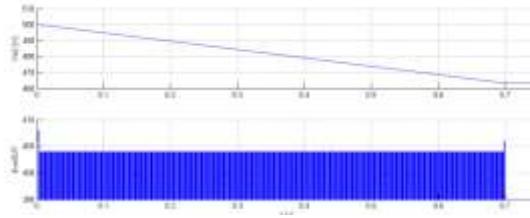


Figure 2: Execution time of the model based approach

10. Conclusion

The paper focuses on properties, development methods, analysis methods, and tools for software-intensive systems directly interacting with their environment. Many such systems are built from autonomous components that may exhibit proactive behaviour. Software-intensive systems differ from the other engineering systems in that they are clearly more capable for explicit proactive behaviour and rely on dynamic control structure more often as compared to the non-software-intensive systems in the artificial world. This paper states that applications of software-intensive systems require properties that cannot be studied by conventional mainstream methods of computer science, and suggests that a new time-aware model of interactive computation is to be developed. In order to meet this challenge, component-based architectures were introduced to automotive embedded systems. Despite the usage of eg. software product lines, a significant portion of new components must be integrated in each development step. In order to derive an integration order with respects to the proposed parameters an optimization approach based on simulated annealing was developed. In addition to minimize the singe objectives test effort and schedule effort, reasonable combinations were evaluated. It has been shown that minimizing the test effort and minimizing test complexity, which are contrary goals, can be performed by the proposed approach in an sophisticated and reliable manner. Also adding the schedule effort as objective yields favorable results. Optimizing the stub complexity and the schedule effort, which are independent goals, is also possible with good results.

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Machine Learning Algorithms: A Background artifact

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Abstract

With the greater development of technology and automation human history is predominantly updated. The technology movement shifted from large mainframes to PCs to cloud when computing the available data for a larger period. This has happened only due to the advent of many tools and practices, that elevated the next generation in computing. A large number of techniques has been developed so far to automate such computing. Research dragged towards training the computers to behave similar to human intelligence. Here the diversity of machine learning came into play for knowledge discovery. Machine Learning (ML) is applied in many areas such as medical, marketing, telecommunications, and stock, health care and so on. This paper presents reviews about machine learning algorithm foundations, its types and flavors together with R code and Python scripts possibly for each machine learning techniques.

1. Introduction to Machine Learning (ML)

ML denotes to the methods tangled in distributing through massive facts in the greatest intellectual way to arise better understandings. ML algorithms are defined to be culturing an objective function (f) which better draws input identifier (g) to an output identifier (h) as in equation 1[1].

$$h = f(g) \quad (1)$$

This future output prediction is not that much easier to do manually. Hence an automated system is expected to do the process [1]. Thus use of machine learning algorithms come into the scene. For every new input (g) the output (h) is predicted genuinely using machine learning algorithms. This state is said to be predictive molding/predictive analytics. The major operation is to assess the most possible predictions with the present data.

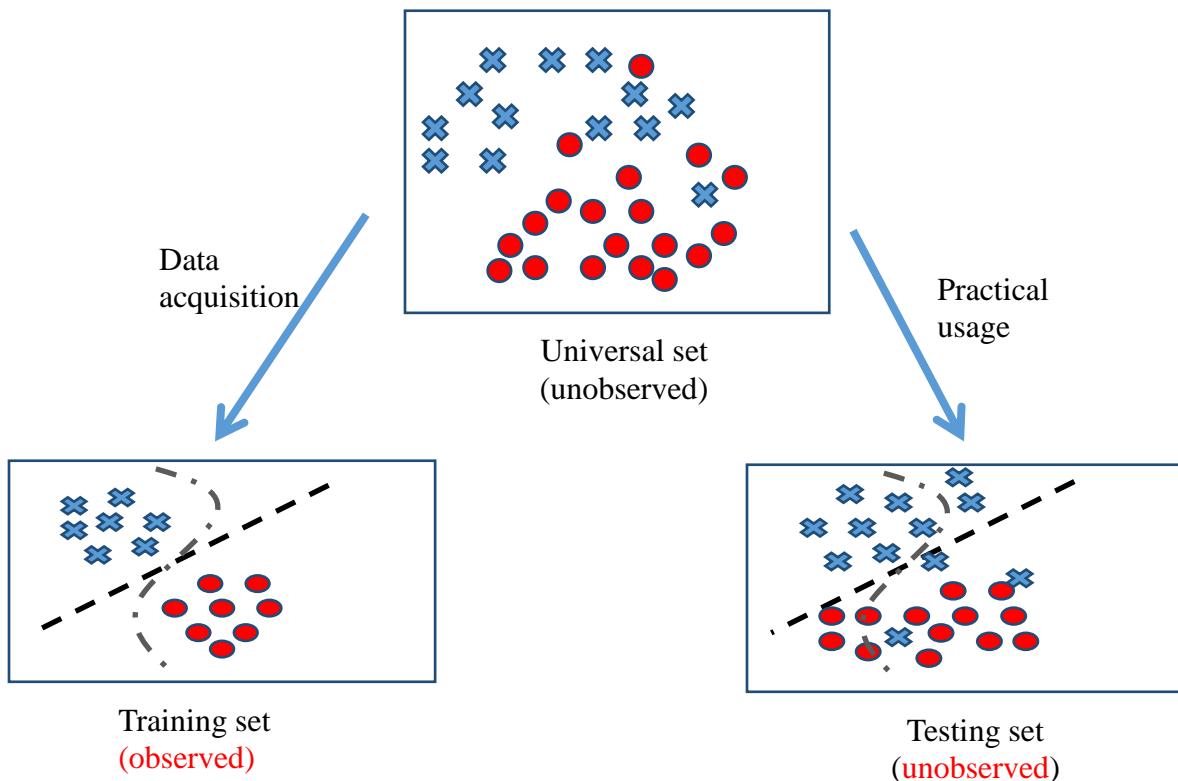


Figure 1 Training and Testing model in machine learning system

1.1 Five basic steps for a ML task

1. Data accumulation: Data gathered from various sources are used for analysis.
 2. Data preprocessing: Before getting into the actual processing of data, preprocessing is mandatory. This step is used to remove noise or other unwanted data from the gathered data.
 3. Prototype training: This step contains selecting the suitable algorithm and depiction of data in a pattern (model) format. The preprocessed data is often divided into two parts namely training and testing data.
 4. Pattern evaluation: In this step, the resultant pattern is validated for its correctness.
 5. Performance enrichment: This step involves picking another different pattern with better efficiency. However substantial time is required in data gathering and training.
- Despite any model/pattern, the above said five steps are mandatory to configure the ML technique.

1.2 Types of machine learning algorithms – Scenario based

1.2.1 Supervised Learning (SL) or Prognostic models

This is used to assess the upcoming result with the help of chronological data [2]. These models are instructive as much concentration is emphasized in training phase[5]. For instance, SL is applied if a selling firm wishes to find its customers list. It could also be used in prediction of earthquakes, cyclones etc. to determine the Insurance credit. Few examples of these prediction algorithms are: Nearest neighbor, Naive Bayes, Decision Trees (J48, Random Forest), Regression etc.

1.2.2 Unsupervised Learning (UL) or Evocative models

UL is suitable to train vivid models with no target and no sole feature is significant compared to one another [3]. For instance, UL is applied in case if a vendor desires to find which product does the customer buys frequently. Moreover, in medicinal business, UL may be applied to envisage the diseases that may prone to occur laterally with diabetes. Few examples of UL based algorithms are Apriori algorithm, Simple K-means clustering.

1.2.3 Reinforcement learning (RL)

RL is applied when the system is trained to yield decisions automatically with the business requirements only with a sole motto to exploit better effectiveness (performance) [2]. The underlying idea is a software agent is trained in an environment for problem solving. This repeated learning procedure promises lower human proficiency thus saving human effort [6]. One best example of RL algorithm is Markov Decision Process. RL fundamentally includes learning by relating using the situation. Thus it differs from SL in its characteristic.

2. Parametric and Nonparametric Algorithms

2.1 Parametric Algorithms

In parametric algorithms, the function can be simplified to any recognized form called as parametric ML systems [3]. Generally, parametric procedures are divided into 2 steps:

- 1) Choosing an appropriate procedure of the function
- 2) Acquire the quantities of the function

Few examples of parametric ML algorithms are Linear Regression and Logistic Regression [13].

2.2 Non Parametric Algorithms

On the other hand, processes with negative conventions for relating the parameters are called as nonparametric ML algorithms [3]. Without creating expectations, they are made free for training process. These are frequently agiler, attain restored accuracy. Though, the time for training the data is substantially very high. Some instances of nonparametric algorithms include Support Vector Machines (SVM) and Neural Networks (NN) [25].

3. Notion, Divergence and Tradeoffs

In general, ML algorithms are evident from notion, divergence and tradeoffs. Notion are shortening prospects for easy learning of the target function. In general, parametric algorithms are easy to learn and understand compared to nonparametric algorithms [2]. They possess less analytical routine on composite problems. Decision trees are considered to be less bias algorithm example and linear regression are considered to be high bias algorithm example.

Divergence is the quantity estimate where the target function drives to alteration with diverse training data. With training data, the algorithm must possess some divergence, without nil variance. The aim of any prognostic modeling ML algorithm is achieving low bias and low divergence. Likewise, the devised algorithm is expected to perform better.

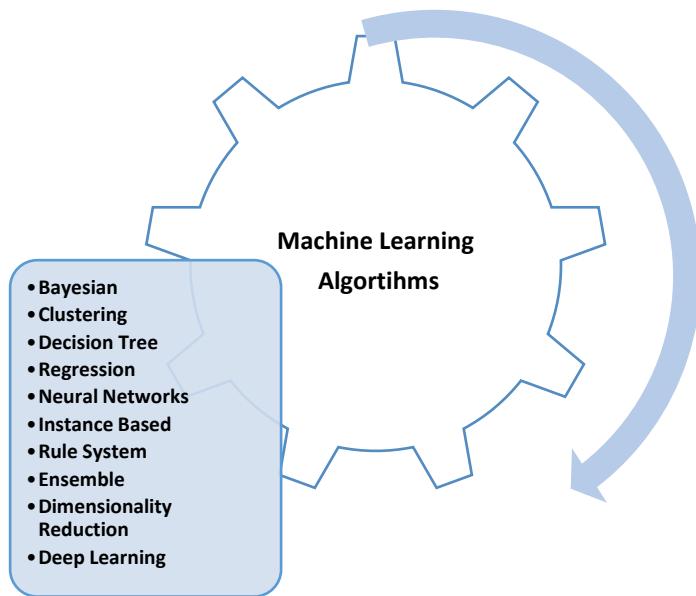


Figure 1 Categories of Machine Learning (ML) Algorithms

4. Linear Algorithms

4.1 Linear regression

Linear regression is one well tacit algorithms in the area of statistics and machine learning. It is being used over 200 years. Predictive analysis is chiefly apprehensive when the error is minimized or when the prediction is accurate, at the expense of explainability. The linear regression is signified using an equality describing a line fitting the association amid the input (g) and the output (h), using coefficients weighting as in equation 2.

For example:

$$h = X_0 + X_1 * g \quad (2)$$

The output (h) can be predicted based on given input (g) and the major task is assigning perfect coefficients X_0 and X_1 .

A better practice while using linear regression is removing correlated variables and noise from the given data, if possible. The K-Nearest Neighbors (KNN) algorithm stands as a finest instance of high-variance algorithm, and Linear Discriminant Analysis (LDA) stands as a finest instance of low-variance algorithm [24]. The parameterization of ML algorithms must handle notion and divergence. Notion and divergence are opposite poles where increasing the notion will decrease the divergence and vice versa.

Python script for implementing linear model

```
#Import necessary libraries like pandas, numpy
from sklearn import linear_model
xx_train=input_variables
yy_train=target_variables
xx_test=input_variables
# Generateregression object
linearr = linearr_model.LinearRegression()
# Train the model and assess score
linearr.fit(xx_train, yy_train)
linearr.score(xx_train, yy_train)
print ('Coefficient:', linearr.coef_)
print('Intercept: \n', linearr.intercept_)
# Output Prediction
predicted_output= linearr.predict(xx_test)
```

R Codefor implementing linear model

```
#Load datasets
xx_train <- input_variables
yy_train <- target_variables
xx_test <- input_variables
h<- cbind(xx_train,yy_train)
# Train the model and assess score
linearr<- lm(yy_train ~ ., data = h)
summary(linearr)
#Output Prediction
predicted_output= predict(linearr,xx_test)
```

4.2Logistic Regression Algorithm

Logistic regression is yet another MLtechniquein statistics. It is used for dualcataloging problems (difficulties with 2 class values). In this method, output prediction is distorted using a logistic function whichis capable of transforming any value into the range 0 to 1. This probabilistic conversion simplifies to breakideals to 0 and 1 and guess a class value.This is more useful for those problems requiring greater justifications for prediction.Similar to linear regression, logistic regression fails to workin case of unrelated attributes and duplicate attributes.

Python script for implementing LogisticRegression

```
#Import necessary libraries
from sklearn.linear_model import LogisticRegression
# Make object
Model1 = LogisticRegression()
# Train the model and assess score
```

```
Model1.fit (W,z )
Model1.score(W, z)
print ('Coefficient: ', Model1.coef_)
print ('Intercept: ', Model1.intercept_)
# Output Prediction
predicted_output= Model1.predict(xx_test)
```

R Code for implementing LogisticRegression

```
h<- cbind(xx_train,yy_train)
# Train the model and assess score
logistic_reg <- glm(yy_train ~ ., data = xx, status='binomial')
summary(logistic_reg)
# Output Prediction
predicted_output= predict(logistic_reg,xx_test)
```

4.3Linear Discriminant Analysis(LDA) Algorithm

As stated in the above section, Logistic Regression works better only for 2-class classification problems. In cases where classification algorithm with additional classes if present, then LDA algorithm is best suited (a brute-force approach). It contains algebraic assets of data, projected for each class. Every distinct input variable includes the following:

1. The Mean.
2. The Variance.

Estimates are completed by scheming a different cost of every class and predictions are made based on the thus attained biggest value.

5. Non-linear algorithms

5.1 Classification and Regression Trees algorithm

Decision Trees are better used for predictive modeling machine learning that are represented as a binary tree from algorithms and data structures. Each node signifies a particular input (x) and a splinter point. The leaves possess an output (y) for making prediction. Predictions are done based on dragging all beside the tree nodes via fragments till arriving the leaf. The leaf nodes output the class value. Generally, decision trees are believed to learn fast and even much very faster for making predictions. With much lesser preprocessing of data decision trees offer accurate for a broad range of problems. Decision trees possess high-divergence and be able to return further precise predictions in a group [10]. The technique adopts a Gaussian distribution (bell curve). Hence, it works better if outliers are removed from the data beforehand.

Python script for implementing DecisionTrees

```
#Import necessary libraries like pandas, numpy
from sklearn import tree
# Generate object
Model1 = tree.DecisionTreeClassifier(criterion='Infogain')
# Train the model and assess score
Model1.fit(W, z)
Model1.score(W, z)
#Output Prediction
predicted_output= Model1.predict(xx_test)
```

R code for implementing DecisionTrees [4]

```
library(rpart)
h <- cbind(xx_train,yy_train)
# cultivate tree
fitt<- rpart(yy_train ~ ., data = xx,method="class")
summary(fitt)
#Output Prediction
predicted_output= predict (fitt,xx_test)
```

5.2 NaiveBayes classification

NaiveBayes is a modestand powerful procedure suited inprognostic modeling.Two kinds of probabilities are encompassed from the calculations obtained throughtraining data.They are as follows:

1. The probability value of everyseparateclass.
2. The conditional probability value of every class specifiedfor all x value.

After the individual and conditional probabilities are calculated, Naïve Bayesis adopted for predictions using Bayes Theorem for each independent input x values.Nevertheless, for real-valued data Gaussian distribution is usedfor approximating these probabilities [13]. Once if probabilities are calculated correctly, the method is identically efficientfor huge complex problems.

Python script for GaussianNaiveBayes algorithm

```
#Import necessary libraries
from sklearn naiveBayes import GaussianNB
# Generate SVM object model
# Train the model and assess score
Model1.fit (W, z)
```

```
#Output Prediction  
predicted_output= Model1.predict(xx_test)
```

R codefor Gaussian NaiveBayes algorithm [4]

```
library(e1071)  
h<- cbind(xx_train,yy_train)  
Bfit<-naiveBayes(yy_train ~ ., data = h)  
summary(Bfit)  
#Output prediction  
predicted_output= predict(Bfit,xx_test)
```

5.3 KNearest Neighbors(KNN) algorithm

KNN algorithm uses the whole training dataset for using K utmostalikeoccurrences (the neighbors). The method uses the Euclidean distance metric to estimate the likeliness.Yet, KNN entailsmuch larger memory to accommodate all data. Classifying the data based on the closeness may lead to very high dimensionality breakdown. This is stated as curse of dimensionality [24]. So, output prediction must be done only based on the relevant input variable.

Python script for KNN algorithm

```
#Import necessary libraries  
from sklearn.neighbors import KNeighborsClassifier  
# Generate KNN object model  
KNeighborsClassifier (n_neighbors=7)  
# Train the model and assess score  
Model1.fit(W, z)  
#Output Prediction  
predicted_output= Model1.predict(xx_test)
```

5.4 Learning Vector Quantization (LVQ)

The great impact of KNN is that always the modelling function depends on the entire data. LVQ is a non-natural neural network algorithm [13].LVQ is represented as a group of codebook vectors. At the primary stage itself, the vectors are designatedarbitrarilyand improvedto review the best output for a number of repetitions. The bestappropriate neighbor is recognized using distance computationamongindividual codebook vector and the novel data case. The class cost for the unsurpassed matching part is laterresumed as prediction.Preeminentoutcomes are attainedby rescaling the data between 0 and 1.KNN yields best results withdataset by accepting LVQ to diminish the memory of storing larger dataset.

R code for implementing LVQ

```
#LVQ
set.seed(7)
library(caret)
data(iris)
control <- trainControl(method="repeatedcv", number=10, repeats=3)
grid <- expand.grid(size=c(5,10,15,20,25,30,35,40,45,50), k=c(3,5))
model <- train(Species~., data=iris, method="lvq", trControl=control, tuneGrid=grid)
print(Model1)
plot(Model1)
```

5.5 SVM algorithm

SVM are possibly one among the prevalentML algorithms. SVM possess a hyperplane that best distinct the points in the provided input variable space using class (class 0 or class 1) [8].The diffidenceamong the hyperplane and the neighboring data points is the margin.Basically, an optimization algorithm finds the coefficient values[9].It bidspreeminent classification performance andoffersbest efficiency for perfect classification. Still, the method doesnot promise any stoutguess on data andapt the data onto the input space [21][22]. Data points cannot be classified in case where more than one SVM class accepts or rejects the data points.

Python script for implementing SVM

```
#Import necessary Libraries
from sklearn import svm
# Generate SVM object
Model1 = svm.svc()
# Train the model and assess score
Model1.fit(W, z)
Model1.score(W, z)
#Output Prediction
predicted_output = Model1.predict(xx_test)
```

R code for implementing SVM [17]

```
library(e1071)
h <- cbind(xx_train,yy_train)
fitt <-svm(yy_train ~ ., data = h)
summary(fitt)
# Output Prediction
predicted_output = predict(fitt, xx_test)
```

6. Ensemble Algorithms

6.1 Bagging and Random Forest

Random Forest is yet another popular and most powerful ensemble machine learning algorithms. Bootstrap is an influential statistical technique for approximating a magnitudeon data.Bagging uses a similar approach but inherits numerous examples of training data from which the models are constructed. The predictions are made on the average of every individual model [13].The models thus shaped are dissimilar yet much accurate.

Each tree is lodged& grown as follows:

- In N amount of situations, few samples are picked at arbitrary however with replacement which are considered to be training set for growing the tree.
- With M inputs, a distinct number $m < M$ is acknowledged for the best split to be done. This m value must be persistent for the forest growing.
- Every tree is grown up for its leading promising height with no pruning.

R code for implementation of RandomForest algorithm

```
#Random Forest
# Load the party package. It will automatically load other required packages.
library(party)
library(randomForest)
library(forestFloor)
library(AUC)
# Create the forest.
output.forest <- randomForest(nativeSpeaker ~ age + shoeSize + score, + data = readingSkills,
keep.inbag = T, keep.forest = T)
# View the forest results.
print(output.forest)
Call:
randomForest(formula = nativeSpeaker ~ age + shoeSize + score, data = readingSkills, keep.inbag = T,
keep.forest = T)
print(importance(output.forest, type = 2))
getTree(output.forest, 3, labelVar = TRUE)
ff = forestFloor(output.forest, readingSkills, binary_reg = T, calc_np = T)
Col = fcol(ff, cols = 2, outlier.lim = 2.5)
#2D Visualisation
plot(ff, col = Col, plot_GOF = T)
#3D Visualisation
show3d(ff, 1, col = Col, plot_GOF = T)
library(rgl)
rgl.snapshot("3dreadingSkills.png")
```

6.2 Boosting and AdaBoost

Boosting is an ensemble technique that generates a robust classifier out of feeble classifiers. A model is constructed from the training data, then engendering a next model by correcting the errors in previous model [14].

AdaBoost is a successful boosting algorithm recognized for binary classification that are used with smaller decision trees[7] [16]. The tree's performance for each training example is used to shape the subsequent tree without error[15]. The models are produced consecutively with updated weights on the training instances. The process is continued for many iterations until the last static model is obtained. Once all the trees are completed, the individual tree's performance is weighted on the training data [12]. Outliers are to be removed as error correction is emphasized at each renewal.

R Code for implementing Boosting algorithm

R supports many boosting algorithms. However, here one such execution that uses decision trees as base classifiers are used. Therefore, the rpart package must be weighed down. Together the ada package could be used. With X be the matrix of features and class labels 0-1 then the command is
boostModel1<- ada(x=X, y=class_labels)

7. Dimensionality Reduction (DR) algorithms

Data are being captured in greater extent in day to day life. For these situations, DR algorithms could be used along with various other algorithms like Decision Tree, Random Forest, PCA, Factor Analysis for prediction.

PCA using R

Scenario: The Wine Data Set from the UCI Machine Learning Repository is considered. This data set contains the results of chemical analysis of 178 different wines from three cultivars. These observations contain the quantities of 13 constituents found in each of the three types of wines. The wine dataset is included in the HDClassif package, so let's install that and examine the dataset.

```
install.packages("HDclassif")
library(HDclassif)
data(wine)
str(wine)
install.packages("stats")
library(stats)
wine_pca <- prcomp(wine, center = TRUE, scale = TRUE)
summary(wine_pca)
#Visualizing the data set
biplot(wine_pca)
```

8. Neural Networks (NNs)

NNs are well suited with big data analysis. However, the computational cost is very high for handling such data [19] [20].NNs are just the interconnected nodes that corresponds to the input signals.

R Code Example for Neural Networks

```
library(iris)
field(infer)
library(neuralnetwork)
nn<- neuralnetwork (case~name+parity+induced+spontaneous, data=infer, hidden=2,
error.fct="ment",linear.output=FALSE)
nnfield(nn)
# resultant matrix
nn$resultant.Matrix
output<- cbind(nn$covariate,nn$net.resultant [[1]])
dimensionnames(output) <- list(NULL, c("age", "parity","induced","spontaneous","nn-output"))
head(output)
head(nn$generalized.weights[[1]])
plot(nn)
```

9. Rule Systems

Rule-based systems or Rule system uses a distinct way to access data that are used artificial intelligence applications, domain-specific expert system. For instance, an expert system aids doctors for easy diagnosis of diseases. They find their applications towards natural language processing [23].Rule are extracted automatically from the data to take decisions using many indirect methods. Few rule based algorithms are Cubist, OneRule, ZeroRule, etc.

R code for Cubist algorithm

```
library(cubist_rule)
library(mllbench)
data(iris)
iris$chas <- as.numeric(iris$chas) - 1
set.seed(1)
Train <- sample(1:nrow(iris), floor(.8*nrow(iris)))
Train_Predictors <- iris[Train, -10]
Test_Predictors <- iris[Train, -10]
Result<- iris$medv[Train]
Test_Outcome <- iris$medv[Train]
Tree1<- cubist_rule(xx = Train_Predictors, yy = Test_Outcome)
```

Tree1

summary(Tree1)

10.Deep Learning algorithms

Deep learning is a machine learning technique that tries to model high-level abstractions in data using multiple processing layers [18]. For instance, with an image data the output is represented as vector values per pixel, edges or, regions of particular shape, etc. Deep learning works better with competent algorithms in classification or clustering. Numerous deep learning designs such as deep- neural networks, Convolutional Neural Networks(CNN), deep-belief networks and recurrent-neural networks applied to many domains like computer-vision, speech-recognition, NLP, audio-recognition and bio-informatics. Few deep learning algorithms are Boltzman Machine, Deep Belief Networks, CNN,Stacked Auto Encoders, etc.

R code for CNN to recognize handwritten images

```
train_data <- read.csv ("imageset.csv")
mm = matrix(unlist(train_data [10,-1]), nrow = 28, byrow = TRUE)
image(mm,color=grey.colors(0-255))
rotate <- function(x) t(apply(x, 2, rev))
parameter(row=c(2,3))
lapply(1:6,
  function(x) image(
    rotate(matrix(unlist(train_data [x,-1]),nrow = 28, byrow = TRUE)),
    color=grey.colors(0,255),
    xlab=train_data[x,1]
  )
)
parameter (row=c(1,1))
library (caret)
Train<- Split (train_data$label, k=0.8, list=FALSE)
Train<-train_data .data[Train]
Test<-train_data .data [Train]
write.csv (train, file = "image1.csv", row.names = FALSE)
write.csv (test, file = "image2.csv", row.names = FALSE)
library(h2o)
local.h2o <- h2o.initilaize(ip = "localhost:8080", port = 23444, startH2O = TRUE, nthreads=-1)
train<- read.csv ("image1.csv")
test <- read.csv ("image2.csv")
train_data[,1]<-as.factor(train_data [,1])
ttrData<-as.h2o(train)
ttsData<-as.h2o(test)
result.dl <- h2o.deeplearning(h = 2:785, yy = 1, ttrData, activation = " ", hidden=repres(150,5),epochs = 30)
predict.dl<-h2o.predict(object=result.dl, newdata=ttsData[,-1])
predict.dl.df<-as.data.frame(predict.dl)
summary(predict.dl)
```

```
testnew_labels<-test[,1]
summary(diagram(table(test_labels,predict.dl.df[,1])))
test<-read.csv("image2.csv")
test_h2o<-as.h2o(test)
ddf.test <- as.data.frame(predict.dl.test)
ddf.test <- data.frame(ImageId = seq(1,length(df.test$predict)), Label = df.test$predict)
write.csv(ddf.test, file = "summary.csv", row.names=0)
h2o.shutdown(prompt = 0)
```

9.Conclusion

ML is an extremely influential tool for solving many of the real-world problems. The primary aim of ML researchers is to propose a better and smart learning systems that reduces human effort. However, ML is emphasized towards data handling and analysis rather than time/cost complexity. These automated ML algorithms obviously reduces human error and effort. As ML algorithms are entirely big data-oriented they are continually grander and trustful thus used for direct programming. The sole overhead involved is to have structured data so that every individual ML algorithm might handle itself.

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Secret Bot: A Bluetooth Controlled Spy Robot

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Abstract

Secret Bot: A Bluetooth Controlled Spy Robot is an Arduino Uno based robot that can be monitored and controlled by an Android device using an Android application. The Wireless Network Camera mounted on the robot can also be displayed on any other Android/iOS device for monitoring. In this project simple materials are used like plastic wood for the chassis, cycle spokes for the wheel axle, L293D motor driver and two 600 rpm DC motors for propulsion in four directions namely front, reverse, left and right. Bluetooth module HC-05 is used to receive commands in the form of strings from the Android application. The robot is covered with camouflage texture so that it does not alert surroundings. It is made up of simple materials rather than preassembled kits because the materials are readily and cheaply available, the robot becomes very lightweight and it can be formed into any desired size.

Keywords: Robot; Robotics; Camera; Arduino; Android; Spy;

1. Introduction

Every day in the world, incidents are taking place that pose life threatening consequences of human intervention. In these cases, involvement of human is very risky. For example, investigating potential crime scenes like bomb sites and dealing with hostage situations can be hazardous for forces like police and army and also for hostages themselves. If terrorists sense that law enforcement is coming to them, they would wreak havoc. Something can go wrong that the enforcement is not aware of, like bomb explosion or human casualties. The July 2016 Dhaka attack at the Holy Artisan restaurant claimed many innocent lives of both hostages and police members, which happened due to lack of proper strategic plan as police could not know what was happening inside the restaurant [1]. This would not happen if enforcers carried out their operations without letting the terrorists know. The Secret Bot should be capable to handle these type of situations, by carrying out stealth operations independently like locating vantage points and the position of threats and hostages, that require no human intervention except controlling it remotely. By using the Secret Bot, enforcers and other agencies could pinpoint strategic problems from distance and then lay out an effective plan accordingly. The robot should not disturb the crime spot in anyway, as it would be small in size and silent having no alarms and lights and have camouflage texture. It is based on Arduino Uno R3, a microcontroller board based on the ATmega328P AVR microcontroller unit, which is connected with the two motors through the L293D motor driver. It is also powered by a 7.4 Volts Rechargeable Lithium-Polymer battery. The Wireless Network Camera uses Wi-Fi network and is also powered by the battery.

2. Related Works

There are many projects which are similar to this or related in some way. The design, functions and capabilities of the robot is inspired from these works. Spy robots already do exist commercially that are used extensively in military operations, which are very expensive.



Figure 1: Military Spy Robot by Recon Robotics [2], Gladiator TUGV [3]

2.1 Spy Night Vision Robot with Moving Wireless Video Camera & Ultrasonic Sensor

It is a computer controlled spy robot that can act as a live telecast of audio and video information (including night vision) from the surroundings and can be sent to a remote station through RF signals to maximum range of 200 meters. It can measure the distance of object at front of robot and also automatically stop robot if a distance of object inside 10 cm is detected [4].

2.2 Smart Spy Robot

It is a robotic spy vehicle using RF technology for remote operation that can be monitored using webcam attached to it by wirelessly transmitting real-time video and will give confidential information regarding opposite parties [5].

2.3 A Smart Spy Robot Charged and Controlled by Wireless Systems

This robot, is controlled and charged wirelessly from control station and charge transmitter respectively. It has sensors that monitor the parameters of environment like temperature, humidity and detect obstacles and presence of humans [13].

2.4 Intelligence Spy Robot with Wireless Night Vision Camera Using Android Application

This robot is controlled by Android mobile device through Bluetooth signal. It is equipped with night vision wireless camera for surveillance and aims to prevent damage and loss of human life especially when military men enter unknown territory. The microcontroller 89C52 is used and the camera transmits data to TV tuner through radio frequency signals [14].

3. Proposed work

Unlike most related systems which use remote controllers that communicate with robot through Radio Frequency (RF) signals, the proposed system uses an Android device that communicates with robot through Bluetooth signal. This approach is better because Android devices in the form of smartphones and tablets are very portable and widely used [6]. The robot can be controlled from any Android device if the passkey for pairing is known, so it will not be a problem even if the Android device is not working. In the proposed system, when the switch of the robot is turned on, the battery powers on the Arduino board which is connected with L293D motor driver and HC-05 Bluetooth module. After pairing the Android device with the module, when the user presses control buttons on the Android application, the corresponding string is transmitted to the module. The module receives the string and the Arduino's microcontroller processes the string for the motor driver to drive the DC motors according to the code uploaded to it.

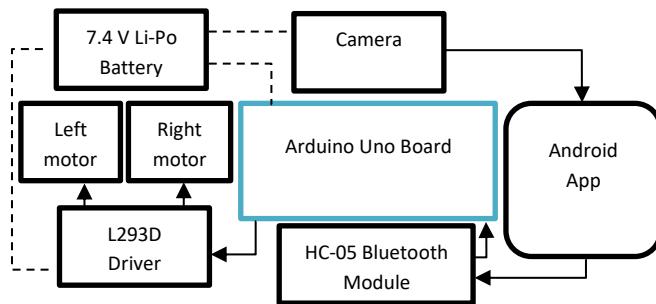


Figure 3: Block diagram of the proposed system

Button	String	Result
Left	L	Left motor backward Right motor forward
Right	R	Left motor forward Right motor backward
Up	F	Left motor forward Right motor forward
Down	B	Left motor backward Right motor backward
Stop	S	Left motor off Right motor off

Table 1: Instructions programmed to Arduino

3.1 Hardware Description

Hardware devices used in this system are given below:

3.1.1 Arduino Uno R3



Figure 4: Arduino Uno R3

Arduino Uno R3 is a microcontroller board based on the ATmega328P microcontroller that can be programmed by any Personal Computer through USB interface [7]. Instructions are programmed into Arduino using C/C++ language and Arduino IDE [8].

3.1.2 L293D Motor Driver

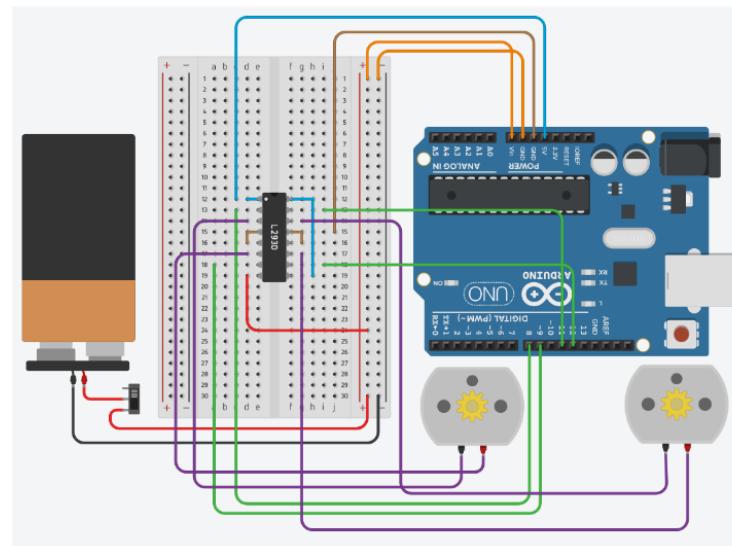


Figure 5: Motor driver circuit used in the project

The L293D is a typical Motor driver IC which allows the DC motor to be driven in either direction according to the way it is coded. It is a 16 pin IC which can control two DC motors simultaneously in any directions with the help of the code. The IC uses an input of 5 volt at pin 8 and 16 as well as pin 1 and 9 which is enable, the other pins 4, 5, 12 and 13 are grounded. The inputs to the IC's pin no 2 and 7 are for the first motor connected at pin 3 and 6. The inputs to pin 10 and 15 are for the second motor which is connected at pin no 11 and 14 as shown in figure 5. The inputs are logic 0 or logic 1 given from digital pins 8, 9, 11 and 12 of the Arduino Uno [9].

3.1.3 HC-05 Bluetooth Module

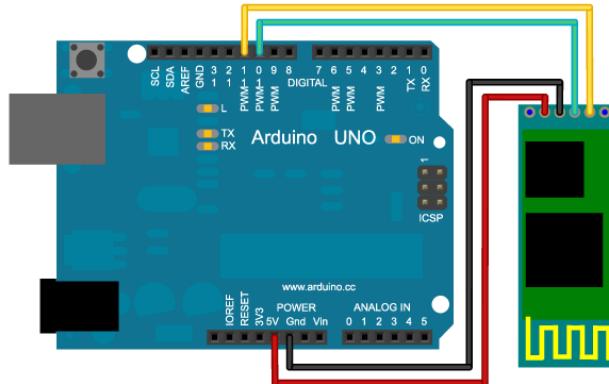


Figure 6: HC-05 Bluetooth module connection with Arduino Uno R3

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The Vcc, GND, RX and TX pin of the module is connected to 5V, GND, TX and RX pin of the Arduino respectively. The module used in the project communicates at a baud rate of 38400 bits per second [10].

3.1.4 Wireless Network Camera



Figure 7: Wireless Network Camera

The Wireless Network Camera, also known as Wi-Fi IP Camera, is used in this system to stream videos live to any mobile device, including Android and iOS devices, using Wi-Fi network. It can also capture photos and videos which can then be shared across other devices and cloud services. It also has infrared supported night vision and an integrated microphone and speaker for audio transmission between itself and the mobile device. Furthermore, it can also rotate approximately 360 degrees both horizontally and vertically [11].

3.2 Product Description

3.2.1 The Secret Bot



Figure 8: The Secret Bot, Early development stage of the Bot

The Secret Bot has two 600 rpm DC motors attached to the rear wheels. All the hardware is connected on a breadboard according to the circuit shown in Figure 5 and 6.

3.2.2 The camera Interface

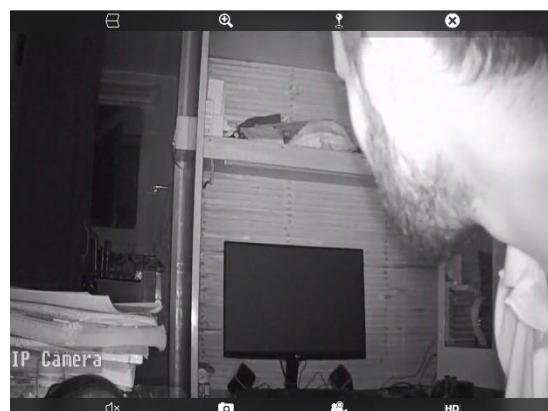


Figure 9: The interface showing footage in dark

The camera interface of the Android/iOS application displays live footage of the Network Camera, including night vision (aided by infrared sensors), which is ideal for spying. The camera can be rotated by swiping on the footage screen in desired direction. The footage can be captured as image or video, which can then be shared across devices including other mobile devices, computer through Wi-Fi network, Bluetooth, or cloud services like Google Drive and OneDrive.

3.2.3 The Controller Interface

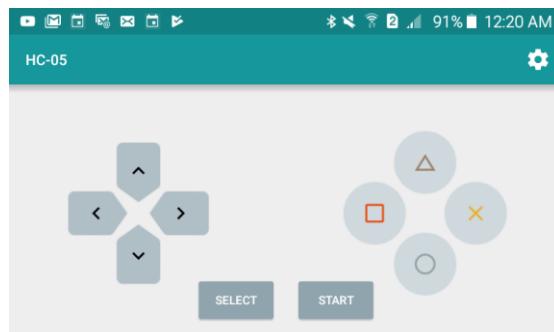


Figure 10: The Controller Interface

The controller interface of the android application consists of custom buttons that can be assigned strings to be transmitted to the HC-05 module through Bluetooth signal. Using these strings, the Secret Bot will decide whether to move forward, backward, left or right, or stop. For a new device, the pairing key should be entered to access this interface.

3.3 System Testing

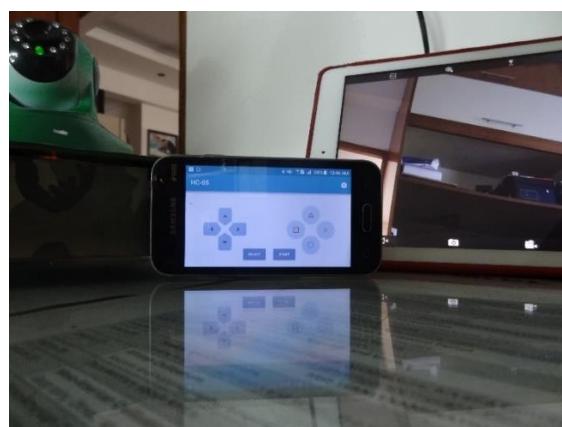


Figure 11: Final Testing

All the components have been tested and it is seen to be working properly. As shown in Figure 8, the robot is active by looking at the red light of the Bluetooth module and green light of the Arduino. During the final testing shown in Figure 11, everything worked as expected. After testing, the wires are soldered to the breadboard for reliability.

3.4 System Functionalities

- Blends in with its surroundings by having a camouflage body
- Small and lightweight in size
- Locates vantage points, objects and beings through the IP camera.
- Goes as far as 100 m from the controller device [12]
- Relays visual information from night vision IP camera back to person
- Its control can be taken by any person through security (pairing) key when necessary
- Require no human intervention while in operation

3.5 Hardware & Software requirements

- Arduino Uno R3
- L293D Motor Driver
- Two 600 rpm DC motors
- Breadboard
- Lithium Polymer Battery
- Bluetooth Module HC-05
- Slide Switch
- Wheels
- Jumper Wire Set
- Plastic Wood
- Paper
- Cycle Spoke
- One Android device for controlling robot and any other Android/iOS device for viewing footage
- Android 4.0 or up
- Arduino IDE

3.6 Algorithm

3.6.1 Robot

Step1. Initialize the pins, motor driver and HC-05.

Step2. Arduino communicates serially with HC-05 at 38400 bps.

Step3. If HC-05 receives string then process the string to control the motors through motor driver.

3.6.2 Controller

Step1. Pair the robot with the application, enter key if necessary.

Step2. Customize the buttons according to the strings.

Step3. Send corresponding string when button is pressed.

3.6.3 Camera

Step1. Connect the camera to a Wi-Fi network, preferably a mobile hotspot.

Step2. Run the application and view footage

Step3. If it is dark then activate night vision automatically.

4. Conclusion

The proposed project makes it easier for people, especially the law enforcing agencies, to monitor persons and places. Secret Bot is created very simply and easily so mass production of this robot takes very little time, therefore if one Bot is attacked then another one can be deployed when needed. This way, human lives can be saved in critical situations. As smart mobile devices are readily available to almost everyone, and the Bot can be made smaller, and audio transmission between the Bot and mobile device is possible, the Bot is useful also in many other applications like home surveillance, getting news information from, for example, trapped humans under rubble and in similar conditions. In the future, we plan to improve the proposed system by consolidating the two interfaces in 3.2.2 and 3.2.3 into one dedicated software application which will also incorporate face recognition, and also make the Bot to defuse bombs and armored in order to withstand blasts. To allow Secret Bot to move around on all terrains, continuous track plates are also intended to be added to the Bot's wheels.

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Modified HOG based on-road vehicle detection method

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Abstract

A new vehicle detection method based on modified histogram of oriented gradient (HOG) is introduced. Three variants of the modified HOG based feature are used to train linear and nonlinear support vector machine (SVM) classifiers. A comparison between classifiers based on proposed HOG variants and the conventional one is done. The classifiers are trained and tested on samples extracted from KITTI dataset. The comparison between the results show that the proposed method increased the discriminative power and improved the detection rates. Finally, the best performing classifiers in the comparison are used in detection of vehicles in image frames provided by KITTI dataset.

Keywords: Vehicle detection, Histogram of Oriented Gradient, HOG, Compass Gradient, Support Vector Machines, SVM

1. Introduction

In the last few years, making driving safer has been a target for automotive industry. While it was reported that most of the road crashes are due to human factors [1], manufacturers are keen to provide advanced driver assistance systems (ADAS) (i.e. collision alert, lane departure assistant, driver alertness check, ...) to decrease the probability of human error and a more long-term target is to replace the human driver with automated one that will make the roads secure and save more lives. A main module in any ADAS or autopilot is the perception module that provides the vehicle driver (human or computer) with information about the surrounding environment, depending on sensors like cameras, radars and lidars. A whole picture of the vehicle surrounding is provided for the vehicle driver to take proper actions according to the changes in environment. One core function in the perception module is the vehicle detection, as surrounding vehicles are one of the dynamic obstacles which represent a prospective collision threat that needs to be taken care of. Cameras as a passive sensor are widely used in the perception module of vehicles. A lot of research efforts were done to develop methods for vehicle detection using either stereo or monocular cameras. The method introduced in this paper depends on data from monocular camera. Vehicles are visually different objects that have a lot of variations in colour, size and shape. In on-road vehicle detection unlike in surveillance cameras, the camera scene is always changing which makes the vehicles background to be visually complex, besides the challenges of detection based on visual information such as illumination variation and occlusion. All the mentioned reasons make vehicle detection from camera information a non-trivial task such that a lot of research effort was paid to approach this problem. Vehicle detection using monocular camera can be classified into two main approaches, the first is motion-based at which sequence of images are used in detection process and the second is appearance-based at which only one image can be used to detect vehicles. One of the motion-based techniques used in vehicle detection is optical flow which is used in [2] for detection of overtaking vehicle to use this information in lane changing decision. Also in [3] optical flow is used along with hidden Markov model (HMM) in vehicle detection in different lighting conditions. Other motion based techniques such as dynamic scene modelling was used in [4] along with hypothesis testing and robust information fusion to detect overtaking vehicles. Dynamic background modelling based on sparse optical flow was used in [5] to detect overtaking vehicles. Appearance-based vehicle detection is a two-stage process which includes feature extraction and classification [6]. A lot of features were used in vehicle detection. Symmetry feature of vehicles was used in their detection [7]. In [8], the shadow underneath the vehicle was used as a feature for vehicle detection in traffic scene. In [9], a fusion of both symmetry and shadow features was used in vehicle detection. Edge-based constraint filter was used in [10] to segment vehicle from background as a step in vehicle detection and tracking. Combination of features (symmetry, vertical edges, taillight and shadow) was used in [11] to detect

vehicles in different weather and lighting conditions. Haar like features which were used in the well known Viola-Jones face detector [12], were used in vehicle detection in [13]–[15]. Also it was used to detect independent vehicle parts in [16] full review of the methods used in vehicle detection can be found in [17] and [16].

The following parts of this paper is organized as follow: Related work is described in Sec. 2. The proposed HOG variant along with experiments done and results of the comparison between the proposed HOG with the original one are described in Sec. 3. Discussions of the results and conclusions are in Sec. 4.

2. Related Works

One of the features that is widely used in object detection is the histogram of oriented gradient (HOG). The HOG feature is firstly introduced by Dalal and Triggs [18] with application on pedestrian detection but it had been used in various object detection applications including vehicle detection [19], [20], and [21]. Since then efforts had been made to improve the discriminative power of HOG introducing different changes on Dalal and Triggs HOG version. In [22], Zhang et al. introduced the local structured HOG (LSHOG) fused with local structured Local Binary Pattern (LSLBP) and applied it for object detection. In [23], Cheon et al. made use of the symmetry in HOG feature vector for symmetric objects such as vehicles and introduced a new HOG variant called symmetric HOG. In [24], Kim et al. concatenated position and intensity data for the original HOG to form a position and intensity HOG (π HOG). Recently Kassani el at. [25], introduced the soft HOG (sHOG) that depends on random selection of cells position with symmetric features and applied it on traffic sign detection. However, all the mentioned efforts maintained the same gradient calculation method as in conventional HOG. The goal of this paper is to introduce a new HOG variant using compass gradient mask in the calculation of HOG that is proved to increase the discriminative power of the original HOG on vehicle detection. The classification part is done using the support vector machines (SVM) [26] which is widely used in literature in combination with the HOG feature [23], [27].

3. Proposed work

3.1 Overview on HOG calculation

The original HOG computation is done in five steps as described in [18]. First the image goes through colour normalization and gamma correction. Then the image is divided as a grid of cells. The cells are grouped into larger overlapping blocks at which the cells can belong to more than one block. Figure 1 shows an example for dividing an image into cells of size 16x16 at which each cell has 256 pixels and blocks of size 2x2 which means that each block contains 2 cells in each direction. The blocks in the figure have overlapping ratio of 50% at which half of the block cells are shared with the neighbour block. Cell size and block size are parameters to be determined by the user according to the image size and amount of details needed to be captured.

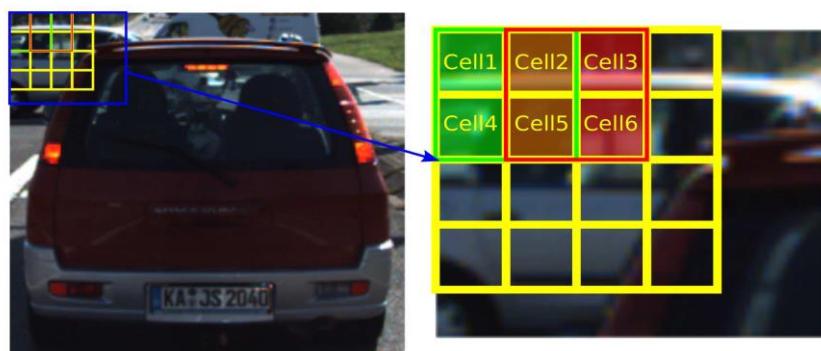


Figure 1: The image is divided into cells (outlined in yellow), the figure shows cells of cell size is 16x16, cells are grouped in overlapping blocks (outlined in green and red), the block size shown in the figure is 2x2 at which the block has 2 cells in each direction the overlap ratio between blocks is equals to 50 % where 2 cells (cell2 and cell5) contribute in the result of both highlighted blocks.

The second step which is the main concern in this paper is computing the image gradient. It was mentioned in [18] that various gradient masks were compared but a combination of different gradient masks, which is proposed by this paper is not mentioned. In [18], the approach was used with application on pedestrians which are visually very different from vehicles. After calculating the gradient, a histogram of the orientation of the gradient is done. Number of bins in the histogram is also a user parameter. The Third step is calculating weighted vote using tri-linear interpolation method at which each pixel not only contributes in the results of the cell where it's located but also to the nearby cells and nearby bins in the histogram. The weight of contribution is determined according to the spatial location of the cell as well as the gradient value. As shown in Fig. 2, the center pixels denoted by $(x_0, y_0), (x_0, y_1), (x_1, y_0), (x_1, y_1)$ have contribution in one another results according to their location, and also they contribute in the results of nearby orientation bins according to their gradient orientation values. The fourth step is the normalization of results over overlapping spatial blocks and the last step is to collect the HOG's of the detection window to form the feature vector representing this window.

3.2 Compass HOG

In the conventional HOG, the gradient of the image calculated using the intensity change in two directions only (vertical and horizontal). This will result in losing data from the image and make the feature less discriminative because it ignores the intensity diagonal changes. On the other side, the proposed compass HOG uses gradient calculated from the change in all compass eight directions, which make it more descriptive for the image and hence more discriminative feature. Compass gradient is used to create three different HOG variants, the first one is calculated by concatenating the HOG features calculated using the four-compass gradient.

$$compHOG = [HOG1 \ HOG2 \ HOG3 \ HOG4]$$

At which $HOG1, HOG2, HOG3$, and $HOG4$ are the HOG features calculated using the gradient in four directions described in Fig. 3. The feature vector in this HOG variant is four times the length on the conventional HOG. Other HOG variant is formed by averaging the gradients in four compass directions. The third HOG variant is formed by taking the direction of the gradient that has the maximum magnitude. The latter two HOG variants have the same vector length of the conventional HOG.

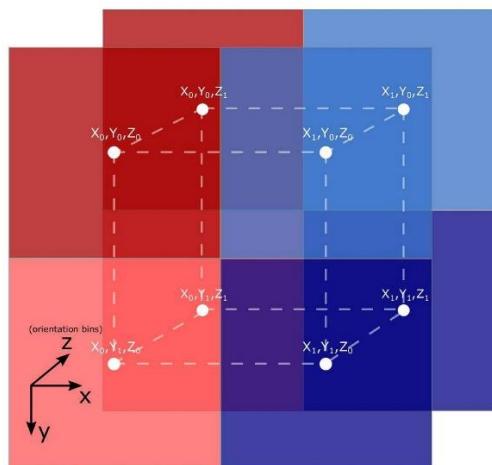


Figure 2: White points represent the cells center contributes in the tri-linear interpolation, Z is the dimension of orientation bins, the pixels contributes to the results of each cell according to its spatial location and gradient value.

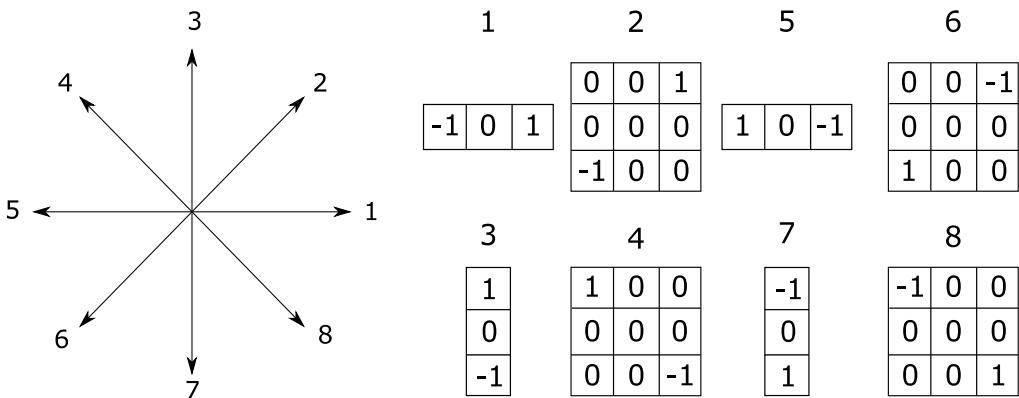


Figure 3: Filters used in calculating gradient in four directions

3.3 Experiments

3.3.1 KITTI Vision Benchmark [28]

In experimental work the KITTI dataset was used in training and testing. Introduced by Geiger et al. [29] in 2012 KITTI dataset aimed to bridge the gap between lab produced datasets and real life problem. KITTI dataset contains realistic data collected by driving around a city, so it has most of the challenging problems addressed by autonomous driving vision system. KITTI data acquisition setup is a car equipped with two sets of high resolution stereo cameras (Color set and grayscale set) and a GPS/IMU system that is used for accurate vehicle localization.

The dataset contains a visual odometry sequence of length 39.2 Km also it has 7481 stereo pairs for training with and 7518 stereo pairs for testing. The training images come with around 200 thousand labeled objects of different classes such as cars, vans, pedestrians and cyclists. The dataset could be used in a lot of application such as stereo matching, optical flow estimation, 3D visual odometry and 2D/3D object detection and pose estimation. That makes KITTI dataset one of the main datasets for testing state-of-the-art work related to vision systems for autonomous vehicles. The vehicles in the dataset are classified according to their detection difficulty into three levels, the vehicle detection difficulty is determined based on the size of the vehicle in the frame, the occlusion percentage and the truncation from the frame. The proposed approach is tested on the fully visible sedan vehicles.

3.3.2 Samples preparation

To test the proposed method, the training frames provided by the KITTI dataset is divided equally into two groups, one for training and the other for testing. Using the ground truth of the dataset, fully visible sedan vehicles extracted from the training and testing groups to be used as positive training and verification samples respectively. Negative samples are extracted randomly from the frame parts that have zero overlap with all vehicles in the frame. Fig. 4 shows positive samples.

3.3.3 Feature extraction

The extracted samples are then preprocessed before feature extraction. The sample is resized so that its height becomes one of the fixed heights which are 32, 64 and 128 pixels. The height is chosen based on the original size of the sample, the width is then determined so that the sample maintain the average aspect ratio. The next step is calculating the different HOG feature variations for each sample, the cell size is changed for each sample size so that all the samples have the same feature vector length.

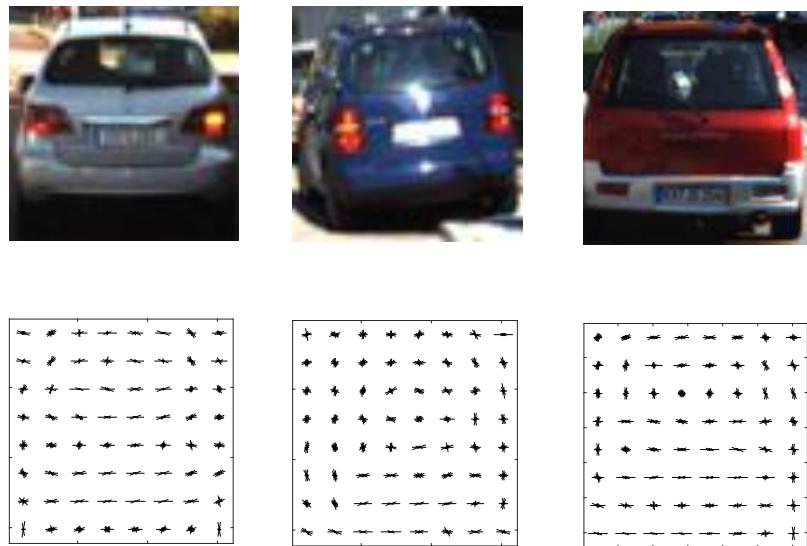


Figure 4: Positive samples for vehicles (above) and their HOG representation (below)

3.3.4 SVM classifier training

Linear SVM and nonlinear SVM classifiers are trained for car detection. Gaussian kernel was used as a kernel for the nonlinear SVM. The numbers of samples used are 2382 and 10226 for positive and negative samples respectively.

3.3.5 Testing using patches

Linear and nonlinear SVM classifiers based on different HOG variants are trained for detecting vehicle rear view and tested using 1657 positive test sample and 10113 negative samples. ROC curve is used to compare the performance of classifiers; the curve was plotted by choosing different thresholds for the classifiers confidence level. As shown in the ROC curve (Figure 5) both classifiers show similar relative behavior between the different HOG variants however all the nonlinear classifiers outperform their corresponding linear classifiers. All classifiers based on compass HOG performance exceeds that of the convenient HOG, the compass HOG classifier shows the best performance followed by the compass HOG with maximum gradient selection. The best performance achieved by nonlinear SVM based on compass HOG classifier shows a true positive rate of 89.56 % and true negative rate of 92.55 % with AUC equals to 0.9814.

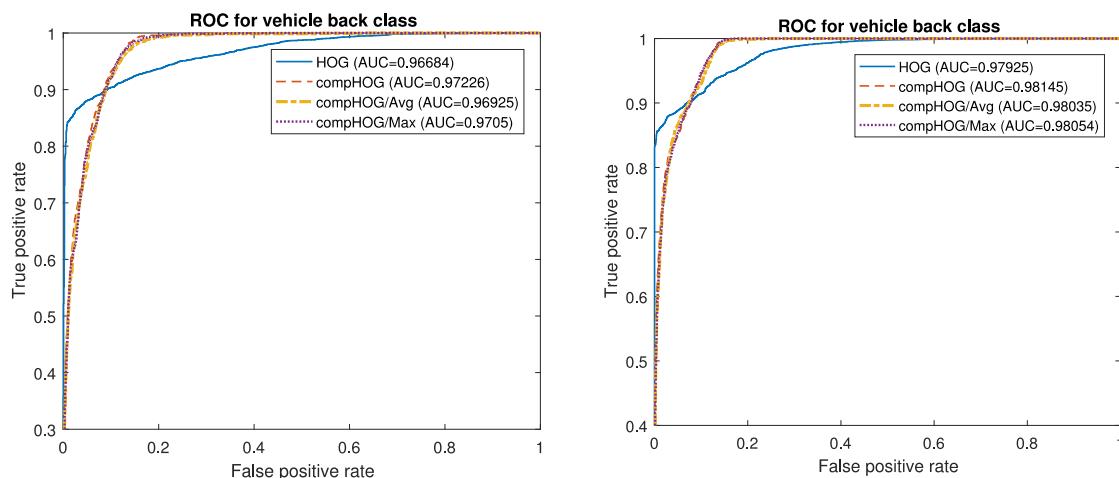


Figure 5: ROC curve for compared classifiers in the vehicle back class Linear SVM (Left), Nonlinear SVM (Right)

3.3.6 Vehicle detection

In this section, the classifiers which give the best performance in each class are used together to apply vehicle detection on frames provided by KITTI dataset. The exhaustive search technique is used to provide vehicle candidate for the classifiers, a sliding window with different sizes scan the image frame, the sliding windows height used in detection range from 40 to 180 with average step of 20 pixel, the window width is calculated according to aspect ratio associated with each classifier. The next step is to calculate compass HOG feature vector and provide it as an input for SVM classifiers which check if the window has a vehicle or not. The dimensions and locations of the detected vehicles from the three classifiers are then recorded. A non-maximum suppression process is done to reduce overlapping detected windows to only one window, the suppression process is done according to the confidence level of the classifier at each window, the window with the maximum confidence level is left while other windows that overlap with it with an overlap percentage higher than certain threshold are suppressed.

Samples for vehicle detection are shown in figure 6, the results show that the detection algorithm is effective in detecting vehicles with near and medium distance range which is the range covered by the sliding windows used in detection, also the detector shows robustness in vehicle detection of different shapes, colors and at different lighting conditions.

4. Conclusion and Future Direction

We have presented a new HOG based vehicle detection approach. We modified the feature by adding the derivatives from the diagonal direction. A SVM classifier was involved to detect vehicles in different video frames. We demonstrated an exhaustive results and validation section. The experiments showed the success of the proposed compass HOG approach against the conventional one. In the future, we will consider GPU implementation of the proposed technique as well as involving an object tracking approach to achieve real time performance.



Figure 6: Results for vehicle detection tested on KITTI image frames, true positive detection (Green), false positive detection (Red)

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MECHATRONIC APPLICATIONS IN INDUSTRIAL AND HOME APPLIANCES

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Abstract: Mechatronics is a locality denoting the mix of technologies that go along to provide industrial robots. Mechatronics area unit outlined as “the integration of Mechanics, engineering, physics, engineering, and information technology to provide or enhance product and systems”. Mechatronic clearly brings out the novel prospects of mixing totally different disciplines and therefore the potential for machine intelligence. A typical mechatronic system picks up signals from the atmosphere, processes them to mechatronicrate output signals, remodeling them as an example into forces, motions and actions.

Keywords: Mechanics, Mechanical Engineering, Electronics, Computer technology, IT and Fuzzy control

1. Introduction

Mechatronics is that the extension and therefore the completion of mechanical systems with sensors and micro-computers that is that the most vital side. The actual fact that such a system picks up changes in its atmosphere by sensors, and reacts to their signals victimisation the suitable scientific discipline, makes it completely different from standard machines. The appliance space of mechatronics is very broad. This technology is firmly employed in the automation of machines, servo-mechanics, industrial product, medical specialty systems, energy and power systems, conveyance systems, electronic communication systems, pc assisted style, CNC and DNC systems etc. automation is directly dependent upon this method.

There square measure redundancies in sensors and actuators and as a consequence it's would like qualified scientific discipline for the information and command fusion. The security techniques can need to be improved so as to master the interaction between man and machine. Intelligent robotic management and machines, that perform tasks autonomously, square measure needed in several fields. The autonomous robots need to perform tasks in numerous environments by themselves like citizenry. For the automation of such a system in industrial application PLC controllers square measure very frequently used. These controllers square measure ordinarily victimisation the dominant devices to manage the movement. The exactness of dominant the movements are totally passionate about the method of management signal mechatronicated. For the correct dominant during this work a fuzzy primarily based dominant theme is to be developed. The combination of intelligence system to the management electronic equipment of the system is concentrated to boost the lifetime of system potency and intern ends up in quicker and reliable operation.

2. INDUSTRIAL AUTOMATION

The application space of mechatronics is very broad. This technology is firmly utilized in the automation of machines, servo-mechanics, industrial merchandise, medical specialty systems, energy and power systems, transport systems, digital communication systems, power-assisted style, CNC and DNC systems, etc. artificial intelligence is directly dependent upon this method. There are uncountable examples wherever this technology is employed. However correct application, utilization, and maintenance of those engineering merchandise and systems are also some significant characteristics as a result of these factors are accountable for the improvement of productivity and therefore the quality of the merchandise and system.

These interactively cooperating, intelligent machines cause new analysis topics within the management techniques of mechatronics and in different areas additionally. It'll be necessary that a

machine and its elements have learning capabilities, self-adaptation and self-calibration. Techniques like the mixture of neural networks, and fuzzy management with knowledgeable systems can more emphasize the importance of software system. The complexity of the controlled mechanical structures and their surroundings, as an example in mobile robots, would require class-conscious or behaviour-based management architectures.

There will be redundancies in sensors and actuators, and as a consequence it's would like qualified IP for the information and command fusion. The security techniques can have to be compelled to be improved so as to master the interaction between man and machine. It's obvious that neighboring areas like work scientific discipline, safety, and ergonomics can significantly increase in importance. Another most vital topic, particularly for synthesis tasks like in mechatronics, is that the style of recent merchandise. The extension of the particular CAD style tools to include mechatronic elements and therefore the art of exploitation the potential of mechatronics to return up with sensible merchandise has nevertheless to be developed. This deficit has been recognized and there are massive efforts to support style education, particularly within the field of mechatronics. As a remark it ought to be noted that there are definitely more engineering areas wherever the progressing use of knowledge science can cause new analysis areas powerfully associated with mechatronics.

3. Operational Description

Intelligent robots and machines, that perform tasks autonomously, area unit needed in several fields. The autonomous robots ought to do tasks in varied environments by themselves like persons. They need to be intelligent to see their own actions in unknown environments by themselves supported sensory data. In advance, human operators will provide the robots their information and talent to some extent in top-down manner. However, once the robots perform tasks in unknown surroundings, the information might not be helpful. During this case, the robots ought to adapt to their environments and acquire new information by themselves through learning. This method returns in bottom-up manner.

Actual activities in mechatronics area unit involved with mechatronically motions in machinery during a controlled method. Dominant motions are important, for instance, in industrial robots, electrical and hydraulic servo drives, or in magnetic bearings. The most topic is that the application of classical ways of management techniques to mechanical plants. In such cases, the contribution of mechatronics primarily consists of supply and shaping the hard-to-please applications and integration the management tasks into the technical system. This assumption, however, seems to be an excessive amount of one-sided, and covers the subsequent way more vital side with not enough scope. Because the technical appliances became a part of our existence and so it's accepted that a synchronicity of technical systems with biological ones can't be denied. This coexistence will definitely transform cooperation, and can it'll be this cooperation between biological or otherwise naturally unstructured systems and technical ones wherever mechatronics will play a really essential role. In such a cooperation it'll be necessary to use machines which might be referred to as intelligent and cooperative, in distinction to current business wherever such Associate in nursing interaction isn't however typically required. In business, merchandise and processes area unit designed from scratch, and thus they're far-famed, and coping with them may be a quite simple action wherever the behaviour will be expected, a minimum of in essence. Even there, however, the quality of tasks and things is increasing, leading already to the employment of unconventional tools like fuzzy management, neural networks, knowledgeable systems, and their mixtures. Therefore, for any such less structured environments we'll want, in future, machines with some quite intelligence. However it'll nearly forever be the case that this "machine intelligence" isn't enough. It'll most frequently be necessary to touch upon exceptions, i.e. to beat things that might not be foretold by the machine. The most effective exception handler we will think about is that the person. This brings US to the conclusion: we'd like machines which might add Associate in Nursing autonomous far to an explicit degree of quality, and in crucial things or on the next level of autonomy the mandatory interactions with the human operator or user ought to be expedited and structured. Such man/machine interactions need Associate in nursing acceptable approach. Just in case of emergency, for instance, it'll not do for the machine, to be simply equipped with a yellow visual signal, a sounding horn, or a mere closedown switch.

Some new application areas will already be seen to develop in promising directions. One among them is that the field of service robots. Even once the particular use of service robots remains terribly restricted because of the still underdeveloped intelligence of those machines, there are a unit already varied analysis programs, particularly on mobile robots, with prototypes for cleansing tasks in railway stations or faculties, to be used in construction or in agriculture and biological science, for distribution tasks in workplace buildings and hospitals, for operating in venturesome environments, or for novel cars and transportation systems. It's well-known that in part several ideas of mechatronics have already been completed a while past, and there, mechatronics has helped to form the big dimensions of area accessible to humans. And now, recently, they vary of the terribly little is meeting growing technical interest, with mechatronics leading the thanks to micromachining and nanotechniques. These new fields can intensively use ways from mechatronics to form motions inside the terribly little dimensions visible and governable. The medical space, too, primarily the support of diagnosing, surgery, and caretaking, wherever a controlled interaction between man and machine is indispensable, goes to be a distinguished analysis and market space for mechatronic merchandise. After, golem manipulators for construction work, with visual capabilities, as Associate in nursing example for a cooperative intelligent machine are bestowed in additional detail.

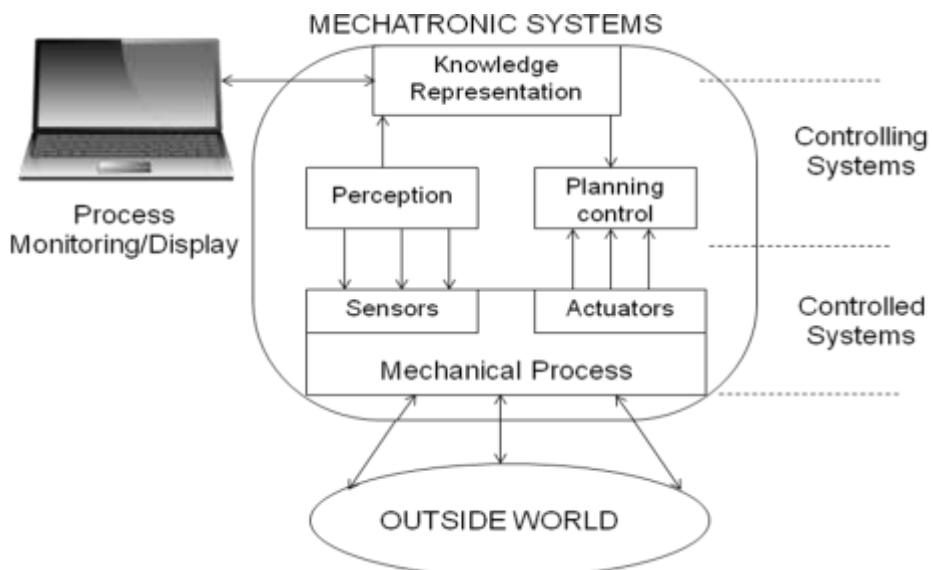


Fig. 1: Mechatronic system architecture

A mechatronic system has 2 main parts as shown in fig.1. The controlled system may be a mechanical method that's up-to-date with the atmosphere by mean of all its sensors and actuators. Characteristic options of the mechatronic system area unit 3 sub-systems of the dominant system used for perception, data illustration, designing and management. The intelligence is typically embedded within the designing and management sub-system. Thus, supported data taken from the sensors, procedure intelligence ways area unit exploited to arrange a course of action which will alter the controlled system to attain any given task. Typical microprocessors, artificial neural networks, formal logic and probabilistic reasoning area unit among the tools employed in the sub-system for IP and deciding.

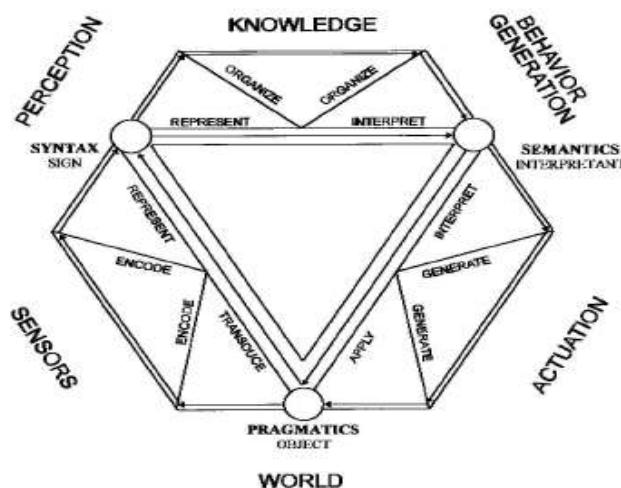


Fig. 2: The functional diagram of semiotics

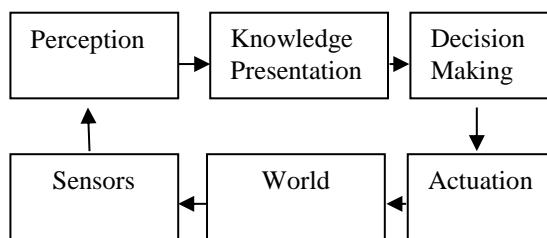


Fig. 3: The six-box diagram of behavior formation.

Recently, a wider idea, idea of "semiotics" continues to be planned as a replacement paradigm of science within the twenty first Century. It's outlined as a theoretical field that analyzes and develops formal tools of data acquisition, illustration, organization, mechatronicration and improvement, communication and utilization. The practical illustration of philosophical doctrine given in fig. 2, is totally different, (and it's additional descriptive) than of fig. 1 one and, therefore, displays the link between philosophical doctrine and mechatronics. Constant figure, is drawn as a six box diagram, it are often wont to describe the behavior formation of living creatures and mechatronic systems. In every box of fig. 3, constant six-box diagram are often inserted, it indicates a multiresolutional hierarchy.

4. Fuzzy Controlling

The way a FLC works and can be implemented is straightforward and intuitive. On the other hand, the mathematical formulation can be cumbersome. Therefore, the methodology of an FLC will be explained using a highly simplified yet relevant example. Consider a controller with two inputs and one output, as shown in fig. 4. Each input is represented by five triangular MSF's. The specific control task is to send a torque command to an EM, based on a desired torque contribution and the SOC of the supply battery pack. All signals are normalized. The range of the torque signal is between (meaning maximum torque as a generator) and 1 (meaning maximum torque as a motor). The SOC range is between 0 (meaning the battery pack is completely discharged) and 1 (meaning the battery pack is fully charged). The rule base in our simplified example, which represents the control law, has 25 rules (found by multiplying the total number of MSF's of each input). Let us suppose that the actual value of the desired torque and the actual SOC 0.50, as shown in Fig. 6. The two rules that are on are given by the member.

- If is high positive and SOC is medium, and then is positive.
 - If is positive and SOC is medium, then is neutral.

This rule base restricts the actual torque command sent to the EM, considering the SOC of the battery pack. If the battery pack is not completely charged, the torque command is lower than the desired torque to prevent depleting the batteries and damaging the battery pack.

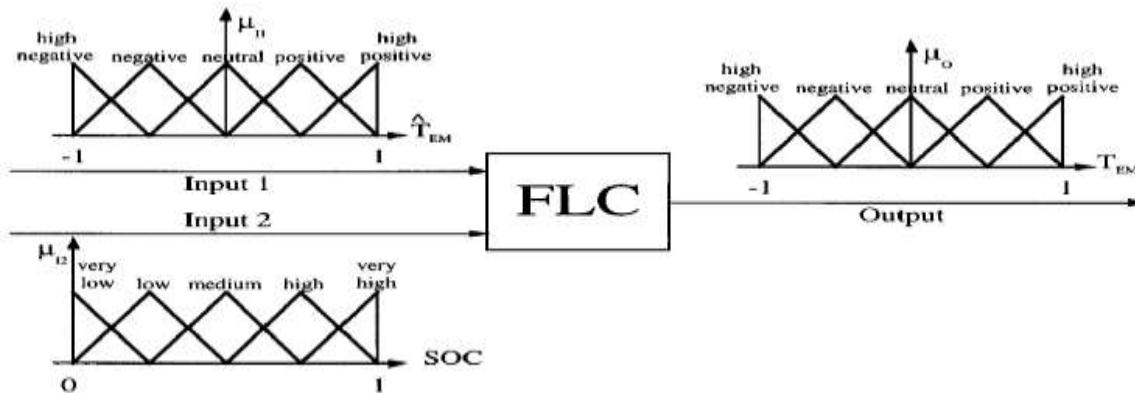


Fig. 4: Membership Diagram

other words, one is 75% certain that the torque value of 0.875 is *high positive*. SOC 0.50 is a member of only one MSF; An SOC of 0.5 is considered to be 100% “medium.” Because of how the MSF’s have been chosen, the degrees of membership for each input must add up to 100%. However, it is possible to define MSF’s of qualitatively and quantitatively different shapes. The next step is the inference process. Each rule is checked for the degrees of membership for the participating inputs. Here, rule 1 says that if is high positive (of which one is 75% certain) and the SOC is medium (of which one is 100% certain), the output has to be positive. In order to determine the degree or certainty with which is a member of the MSF “positive,” the minimum method is applied. That means the minimum of the values of the inputs is going to be the value for the output.

5. Observation

A case study is meted out on c-elegans chromosome-III dataset for the performance analysis. The evaluations were meted out on the longer and shorter super molecule sequences for DNA prediction and retrieval supported the urged and standard approaches. To judge the performance the projected approach is compared with the observations obtained from Rong Sh.et.al. The observations are as printed below.

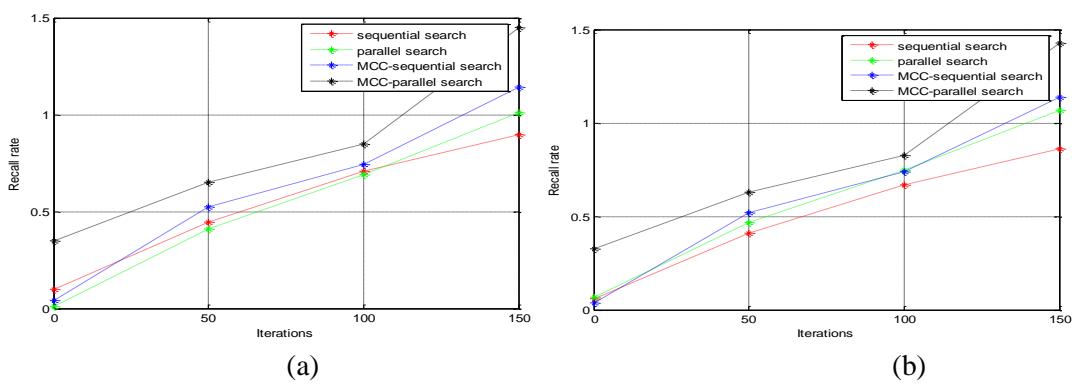


Fig. 5: Iteration v/s recall rate (a) at distortion level of 0.1, (b) at 0.2

The developed GSP application victimisation signal extraction, illustration and MVL computation is meted out below totally different case studies. The observational parameters were the recall rate for the estimation and search time (i.e. total computation time) with regard to variation in iteration count and knowledge density below variable randomness in knowledge illustration. The developed approach is evaluated with the benchmarking approaches of information retrieval

victimisation ordered looking, parallel looking, and projected MCC looking with ordered and parallel search approach. The recall rate with the variation in iteration is illustrated in fig. 5.

The observation is ascertained at Distortion level of zero.1 with knowledge Density of one50 x 104. It might be ascertained from the observation that the recall rate for the mechatronic postulation is improved with the amount of iterations offered to converge. It's ascertained that as in initial case wherever the projected technique shows comparative improvement, at higher iteration the tactic have obtained terribly high variation in recall accuracy as compared to the standard strategies. This observation is thanks to the very fact that, the process knowledge for identical period of time is sort of high in projected MCC approach as compared to standard strategies. An identical observation is meted out for the variation within the original knowledge distortion and also the results obtained are illustrated in fig.6 – 8.

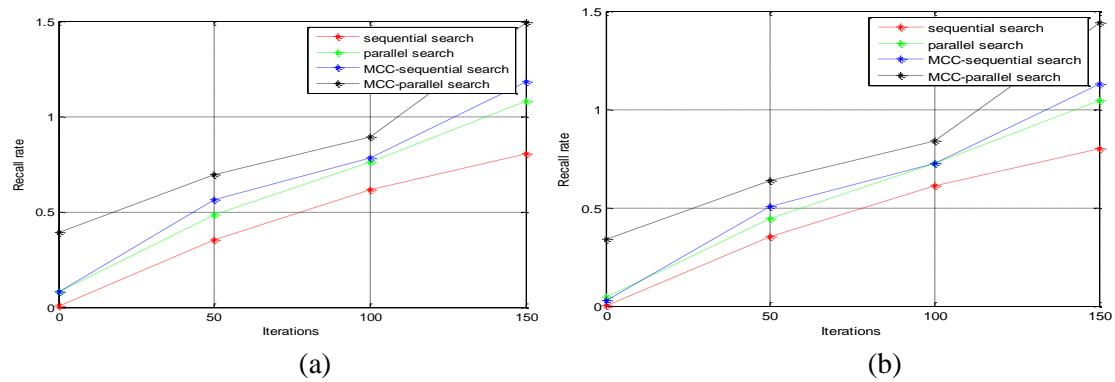


Fig. 6: Iteration v/s recall rate (a) at distortion level of 0.3, (b) at 0.4.

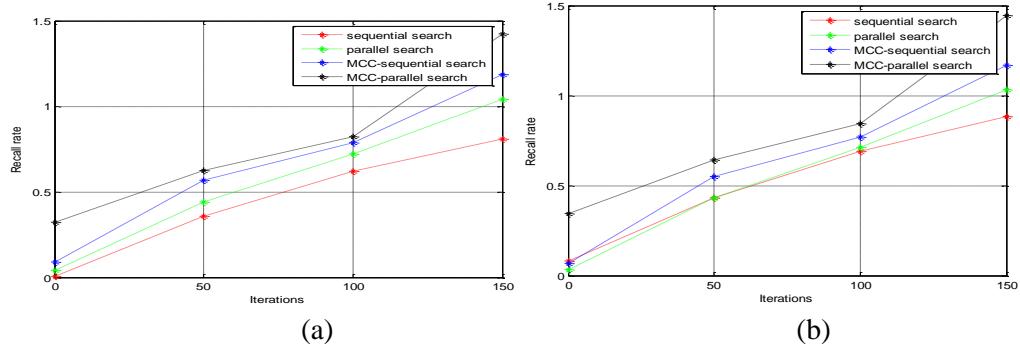


Fig. 7: Iteration v/s recall rate (a) at distortion level of 0.5, (b) at 0.7.

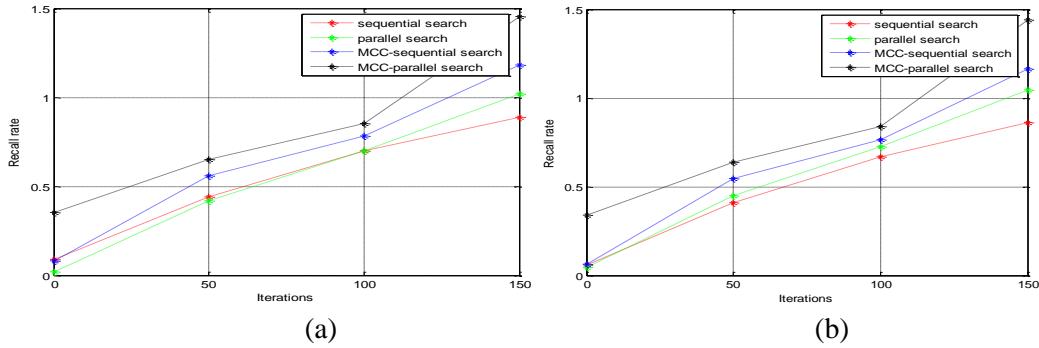


Fig. 8: Iteration v/s recall rate (a) at distortion level of 0.7, (b) at 0.8.

A performance analysis is administrated for the search time taken w. r. t. variation in information density to method. The search time is evaluated for the projected approach over standard approach by varied the entire information within the information to method. The search time is evaluated over a standalone system running with 2GB RAM and Intel PIV processor. From the observations created it's discovered that because the information density will increase within the information base, the search time for question decreases, this search time is kind of low just in case of

projected MCC based mostly looking as compared to the traditional approaches. The search time for system running with MCC in parallel computation takes the minimum time to result than the primitive technique. The reduction within the search time is as a result of the very fact that the increment in information set improves the agglomeration data, and because the availed data will increase the mean cluster distance and variety of knowledge per cluster will increase. This is often handiest just in case of MCC agglomeration. With this approach the observations obtained are a unit illustrated as; the results obtained are illustrated in fig. 9 – 11.

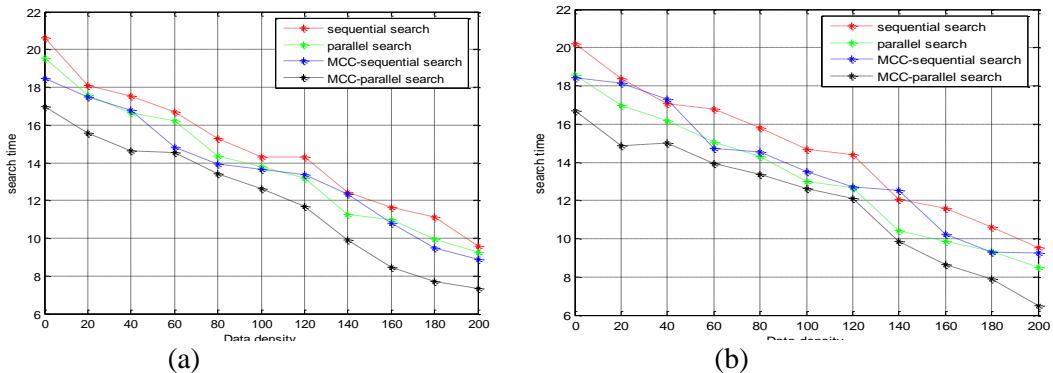


Fig. 9: Data Density v/s search time for the developed methods (a) at 100 iterations, (b) at 350 iterations at distortion level of 0.5.

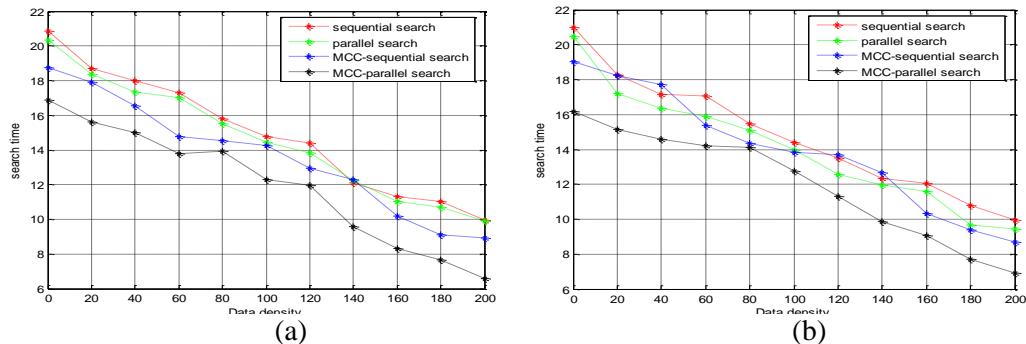


Fig. 10: Data Density v/s search time for the developed methods (a) at 100 iterations, (b) at 350 iterations at distortion level of 0.1.

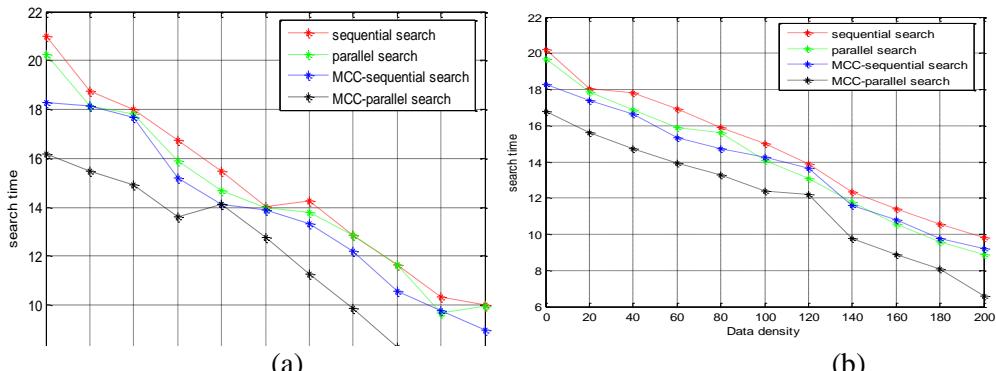


Fig. 11: Data Density v/s search time for the developed methods (a) at 100 iterations, (b) at 350 iterations at distortion level of 0.8.

6. Conclusion

The proposed approach is further evaluated with the evaluation of number of cluster per data base for the developed method with respect to considered search time. In any information retrieving system number of clusters in given observation results in faster computation than the scattered data set. It is hence required to evaluate the performance of the suggested approach with respect to number

of cluster to process. A comparative simulation is carried out to evaluate the search time taken for the proposed method with conventional methods as the number of cluster increases. It is seen that searching time for a mechatronic information within a single cluster is comparatively very time consuming as compared to larger clustering. The obtained comparison results obtained are as shown fig. 12-13 below,

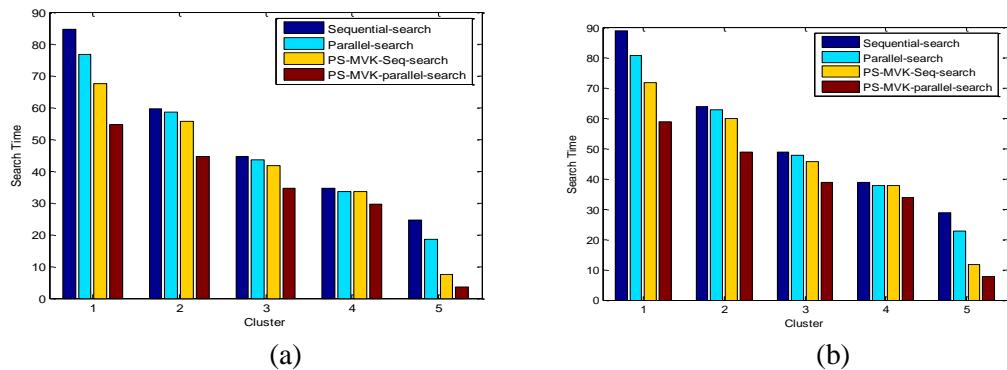


Fig. 12: computation time for searching v/s cluster number at (a) distortion of 0.2 and data density of 250, (b) distortion of 0.4 and data density of 400.

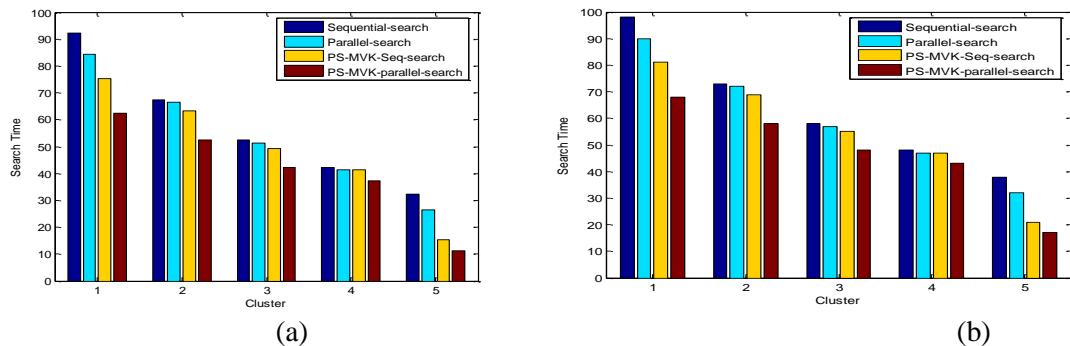


Fig. 13: computation time for searching v/s cluster number at (a) distortion of 0.7 and data density of 900, (b) distortion of 0.8 and data density of 750.

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Effective and Efficient Design for 2D Mesh Network-on-Chip Router

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Abstract

On single chip, Integration of storage and computational block has become viable due to continuous shrinking of CMOS technology. On-chip routers provide necessary routing functionality with low complexity and comparatively high performance, for effective global on chip communication. Designed router gives higher quality performance with reduced area and power consumption. This paper renders complete design and implementation of network on chip (NoC) router architecture. High level of parallelism has been attained by allowing router function for each input port and distributed arbiter which results in low latency, high speed and maximum performance.

This paper presents an On-chip routers design using First In First out (FIFO) buffer. The concept of virtual channels (VCs) is removed from the previous designs by using a systematic flow control scheme that uses the storage already present in pipelined channels in place of direct input virtual channel buffer. The designed router shows power improvement of up to 66.66% with reduced delay of up to 99.80% in comparison with generic router while power improvement of up to 60.48% with reduced delay of 90.88% in comparison with virtual channel router.

Keywords- NoC, VCs, FIFO

1. Introduction

Advancements of deep submicron technology emphasized the necessity of the on-chip interconnects. As diminishing features sizes have led increases in global wiring delays. NoC architectures are look up as possible solution to the wiring challenges. Both NoC performance and energy budget depends mostly on the router buffer resources. Technology scales continuously increasing number of components and complexity for soc design. Commonly used shared bus on chip interconnect is not a good choice for large systems due to global wiring delays, noise, power dissipation and complexity of arbitration. With the advancements in IC technology, the gate delay reduces which lead to relatively increase the wire delay. The wire delay decides the overall performance of the system. Many researchers are trying to solve long global wire problem through the buffer insertion. Many SoCs use a system bus to connect several functional units. SoC system bus can support only limited number of functional units and there may be a scalability problem in heterogeneous multiprocessor system on chip (MPSoC).

In order to solve these long global wire delay and scalability issues, many researchers suggested Packet based communication Network which is known as Network-on-Chip (NoC). NOC is used to connect many functional units (IP) with a universal communication network [1, 9, and 10] global synchronization becomes harder to achieve due to costly clock skew [2, 11]. Under such circumstances, on chip global wires begin to behave like transmission lines, which requires higher power consumption and chip resources in order to meet timing constraints.

To overcome the above problem, here use the communication centric approach to integrate functional elements in complex SoCs. This new design allows the decoupling of the processing element from the network. Therefore global synchronization is not required.

2. Related Works

NoC design assumes data routing network consisting of communication paths and routing nodes to provide a shared, segmented global communication structure within the on chip. Wiring required

to form communication paths is very short because wires have to travel only local distance between routing nodes instead of global distances of an entire on chip system [3].

Buffering is essential in most on-chip routers to provide temporary storage of packets that are in transit, and also helps to control traffic of transmitting data. Buffering is implemented mostly with first-in, first-out (FIFO) memory and can be expensive in terms of area for on-chip application [12]. As storing of packets requires more power in comparison with transmission, so it is better to transmit packets for developing cost effective system, the improved system performance can be achieved by reducing the buffer in quantity and size which reduces area and power consumption. Hence the design consideration focuses on two aspects i.e. Buffer size and the buffering scheme [4].

To minimize the size of buffer, iDEAL (inter –router Dual Function Energy and Area efficient Links) proposed and utilize repeaters with inter router channels as storage units. This design reduces the number of input buffer to half but with the cost of increased latency and complexity [6, 14]. Dynamic buffering resources allocation ViChaR (Virtual Channel Regulator), focused on efficiently allocating buffers to all virtual channels, by deploying a unified buffering in spite of separated buffers with minimum Size [6, 15]. Buffer less routing is another approach which eliminates all input buffers without utilizing channel buffering [6]. The wormhole router splits the packets into several flits which can be transfer in a single transmission. Buffer allocation and flit control are performed in a flit level in wormhole routing since wormhole routing does not allocate available buffers to whole packet [5,6]. Therefore the wormhole routing is a method which can minimize overall latency and may decrease buffer size compared to others. In addition, VCs are used to avoid deadlock problem and thus increase throughput. The main purpose of VCs is to decouple the allocation of buffer space to allow a flit to use a single physical channel and competing with other flits. There are existing two router techniques based on wormhole and other based on Virtual channel as below.

2.1 Wormhole Router- This router is generic NoC router. Wormhole (WH) switching reduces the buffer requirement in each router by dividing packets into smaller segments called flits (flow control units) and pipelining them through the network. The header flit is interpreted and immediately forwarded when there is space for that flit in the receiving router. The remaining flits of the same packet are forwarded in the same way as the header as they arrive [16]. As a result, a packet occupies buffers in several routers and the links between them; hence WH switching increases the level of blockage in the network in case of a stall [10]

2.2 Virtual Channel Router- This switching does not wait for a packet to be received entirely before making routing decisions [16]. Transfer latency can be reduced by interpreting the header as soon as it is available, without waiting for the data payload to be received after the header. The packet is forwarded to the next router only when there is available buffer space for the entire packet, otherwise the packet is buffered at the local node.

2.3 Parallel Computing

The router is the heart of an on-chip network, which performs crucial task of coordinating the data flow. The router operation consists of two basic fundamental regimes first the data path and the second associated control logic. The router is main component for the design of communication back-bone of NoC system. In a packet switched network, the router functionality forwards an incoming packet to the destination resource if it is directly connected to it, or forwards the packet to another router connected to it [4]. In router architectures functional blocks communicate with each other with the help of intelligent switches. Here crossbar is used as switch, crossbar switch provide full connectivity between all available links [12]. Crossbar routes data from input channel to output channel depends on routing decision make by control logic [12]. Crossbar is controlled

by the switch arbiter module [12]. There is a central arbiter which establishes necessary connections between various channels. The bottleneck occurs at the central arbiter, which follows a round-robin approach of service. Theoretically, there are five possible parallel connections out of the total of twenty five combinations in a five port router. This architecture gives high-performance parallel computing systems.

3. Proposed work

Fig.1 shows the block diagram of proposed router which has three main blocks, First in First out (FIFO) buffer, crossbar Switch and arbiter. The Router is packet switched and it provides five input/output ports namely local, North, East, South and West, to communicate with the local logic element and neighboring routers [8]. In proposed architecture, data transfers by segmenting longer messages into smaller data packets, and forwarding these packets individually from sender to the receiver possibly with different routes and delays for each packet. Packet switching offers the potential for scalability.

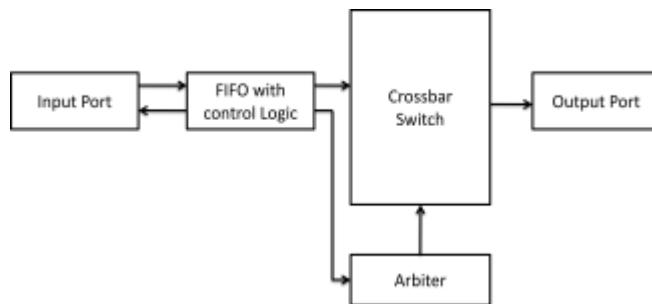


Fig.1 Block Diagram of Proposed Router

Packets are composed of different fields, each field carrying specific information. Here packet size is of 40 bits. The first part is the header which carries three bit source address. Second part is destination address of three bit and remaining bits indicate data portion in which user specify its contents. Packetization of data allow to use wide interconnects for on-chip networks, thus increases the performance.

3.1 FIRST-IN, FIRST-OUT Buffer

In proposed router buffering is required to provide temporary storage of packets that are in transit. There is one input channel at each port, each running its own finite state machine (FSM) control logic. Each input channel has a first in first out (FIFO) buffer of depth 4 and data width of 40 bits and a control Logic which has been implemented as a FSM. Complete transmission of packet occurs if and only if FIFO buffer of that input channel is not full and width of the buffer storage and the on-chip interconnect equal to the packet size. Thereby avoiding the need to transfer a packet in segments [7]. In this manner, the requirement for full packet reception is easily met with reduced complexity. The input channel sets the acknowledge line high, as long as there is a transfer taking place. The packet of data received from the previous router is stored locally in the FIFO buffer thereby implementing a store-and-forward data flow.

3.2 Crossbar Switch

Crossbar switch is designed with 5 multiplexers. A single large crossbar switch is used in this router which decreases router latency. Crossbar switch connects the 5 inputs port to 5 outputs port in a matrix manner. Five, 5:1 multiplexers are used, one at each input to the crossbar. All five inputs to the crossbar is fed to each multiplexer. As five input packets of 40 bits each from five input ports of router, therefore five, 5:1 multiplexers used inside the crossbar. All five inputs are connected to all the multiplexers. Which input is forwarded to the output is decided by the select

lines generated by the control logic of arbiter. Header information of receiving packets will provide arbiter control logic. Outputs of multiplexers are the output ports of router. From that information arbiter computes the number of multiplexer i.e. select output channel. Once multiplexer is selected for outputting data out of router, then three select lines as a input to that multiplexer decides which input will outputted among five inputs coming to that selected multiplexers.

3.3 Arbiter

Arbiter controls the arbitration of the ports and resolves contention problem. It keeps the updated status of all the ports and knows which ports are free and which ports are communicating with each other [8]. Packets with the same priority and destined for the same output port are scheduled with a round-robin arbiter. Suppose in a given period of time, there was many input ports request the same output, the arbiter is in-charge of processing the priorities among many different request inputs. The arbiter will release the output port which is connected to the crossbar once the last packet has finished transmission [8]. So that other waiting packets could use the output by the arbitration of arbiter. In this work, round robin arbitration algorithm use to assign priorities when many input ports request the same output. A round-robin arbiter operates on the principle that a request which was just served should have the lowest priority on the next round of arbitration.

3.4 XY Routing

In XY routing, a packet is forwarded horizontally till the target column is reached and is then forwarded vertically to the destination router. This means that there is no request for the East or West output ports by the North or South input ports. This fact is exploited and the FSMs of the mentioned output channels are simplified, as they need not service the mentioned input ports. This translates to significant area saving and reduction in number of clock cycles in servicing requests. For the implementation of a light weight router XY routing scheme is simple and easy with minimum area overheads and with good level of performance.

3.5. Implementation

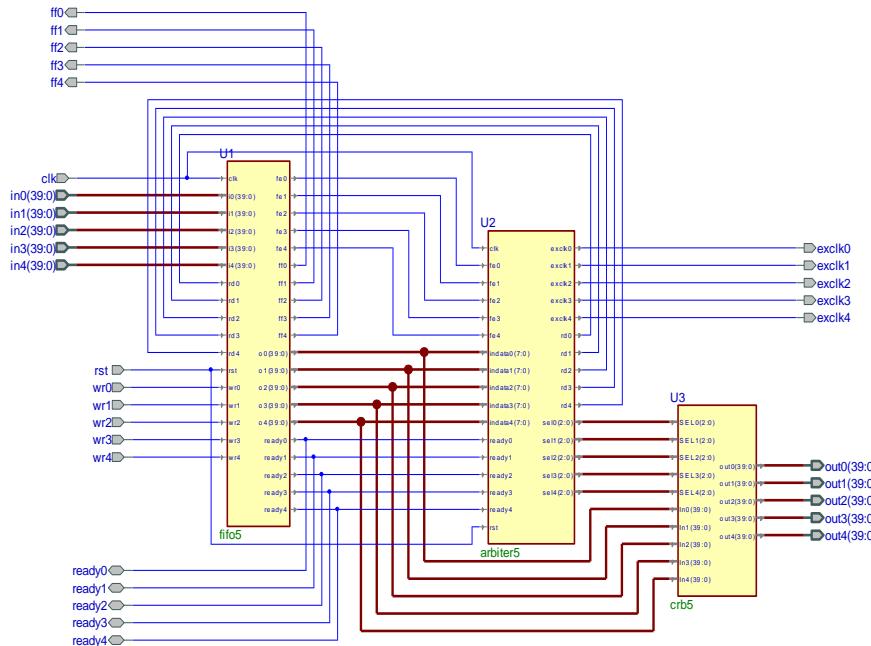


Fig. 2 Main Components of Router Architecture

Design of NoC router with single crossbar architecture has been implemented in verilogHDL and is synthesized for FPGA technology. The router designed consists of four stages; routing, arbitration control logic, crossbar traversal, and four places FIFO buffer for each input channel. The functionality of each stage is replicated at each port to support concurrent connections for overall router. Fig. 2 illustrates the three components that implement the functionality of each stage; crossbar switch, arbitration unit, and four places FIFO buffer.

Five Read signals are generated by considering current status of FIFO buffer signals of that particular port only.

4. Conclusion

NoC router is implemented on FPGA, design and Simulation is done on ActiveHDL 9.3. The design is tested in Synopsys 45nm and 90nm technology and the results are as in table 1

Table 1: Parameters result in Synopsys

Parameters	45 nm Technology	90 nm Technology
Total Cell Area	32464.76 μm	75593.31 μm
Net Switching Power	3.66 mw	954.93 μw
Delay Slack	0.171	0.001

The overall router design provides general Network on Chip support with reduced complexity, thereby achieving area efficiency in conjunction with field programmable gate array device. A Network on Chip Light weight parallel router architecture is implemented on FPGA. For significant area saving, Router has been designed with FSM control logic. A majority of the efficiency for router comes from adaptation of single crossbar design. Such a design allows the switch module to be more area-efficient than other equivalent module. The routing algorithms adapted for crossbar design provide low-complexity implementation of their logic. Complexity is further reduced by using the store-and-forward switching technique. A handshaking signal is used to provide low-overhead link-level flow control for reliable communication between router's ports. FSM description control logic has been used to test the router with different scenarios to ensure correctness. The operational results have shown the functionality of the router to reflect the fact that the router design is suitable not only as an embedded module in future FPGAs, but also as a conventional programmable design in existing FPGAs.

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Towards a Two-tier Context-based Service Discovery Framework for Mobile Web Services

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Abstract

Mobile web services (MWS) enables the realization of a decentralized web service provisioning platform that is powered mainly by mobile devices. This paradigm has, in the last decade, gained research attention because of the growing demands for e-services. However, establishing such an e-service platform faces the fundamental and technical challenge of dynamic context change, which can affect service discovery. Basically, in a MWS scenario, mobile devices are enabled not only as conventional web service requesters but as providers too. Furthermore, mobile environments are prone to changing context. The challenge therefore, is that discovering the right service provider and service are, at any point in time context dependent. This dependence can create a problem where, based on current context, a wrong service provider or service may be chosen or invoked respectively. Consequently, discovery frameworks must be able to support the use of context information to enhance the efficiency of discovering service providers and services in dynamic environments. This paper proposes a two-layer service discovery framework that relies on the resource context of devices to discover the most appropriate service provider and provided service.

Keywords: Device context; mobile web service; relevant service; service discovery; Ubiquitous

1. Introduction

Advancements in the domain of mobile data services has, in part, inspired the current notion of MWS [1]. In the last decade, the MWS paradigm has significantly gained research interests. The paradigm seeks to establish the use of resource-constrained mobile devices as both web service clients and providers while still maintaining the de-facto web services architecture. This interest is being attributed to the strong drive in recent years to achieve ubiquitous computing - a trend that has led to the proliferation of e-markets, supported by the surge in number of fascinating handheld devices, advanced wireless communication technologies and an increasing mobile subscriber base.

For instance, the Juniper Research had forecasted that consumer and enterprise market for cloud-based mobile applications would rise to \$9.5 billion in 2014 [2]. In the same vein, the global wireless subscribers index as at 2008 stood at 2 billion [3]. In fact, by the projection in [4], it is expected that by 2020, mobile devices, MWS and wireless communications will take centre stage in all aspects of live. Owing to the prospect presented by the MWS model, research focus in this domain centres on standardizing MWS provisioning. Such research efforts are reflected in several proposals aimed at developing frameworks that can support decentralized web service hosting and context-based and resource-efficient service discovery [4], [5].

Generally, the insight into the above research direction basically advocates a change in the architecture of cloud and mobile cloud computing (MCC) in order to address challenges fundamental to mobile service consumers [6]. These challenges include, but not limited to lack of or intermittent connectivity, limited bandwidth and high-latency, which results in high energy consumption. Consequently, the emergence in recent years of MCC variances like Ad-hoc Mobile Cloud (AMC) [7], [8], MobiCloud [6], Cloudlets, [9] etc. is clearly driven by the above insight. Therefore, to create a functional model for MWS that can fit into these cloud variances, the last decade has seen a number of MWS discovery

frameworks proposed in the literature [1]. In general, these frameworks have converged research interest centred on easing resource burden and improving service discovery via context-awareness. This paper focuses on the latter research interest and is motivated by the AMC paradigm, which presents an ideal infrastructure-less platform for offering MWS [10]. However, while current MWS discovery frameworks have mainly concentrated only on the client device's context (local context), we argue that achieving efficient MWS discovery requires a more comprehensive device context approach. That is, considering the context of both the client device and the device providing service. The above argument is substantiated by the fact that while a relevant service may be discovered, the context of the service providing device can greatly affect quality of service or the entire discovery process.

For instance, a typical MWS provisioning scenario requires that mobile devices be enabled not only as conventional web service requesters but even as providers. This requirement introduces a two dimensional but interwoven challenge. First, discovering a MWS entails first discovering the right service provider. In the context of this paper, a right service provider is a device (mobile host) that offers the needed service and has the capability in terms of its current context to provide the required service at the time of request. Second, the key resources of mobile devices (battery and memory) are dynamic in nature. Meaning, these resources can change state unanticipated during operation as described in [10]. This inherent nature has phenomenal impact on discovering relevant services or right service providers. Example, a mobile device with a hypothetical battery state, b_k , capable of providing a service at a given time, say t_j , might be incapable of doing so again at a later time t_{j-1} , when the state of the device's battery would have changed from b_k to b_{k-1} . In the same vein, a client device may not be able to consume an offered service if the service fails to fulfil the device's current resource capabilities [11], [12].

Therefore, in principle, a mobile device or node is a composite service – a service that contains a service or services. This consideration raises the need for a service discovery framework that implements context-based two-dimensional approach to MWS service discovery in AMC domain. The framework is aimed at supporting the dual operations of: i) discovery of a node-as-a-service (NaaS) and ii) discovery of the actual web service.

This paper is a response to this need.

2. Related Works

Although the field of MWS is emergent and most research efforts in the domain still at an early stage, current literature reports several state-of-the-art proposals directed at achieving efficient MWS discovery. In all, existing works can be aligned along two research interests, namely: (i) Solving the challenge of resource-burden that may be created by computationally-intensive operations; (ii) Solving the challenge of the effects of context change on discovering relevant services.

In this section, some of the notable works that attempted to address the second challenge are reviewed. This concept of context awareness has been widely employed by discovery mechanisms in mobile environments. Therefore, the work in [8] suggested the need to expand the scope of device context to include resource context in order to consider service relevance as a function of meeting both client requirements and device resource capabilities.

The research work reported in [13] presented an idea of context-based service discovery called device-awareness. The authors' proposal extended the WSDL to make it more expressive to support the incorporation of device capabilities into MWS description. However, their focus did not include device context, in relation to hardware resources such as memory and battery.

In [14], a Cloud-assisted MWS discovery framework was proposed in which the concept of discovery-as-a-service (DaaS) was introduced into the conventional Cloud distribution model. The work dealt with the problem of using various contexts information to tailor and rank MWS. Nonetheless, being a Cloud-assisted discovery mechanism made the challenge posed by the context of the device providing service a nonissue. In the same vein, the authors in [15] presented a Cloud-based framework for discovering MWS in mobile computing environments. In this framework, a keyword-based discovery process enhanced by semantic techniques was adopted. However, the only considered client device's context, namely device profile and environment context. Also, resource context was not investigated.

In our earlier work [10], emphasis was laid on determining service relevance as a function of resource capability of mobile devices that act as Cloud providers. Again, this work did not offer a comprehensive MWS discovery framework that considers a mobile device Cloud provider as a composite service.

Another research reported in [16], presented a context-based service discovery algorithm for mobile MWS. Although all the works reviewed offered MWS discovery solutions that utilize one form of context information or other, none considered a context-based framework that handled both node and service discovery.

Towards creating ad hoc network, several researches have employed Wi-Fi Direct network technologies for supporting multi-hop device-to-device communication [17], [18].

3. Mobile Web Service Discovery Scenario

Conceptually, in a typical MWS provisioning and discovering scenario, the mobile device (node) providing a service is also considered to be a service. That is, a service providing node is a composite service – it contains a service or services. By this concept, the service providing device must be discovered first before the service it offers. This concept, as discussed in section I makes is imperative for MWS discovery process to be structured into two levels:

3.1 Node Discovery Stage

At this level, we introduce the idea of discovering a node-as-a-service (NaaS). This requires that the discovery mechanism be able to search for the device that offers the required service and has the capability in terms of its current resource context to provide the needed service at the time of request.

3.2 Service Discovery Stage

This level handles the discovery of services within a device after a device has been discovered. This level of discovery is challenging due to unpredictable change in resource context. Therefore, it is extremely useful to enhance service discovery using context information. At this service discovery level, resource context is extracted from the client device and incorporated to search queries. Incorporating context information helps to tailor services based on how best the services match the resource capability of the client device.

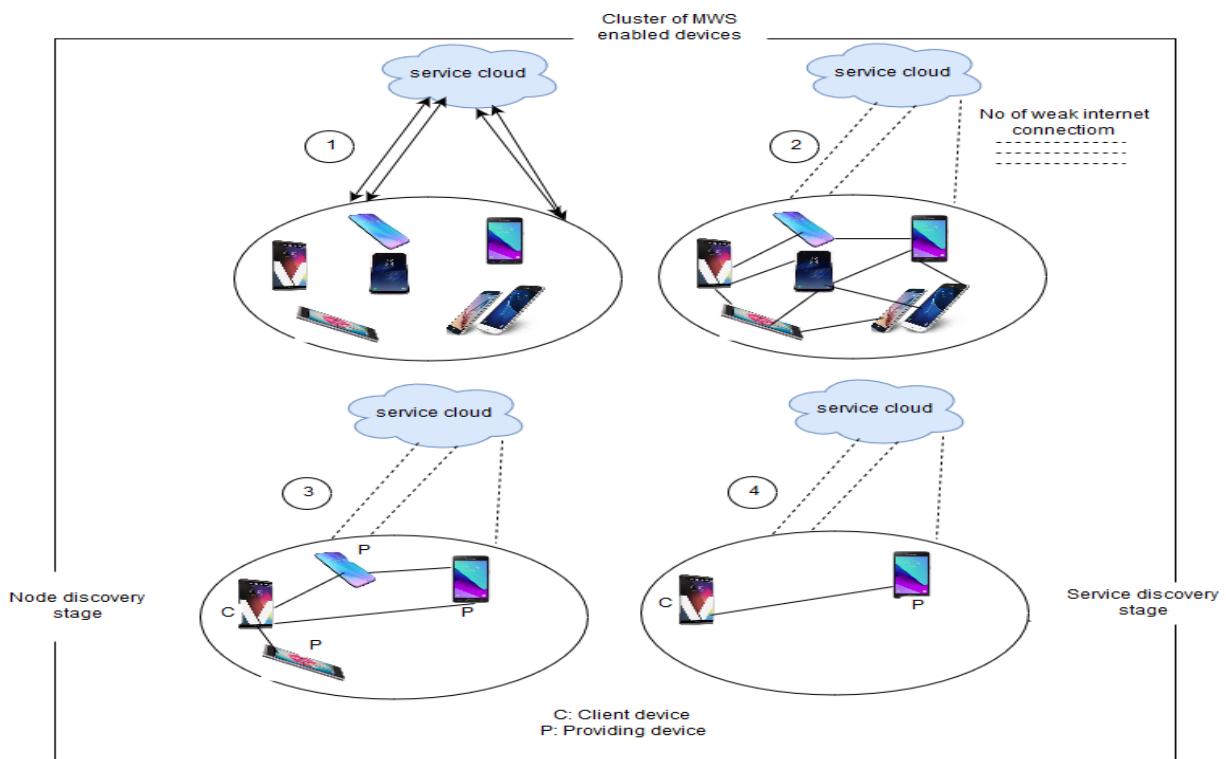


Figure 1: MWS Discovery Process Illustration

Based on the above structure, a typical MWS discovery scenario can be painted diagrammatically as depicted in Fig. 1. This discovery scenario becomes highly imperative in AMC environment where mobile devices exploit a self-organizing network to support direct communication between each other in order to act as cloud providers and or clients [10].

4. Proposed Two-tier Context-based Mobile Web Service Discovery Framework

Based on the MWS paradigm and the concept of composite service, a two-tier context-based framework was proposed for service discovery in AMC environment. The architectural illustration of the proposed framework is given in Fig. 2, showing the components that help to establish effective MWS discovery while utilizing device context.

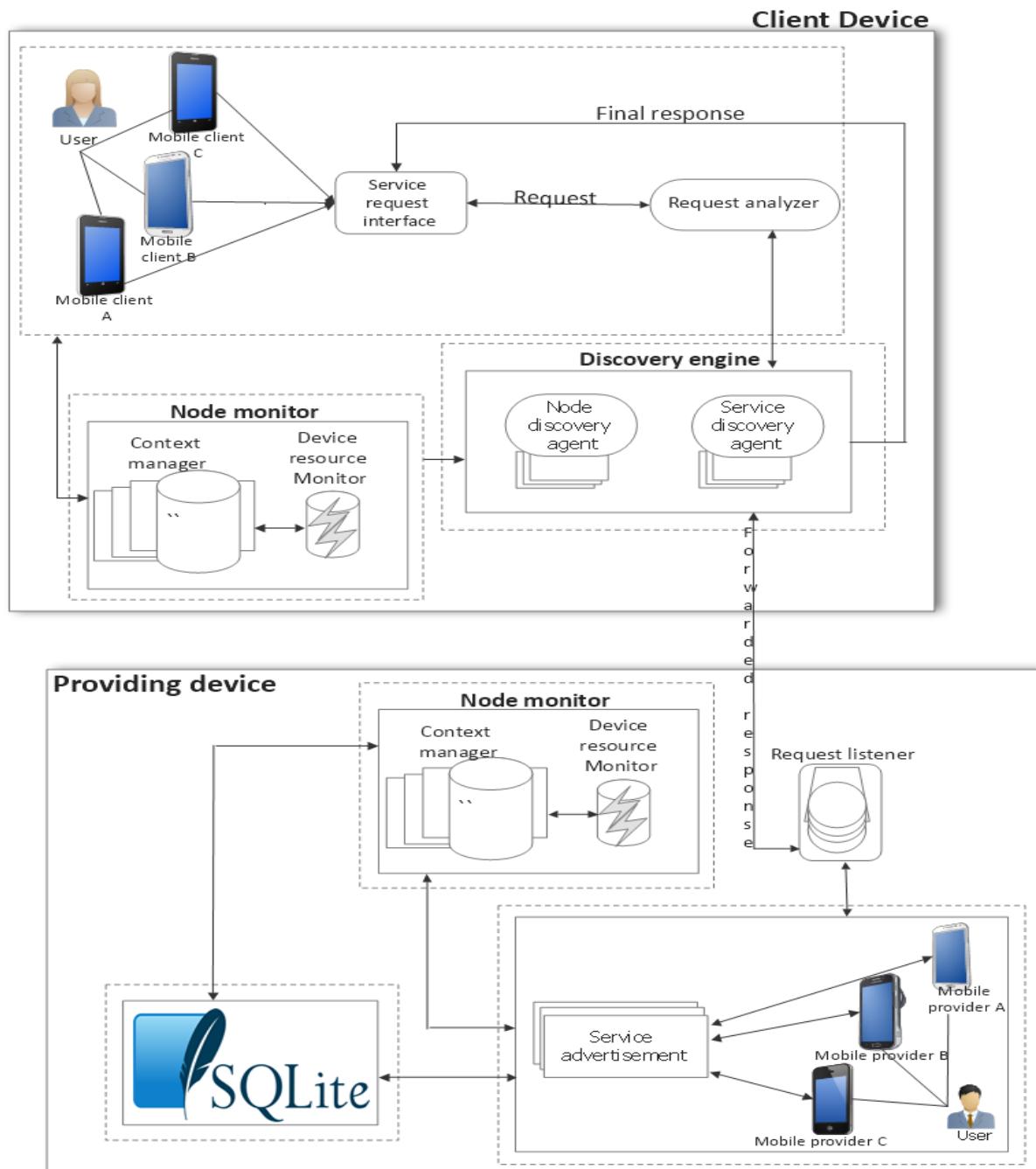


Figure 2: An Architectural Overview of a Two-tier Mobile Web Service Discovery Framework

Basically, every participating device or node has all the supporting components of the framework to be able to function both as client or service provider. However, for clarity in the illustration, the architecture presented in Fig. 2 designates one device as playing the client role while the other takes up the service provider role. Consequently, in each case, only components that support the respective role are in the architecture.

Essentially, there are seven components in the framework:

4.1 Service Request Controller

Service Request Controller (SRC) coordinates and analyzes users' requests in addition to serving as user-client interaction interface. Therefore, SRC consists of two sub components – Service Request Interface (SRI) and Request Analyzer (RA). The SRC component utilizes XML or JSON string (a data format supported by Wi-Fi Direct) to build requesters that are forwarded to the discovery engine.

4.2 Device Monitor

Device Monitor (DM) tracks device resource status - current battery level and available memory, to provide relevant data needed for context-based service discovery. This operation is achieved through the Device Resource Monitor (DRM) and Context Manager (CM) sub components. While DRM helps to poll device resource context data by invoking the FreeMemory() and getBatteryLevel() methods provided in the Android utility functions, CM is responsible for making context information available for the discovery process by interacting with DRM to retrieve these dynamic context.

4.3 Discovery Engine

Discovery Engine (DE) performs context-based node and service discovery operations. To facilitate this process, the DE component obtains context information from the Device Monitor. The DE employs Wi-Fi Direct Device Discovery and Service Discovery methods, defined in the WifiP2pManager class of Wi-Fi P2P APIs [19]. Therefore, DE executes the algorithms that implement the discovery of nodes and services.

4.3.1 Node Discovery Procedure

Definition: Supposed C is a client device, $MWS = \{mws_1, \dots, mws_n\}$ is a set of MWS offered by a service providing node, and $P = \{p_1, \dots, p_t\}$ is a set of service providing nodes. Definition 3.2: Supposed $X = \{x_1, \dots, x_k\}$ is a set of resource status weights, the Resource Capacity Ratio is defined in equation (1):

and the Optimal Node, denoted by N , is the node that offers the kind of service requested and has the highest Resource Capacity Ratio.

The node selection solution can be stated as follows: Given a client, C and a set of service providing nodes, P, select the Optimal Node, N from the candidate set of participating service providers (P) to offer the requested service to the client so that its resources are not depleted while providing a service.

4.3.2 Service Discovery Procedure

Definition: Supposed $DSF = \{dsf_1, \dots, dsf_j\}$ is a set of devices supported features, $MSF = \{msf_1, \dots, msf_i\}$ is a set of MWS supported features.

WSDL-M [11] is adopted, which enables the inclusion of service and device features (additional context information) into MWS descriptions as non-functional parameters.

To determine a match between requested services and capability of the client device, DE compares the service features of each discovered service to the device supported features of the client device, using the Normalized Google Similarity Distance function (f) [20].

For instance, for each retrieved MWS_r, it follows that:

The function f returns a value in the range $x \geq 0.5$ and $x \leq 1$ if there is a match otherwise $x \leq 0.5$.

From equation (2) the degree-of-match is derived thus: $dm = \sum f(msf_{ij}, dsf_j)$, which is a numeric value that indicates whether a returned service has a weak, strong or zero match to the requested service.

4.4 Request Listener

Request Listener Request Listener (RL) listens and responds to incoming service requests broadcast by potential clients within the network. RL component utilizes the broadcast receiver method provided in the Wi-Fi P2P framework to send and receive intents to and from other participating nodes. When RL picks up service request intent, it checks whether the requested service is listed in the service provider's advertisement register and then interacts with the DE component for appropriate action.

4.5 Service Advertisement

The Service Advertisement acts as a quick access register that hold names of the services offered by each service providing node. This register is automatically updated as new MWS are deployed to the mobile host. The resource capacity weight of each device providing services is also held in this register. This weight is used to rate the capability of a device to provide service at any point in time.

4.6 SQLite Database

NoSQL Database
SQLite is an embedded, lightweight database with self-contained library with no server component, and small code footprint. It has limited resource requirements, intended to support resource-constrained devices. This component is used to host MWS and store other forms of static context information.

5. Experiment and Evaluation

A preliminary prototype system was implemented to test the applicability and benefits of the proposed framework. The prototype either executes in client or provider mode and run as a service at the background of the device while utilizing Wi-Fi Direct technology. The implementation was done with Java Language on Android SDK v21. Fig. 3 depicts the service request interface of the framework.



Figure 3: MWS Service Request Interface

A live test-bed experiment was conducted consisting of twenty (20) Android mobile devices, each running the prototype App. The default mode of one of the devices was set to “client”, while the remaining nineteen (19) devices ran in “provider mode”. This setup was meant to enable the device designated as client to execute service discovery in the pool of other devices acting as servicer providers. Each service providing device had at least fifteen (15) MWS. The MWS were represented by service descriptions obtained from online sources and modified based on WSDL-M stored in the SQLite database.

Two set of experiments were conducted. The first investigates the impact of context on node discovery efficiency. This experiment was repeated fifteen (15) times, and at each run of the experiment, two (2) service requests were executed independently – one using resource context and the other without context with the results shown in Table 1 and 2.

Table 1: Resource Capacity of Retrieved Services

Resource capacity ration	Service Request														
	1	2	3	4	5	6	7	8	10	11	12	13	14	15	
Context-based	64.5	69.5	78	83	77	64	88.5	76	57	71	71	66	97	80	
Non-context-based	64.5	29	28.5	77	66	55.5	45	21.5	79	55.5	44	51	80	49	

Table 2: Degree of Match of Retrieved Services

Returned Serviced	Request 1: Device 5	Request 2: Device 15	Request 3: Device 2
Strong match	11	7	10
Weak match	3	5	6
Zero match	0.02	0.03	0.01

The experiment validated the framework’s ability to extract and use context information to achieve effective service discovery in AMC. The demonstration of result in Table 1 and 2 as shown in Fig. 4 and 5 indicates the positive effect of context information on service discovery.

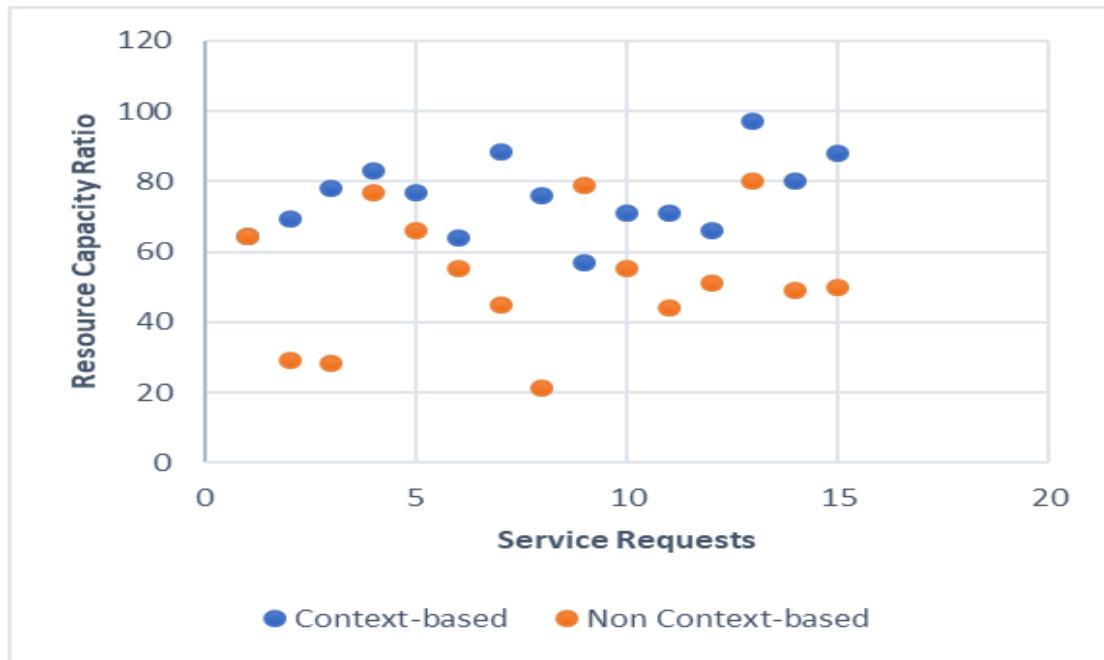


Figure 4: Scatter Diagram Representation of Node Discovery Efficiency

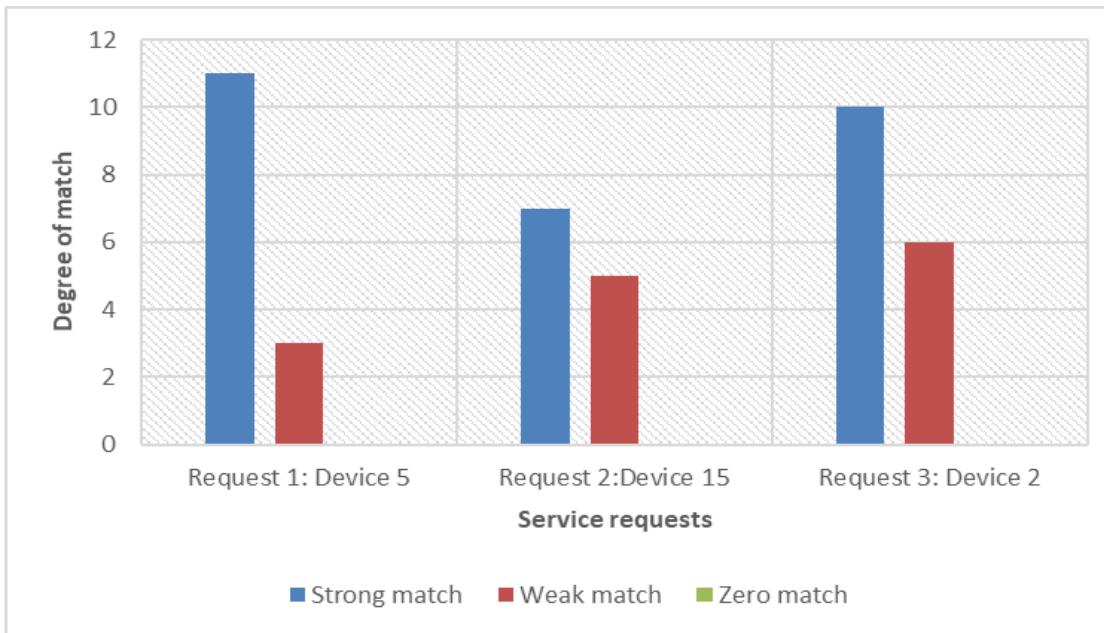


Figure 5: Service Discovery Efficiency

For instance, without context information, as depicted in Fig. 4, there was a high probability of selecting an inadequate service providing with regards to resource capability. However, the reverse was the case when context was employed since all selected nodes had very high resource capability ratio. The second experiment examined the effect of context on service discovery efficiency based on the concept of degree-of-match discussed in section IV. Results obtained indicated that the prototype recorded superior performance with regards to service retrieval. As shown in Fig. 5, out of three requests to three different service providing nodes, a total 42 MWS were returned. Out of these, 28 had strong match while 14 were of weak match and none was a zero-match service.

6. Conclusion

The concept of mobile web services is an emergent e-services paradigm that has, in recent years drawn research attention to the challenge of creating a decentralized and infrastructure-less e-service platform that imports the concepts of mobile cloud computing. To address this challenge, research efforts has also been focused on formulating discovery mechanisms that takes cognizance of the inherent nature of mobile environments, such as dynamic context. In this paper, a two-tier context-based MWS discovery framework was presented. A preliminary prototype was developed to evaluate the framework with regards to impact of context information on efficient service discovery. Though the prototype development is ongoing, initial results demonstrated that using context led to efficiently discovering services that match client capabilities.

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IoT for Development of Smart Public Transportation System: A Systematic Literature Review

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Abstract— Internet of Things (IoT) is a platform where the device used to be smart, everyday is processed to be smarter, and every day communication becomes more informative. IoT is still growing and continues to be researched by some researchers. Various models, platforms and applications are proposed and designed in such a way as to benefit society. This paper was developed using the systematic literature review (SLR) method by conducting surveys on issues oriented towards the utilization of IoT related to the development of intelligent public transport. The architecture presented proposes solving real-life problems by building and disseminating powerful ideas. The purpose of this study is to explore opportunities and challenges for the application of IoT on public transport. the results of this study show that IoT utilization till now tends to give priority to safety in avoiding road accidents but has not yet discussed how intelligent transportation system can be developed by integrating bus scheduling, bus presence detection, and payment efficiency by passengers by booking seat system so that minimize congestion and reduce wasted time passengers. this research proposes breakthroughs incorporating the concept of the Internet with the integration of platforms of industrial actors involved in order to harness the power of IoT for various conveniences especially in the field of public transport and produce intelligence transportation system which is one of the smart city concept indicators.

Keywords: Internet of Thing, intelligence transportation system, smart transportation, public transportation, smart city, integration of Platform.

1. Introduction

The progress of information technology in IoT development is very influential on the various aspects of human activities. The paradigm of the IoT provides a reference to connect all physical objects in the global Internet base as well as the existing infrastructure for information and communication exchange. IoT aims to support rapid and precise identification such as location tracking, monitoring and management. Therefore, IoT is based on multiple integration of communications solutions, technology identification and tracking, sensor networks and actuators, and sharing of other information distribution [1].

According to Chen [2], IoT Architecture network consists of several layers such as layers of sensing, access layer, network layer, middleware layer and application layer. The application layer integrates the functions of the lower system, and builds practical applications from various industries, such as smart grid, smart logistics, intelligent transportation, precision farming, disaster monitoring and remote medical care.

The main function of IoT is to collect data measured by sensors that are already integrated into short-range wireless networks such as Bluetooth, ZigBee, or Wi-Fi, which then transmit data to larger networks such as Internet network gateways [3]. IOT sensors use relatively low cost, scalable, efficient, low-power, and integrated data across all sub-networks. The more sensors that are combined and the increasing time of data collection the data will significantly become larger and known as the "Big Data". Big Data was

introduced by Gartner Report in 2001 [4] and has three dimensions covering 3Vs: Volume, Velocity, and Variety. This definition has been rewritten and reasserted by others to include the fourth V: Veracity [5]. In short, IoT provides means of data collection, detection and monitoring of events, algorithms for acting on an activity, data storage and analysis of large.

From several papers, the authors observed and found that most researchers tend to use and utilize IoT on passenger safety, so they focus more on features that help control drivers in driving the bus, monitoring bus lines and utilizing radio signals and LAN networks and other applications to maximizing IoT functionality on transport. The goal is to minimize the occurrence of accidents. But what about passenger comfort in choosing public transportation? Inspired from the public transport navigation system [6][7][8], The purpose of this research is to know the opportunities that can be used to maximize IoT function on public transportation. if previous researchers have made a monitoring system for bus travel, bus scheduling as well as early detector of the accident then this research tries to explore opportunities that can be obtained and used to produce a better public transportation system. Based on this, the research question is what the IoT function can be used for smart public transportation?

2. Related Work

According to the autoidlabs quoted from Xian, Internet RFID (Radio Frequency Identification) to achieve intelligent recognition and network management. was first proposed by the Auto-ID lab at MIT (Massachusetts Institute of Technology) in 1999. Its main support technology is wireless sensor networks and radio frequency identification technology [2]. according to Mazhar, Intelligent transportation is one component that is an important part of smart city. Meanwhile, good vehicle traffic information is one of the most important sources for smart cities [9].

According to Panchal [10] designing a wireless network using IEEE ZigBee technology more responds to emergencies and informs the right individuals in a timely and cost-effective manner. Greater transport efficiency and most importantly increased safety in driving [11]. According to Tibor [12] that successfully simulate the research, the results of his study is to reduce congestion and generate a rapid response to the information of an accident that occurred. The beaconing frequency of a 1 Hz roadside unit was enough because the infrastructure managed to inform all information related to the vehicle that had an accident on entering the intersection [12]. Krishna using the Accelerometer as a car alarm application so that it can detect drivers who drive badly and harm. As well as a vehicle rollover detector [7].

According to Brian [13] Public transport systems play an important role in the fight traffic congestion, reducing carbon emissions, and promoting a compact and sustainable urban community. The rapid growth of technology and infrastructure has made our lives easier [8]. According to Stefan [6] Public bus services are widely used in cities around the world because it is cost-effective and economical. However, from the point of view of the passengers of the city bus This system can be complex and difficult to navigate. Their research earned Urban Bus Navigator (UBN), a navigation system for bus passengers with the ability to recognize and track physical transport infrastructure such as buses. One of the key technologies of IoT is RFID technology (Radio Frequency Identification, radio frequency identification) originating from the early 40s, which is mostly used on aircraft in fighter and other aircraft. After several decades, RFID can be used for production management, safety, transportation, logistics management, and other fields[14]. RFID on transport is used as one of the passenger detection devices in the bus. IoT can connect with billions of smart devices with embedded systems. As a result, the IoT will greatly increase its size and scope, providing new ways of opportunity, as well as challenges [15].

Based on some literature this research find idea to integrate some application in one platform. Incorporating several technologies that support the use of IoT already used in the modern public transport concept.

3. Proposed Work

This paper uses the methodology systematic literature review [16] to review existing literature related to IoT for public transportation, security in public transportation, and time efficiency. This study conducts a thorough literature review of studies on IOT utilization on public transport. This is the process of determining the source of the research used, which determines the keyword pattern for the

paper search process, initiates inclusion and exclusion criteria, data mining, and analysis of findings for answer research questions.

A. Search Process

The first process is to determine the literature source to find the appropriate articles / journals.

Sources selected for systematic literature review are as follows:

1. IEEE Xplore Digital Library (<http://ieeexplore.ieee.org>)
2. Direct Science (www.sciencedirect.com)
3. Springer Link (link.springer.com)
4. Emerald Insight (www.emeraldinsight.com)
5. Google Scholars (<https://scholar.google.co.id>)
6. Wiley Online Library (onlinelibrary.wiley.com)
7. ACM Digital Library (dl.acm.org)
8. Elsevier (<https://www.elsevier.com/>)

The search mechanism inclusion criteria consists of three filter processes. The first is the search process. All documents we find from source publications related to the specified keywords will be saved as Founded Studies. After that, the next step we filter the paper according to title and abstract. If the title and abstract are free and suitable for determining research questions, then this paper will be stored as a "Candidate Study". Then the final section to filter these writings is that all candidate documents will be read thoroughly to answer research questions. If the letters are appropriate to answer the research question, the paper will be defined as "Selected Studies".

The applied keyword pattern for finding research papers relating to this research was made using the Boolean operator to filter the data, so it can be specified priority to search data based on the symbol used. Boolean symbols and operators used in this paper, such as OR, AND. Combination of keywords are as follows:

- (Internet of thing OR IoT) AND (public Transportation OR intelligence transportation system) AND (smart transportation OR public transportation)
- (internet of thing OR (IoT) OR (public AND transportation) OR (smart AND transport)) AND (IoT OR RFID)
- (public AND transport) OR (RFID AND key IoT)) AND (intelligent OR transportation)
- (internet of thing OR smart transportation) AND (smart cities OR transportation)
- (IoT AND transportation) OR (smart tranport OR Sensor RFID)

The inclusion criteria of searching mechanism consist of three processes of filter. The first is "Founded Studies" process. All of the papers we found from source publication related to the specified keyword will keep as Studies Found. After that, the next step we filtering the paper according to the title and abstract. If the title and abstract complimentary and match to define the research question, then this paper will keep as "Candidate Studies". Then the last part to filter these papers is all of the candidate papers will be read thoroughly to answer the research question. If the papers are appropriate to answer the research question, those papers will be defined as "Selected Studies".

Meanwhile to clarify the validity of literature, the exclusion criteria of searching is defined into some procedure, which are:

- a. This paper is based on the date of their publication between 2010-2018
- b. Structure of the paper complete, which means all identity (journal/conference, identity of author, etc) is mentioned in the paper.
- c. Duplicate paper of the same study is excluded in SLR

B. Data Extractions

The study literature was examined 105 papers from all resource and criteria. From 105 examined papers, there are 53 papers which being to be candidate studies based on related title and abstract to the research question. After studied further, there are only 32 papers which can be used in this research.

Table 1.
Number papers in selected sources

Source	Founded Studies	Candidates Studies	Selected Studies
IEEE	10	2	0
Science Direct	46	16	11
Springer	2	1	1
Emerald	8	2	0
Google Scholar	22	14	8
ACM	8	6	6
Wiley	10	6	1
Elsevier	8	6	5
Total	105	53	32

C. Result and Discussion

This study aims to investigate the extent of IoT utilization on public transport and what kind of model is appropriate for countries with relatively high levels of congestion such as in Jakarta. The tendency towards high congestion that was also identified to have impacted the accident-induced mortality rate resulted in some findings of the model differences on the use of IoT public transport. Based on this, this research will be identified as a new model on IoT transport by adding new features.

C.1 Demographic and trend characteristics

C.1.1 Publishing outlets

As shown in Table 2, this shows the title, type, and sorting in the year of publication.

Table 2.
Source of Publication

Title	Tahun	Type
OneBusAway ...[13]	2010	J
Micro-Navigation ...[6]	2014	C
An IoT Based ...[7]	2015	C
IOT based Smart ...[17]	2016	C
IoT Based Vehicle ...[8]	2017	J
Research on ...[14]	2012	J
An Internet-of-Things (IoT) ...[3]	2016	J
Experiences Creating a ...[18]	2016	C
A Proactive Complex ...[19]	2013	J
An IoT enabled ...[20]	2013	J
Efficient Graph ...[9]	2015	J
Internet Of Things ...[21]	2015	J
Intelligent Transportation ...[22]	2015	J
Developing a Nova ...[23]	2014	J
Internet Of Things ...[24]	2013	J
Collaborative real-time ...[25]	2010	J
Implementing the ...[26]	2014	C
Application of Internet ...[27]	2017	J
Internet of Things Based ...[28]	2018	J
A DNS Architecture ...[29]	2013	J
Reducing driver's ...[30]	2016	J
A survey on Internet ...[31]	2016	J
Use of IoT Technology ...[32]	2016	J
A prototype IOT ...[33]	2017	J
Computer Modelling ...[12]	2017	J
A Survey On Iot ...[31]	2015	J
Demand for Agent-Based ...[34]	2016	J
Management ...[35]	2016	J
Transportation Model ...[36]	2013	J
Energy Efficient ...[10]	2017	J
The Internet of Things ...[37]	2010	J
Ravel: Programming IoT ...[38]	2015	J
Total : 32 papers		

C.1.2. Most prolific authors

As seen from the writer's analysis perspective, there are 94 authors who have written 32 papers in total. There is no consistent author in writing about the use of IoT on public transport. All these authors wrote 1 paper each, as shown in Table 3. The data in table 3 provides information that there

are still many opportunities that can be used to maximize the IoT function of public transport.

Table 3.
Most prolific authors

Authors	#	%	Authors	#	%
Anand Paul	1	0,01	Dhananjay Singh	1	0,01
A. Anusuya	1	0,01	Dijana Capeska Bogatinoska	1	0,01
A. Rakotonirainy	1	0,01	Dimosthenis Kyriazis	1	0,01
Abderraffiaa Koukam	1	0,01	Dr. Thyagaraju G S	1	0,01
Aishwarya S.R	1	0,01	Dr.J.R.Panchal	1	0,01
Alan Borning	1	0,01	Dr.K.Venugopal Rao	1	0,01
Aleksei Sebastiani	1	0,01	Dr.R.N.Panchal	1	0,01
Anant Dattatray awasare	1	0,01	E Krishna Priya	1	0,01
Andreas Menychtas	1	0,01	E. Hajrizi	1	0,01
Anitha Chepuru	1	0,01	Felix Wortmann	1	0,01
Ansar-Ul-Haque Yasar	1	0,01	E Krishna Priya	1	0,01
Antonio Iera	1	0,01	E. Hajrizi	1	0,01
Antonio Marcos Alberti	1	0,01	Felix Wortmann	1	0,01
Arnav Thakur	1	0,01	George Kousiouris	1	0,01
Ashish Rai	1	0,01	Gerd Kortuem	1	0,01
Awais Ahmad	1	0,01	Giacomo Morabito	1	0,01
Bill Karakostas	1	0,01	Gwanggil Jeon	1	0,01
Brian Ferris	1	0,01	HMT Gadiyar	1	0,01
Charitha	1	0,01	J.Sherly	1	0,01
Cheng-Ming Chang	1	0,01	James Hong	1	0,01
D. Gruyer	1	0,01	John J. Lee	1	0,01
D.Somasundareswari	1	0,01	Jonghoon Kim	1	0,01
Dan D. Koo	1	0,01	K. Banupriya	1	0,01
Kari Watkins	1	0,01	S Umamaheswari	1	0,01
Karl Ernst Ambrosch	1	0,01	Samar El-Amine	1	0,01
Kristina Flüchter	1	0,01	Savitha S.C	1	0,01
Laurynas Riliskis	1	0,01	Sheng-Wen Hong	1	0,01
Li Kexin	1	0,01	Shian-Shyong Tseng	1	0,01
Linbing Wang	1	0,01	Stefan Foell	1	0,01
Luigi Atzori	1	0,01	StéphaneGalland	1	0,01
M. Deebika	1	0,01	T. M. Anand	1	0,01
M. Mazhar Rathore	1	0,01	Theodora Varvarigou	1	0,01
Marcus Handte	1	0,01	Tibor Petrova	1	0,01
Marty Humphrey	1	0,01	U B Sujit	1	0,01
Mayra Samaniego	1	0,01	Umer Iqbal	1	0,01
Milan Dadoa	1	0,01	V Mythra	1	0,01
Mingquan Wang	1	0,01	Vishal Chandrasekaran	1	0,01
Murilo Frônio Bassora	1	0,01	Wei Zhang	1	0,01
Niederauer Mastelari	1	0,01	Wei-Hsun Lee	1	0,01
O. Orfila	1	0,01	Wern-Yarg Shieh	1	0,01
P Manju	1	0,01	William Tärneberg	1	0,01
P.P. Ray	1	0,01	X. Krasnici	1	0,01
Pedro Marrón	1	0,01	Xian-Yi Chen	1	0,01
Philip Levis	1	0,01	Yinning Zhang	1	0,01
Prasanth M.A	1	0,01	Yongheng Wang	1	0,01
RalphDeters	1	0,01	Yucheng Huang	1	0,01
Raul Mariano Cardoso	1	0,01	Yue Hou	1	0,01
Reza Malekian	1	0,01	Zhi-Gang Jin	1	0,01
Reza Rawassizadeh	1	0,01	Total Authors : 94 authors	94	

C.1.3. Most productive institution

Most of the sources of papers that I use, published in indexed journals. This explains that an in-depth study has been done by the authors for this transport IoT. The most productive institutions are M S Engineering College and K.L.N. College of Information Technology (India) with 5 and 4 papers respectively, followed by Univ. Bourgogne Franche-Comté, AGTI's DACOE, IUPUI, Kumaraguru College Of Technology, Queensland University of Technology, Stanford University, State University of Campinas, The Open University of Milton Keynes, University of Duisburg-Essen, University of Žilina, UST Global paper each. The rest generally produce two and one paper each. Detailed data can be seen in Table 4. There is a difference in the number of papers in this table (89) as compared to Table 2 (32). This The problem occurs because one paper can be written by more than one author from a different one institution.

Table. 4
Most productive institutions

Institutions	#papers	%
University of Washington	1	1.12%
Univ. Bourgogne Franche-Comté	3	3,37%
AGTI's DACŒ	3	3,37%
Arizona State University	1	1.12%
Bentley University	1	1.12%
Chinese Academy of Sciences	2	2.25%
City University London	1	1.12%
DIEE, University of Cagliari	1	1.12%
ETH Zurich	1	1.12%
G.Narayananamma Institute of Technology and Science	2	2.25%
Hainan University	1	1.12%
Hasselt University	1	1.12%
Hunan University	1	1.12%
Hwa Hsia University of Technology	2	2.25%
Incheon National University	1	1.12%
Instituto Nacional de Telecomunicações	1	1.12%
IUPUI	3	3,37%
K.L.N. College of Information Technology	4	4.50%
Kumaraguru College Of Technology	3	3,37%
Kyungpook National University	1	1.12%
Lund University	1	1.12%
M S Engineering College	5	5.62%
National Chiao Tung University	1	1.12%
National Technical University of Athens	2	2.25%
NTUA	1	1.12%
Polytechnic Institute and State Univ	1	1.12%
Queensland University of Technology	3	3,37%
Sikkim University	1	1.12%
SNS College of Technology	2	2.25%
St. John's University	1	1.12%
Stanford University	3	3,37%
State University of Campinas	3	3,37%
The Open University Milton Keynes	3	3,37%
Tianjin University	2	2.25%
University "Mediterranea" of Reggio Calabria	1	1.12%
University Of Business and Technology	2	2.25%
University of Catania	1	1.12%
University of Duisburg-Essen	3	3,37%
University of Foreign Studies Global Campus	1	1.12%
University of Information Science and Technology St. Paul the Apostle	1	1.12%
University of Piraeus	1	1.12%
University of Pretoria	2	2.25%
University of Saskatchewan	2	2.25%
University of Science and Technology	1	1.12%
University of Science and Technology Beijing	1	1.12%
University of St. Gallen	1	1.12%
University of Virginia	2	2.25%
University of Zilina	3	3,37%
UST Global	3	3,37%
Virginia Polytechnic Institute and State Univ	1	1.12%
Total institutions : 50 institutions	89	

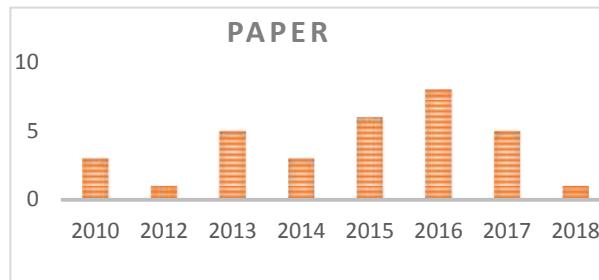
Table 4 informs the University of the authors. Table 5 informs the year of paper publishing. Based on the data it is known that in the year 2016 is the year where the researchers are focusing on IOT transportation. Although such a decline in interest in the next year but this is likely due to the occurrence of different interests. Where in 2017 their focus is to use IOT for other fields one of them is the health field.

C.1.4. Publication trends

Although not too significant but based on table 5 it is known that the interest of researchers to increasingly cultivate IOT especially for transportation is increasing. We can conclude that the convenience and safety in using transportation is of more concern than the researchers in addition to the safety of passengers and drivers. Frequency of papers published between 2010-2018 can be seen in Table 5. At most years the earnings are 2015 (six papers) and 2016 (eight papers). In 2017 IoT utilization is more to the Vehicle Tracking and Accident Detection System [17], Seating Status Monitor System [27], traffic information monitoring [39], intelligence transportation system[12],

shifting in 2018, where IoT began to be utilized as Internet Based Solution for Road Safety and Traffic Management in Intelligent Transportation Systems [28].

Table 5.
Publication Year



C.1.5. Authors Country

Table 6 informs the author's home country. Most researchers come from India and followed by United State. This shows that this data is significant with the country's condition, where the researcher focuses on public transport IOT in accordance with the country's population-densely populated state.

Table 6. Author Country



Based on Table 6 it is known that India is the country with the highest level of research for IoT utilization for transportation. Particularly in some of their research focus papers is the utilization of IoT on public transport. How about Jakarta? Jakarta has a very high traffic jam every day. Densely populated areas with central government resulted in high numbers of congestion. The government provides public transportation facilities namely Trans Jakarta. Currently available Trafi application that can help passengers in seeing the routes as well as Trans Jakarta bus stop stops. But this application has not provided a feature that allows passengers to know the existence of the bus as well as predictions of bus arrival at the desired stop.

C.1.6. Authors academic background

Table. 7 shows that most of the authors have an academic background in Technology Information and computer science. Meaning the researchers have the ability in the field of information technology and this is of course help researchers to further explore the utilization of IOT technology which can then be developed with other technologies such as machine learning.

Table 7.
Author Academic Background

Dicipline	#	%
Blavatnik Interdisciplinary Cyber Research Center	1	5%
Civil & Environmental Engineering	1	5%
College of Information Science and Engineering	2	9%
Department of Computer and Communication	1	5%
Engineering	1	5%
Department of Computer Applications	1	5%
Department of Computer Science	4	18%
Department of Computer Science and Engineering	4	18%
Department of CSE	3	14%
Department of Electrical and Information Technology	1	5%
Department of Electrical, Electronic and Computer	1	5%

Dicipline	#	%
Engineering		
Department of Electronics Engineering	1	5%
Department of Embedded Systems Engineering	1	5%
Department of Information Management	2	9%
Department of Information Technology	4	18%
Department of Marketing	1	5%
Department of multimedia and information-communication technologies	3	14%
Dept. of ECE	5	23%
IT Dept	2	9%
Laboratory on the Interactions Vehicles	1	5%
School of Applied Science & Technology	1	5%
School of electronic and information engineering	2	9%
The School of Computer Science and Engineering	3	14%
Total	45	
<i>Department Grouping</i>	#	%
Communication	4	8.89%
Computer science	15	33.33*
Engineering	6	13.33%
Interdiscipline	1	2.22%
Management	3	6.67%
Technology information	16	35.56%
Total	45	

C.1.6. Keywords analysis

Table 8 lists related IoT studies utilization of IOT in public transport. This keyword finds 32 papers in eight sources. Among the data, it can be seen that the most frequently used is 'internet of things', 'intelligence transportation system', 'smart transportation' and followed by 'RFID'. In other papers found other keywords that overlap.

Table 8.
Most frequently used keywords

keywords	#papers							
	IEEE	science direct	springer	emerald	google scholar	ACM	wiley	elsevier
Internet of things transportation	0	0	0	0	1	0	0	0
public transportation	0	1	0	0	0	0	0	0
internet of things RFID	0	1	0	0	0	0	0	1
IoT smart transportation	0	0	0	0	1	0	0	1
iot public transport	0	0	0	0	0	2	0	0
internet of things intelligence transportation system	0	9	1	0	0	4	1	5
iot intelligence transportation system	0	8	1	1	4	3	0	5
internet of things smart transportation	0	8	1	1	5	3	0	5
iot smart transportation	0	0	0	0	1	0	0	1

The main purpose of this paper is to maximize IoT functionality with an integrated platform. We have applied the SLR methodology to identify the IoT functionality that has been used on public transport in 32 selected papers from 105 papers found. The focus of research and analysis lies in the issue of technology used. five important components of technology in IoT utilization have been tried and will be further developed by integrating on a platform using smartphone applications.

Table 9. IoT function can be used in smart public transportation

component technology on the IOT
smartphone application[40]
RFID[41][17][14][42]
GPS[14]
Bus Navigation[6]
Wireless Sensor[39]

With IoT functionality that can be used in intelligent public transportation as shown in table 9, better public transport systems such as passenger information systems are waiting at the bus stop and on the bus (passenger count system) with a usable payment method with several bank options. According to findings on publicity trends, this research can also be developed into an intelligent public information system of information. Smartphone apps can be used. RFID can be used to scan passenger id codes when boarding a bus. GPS and wireless sensors can be used as Bus Navigation.

4. Conclusion

Based on the analysis of some literatures used, the authors know that most of the researchers focus more on IoT utilization as a medium in monitoring the moving objects. Especially for transportation, IoT utilization using wifi or sensors that will monitor and provide a signal as useful information as a precaution before the occurrence of a condition that will result in an accident. While some authors also explain that IoT can be used. This is more functional for drivers and road managers for both personal and public transport drivers. Need other features that can be used by passengers and drivers to monitor each other conditions during the trip. Such as scheduling process of arrival, departure, availability of bench, and prediction of traffic jam in the streets. Based on this, this study recognizes that there are still many opportunities for developing smart and smart transportation systems to maximize IoT functionality by integrating existing platforms.

According to the SLR Program here, there are some functions of IOT that can be used on smart public transport. Based on 32 papers, the SLR found that there is still an unused IOT function that is online payment function. Public transportation has become a necessity of society so it is expected better improvement. increased knowledge in the field of IoT is also the reason why this research should continue to be developed further. This study aims not only to assist academics and researchers in the study of IOTs on public transport but also to assist government and industry. Increased knowledge in the field of IoT is also the reason why this research continues to be developed further. In the modern era, a large number of heterogeneous objects has been connected to the internet, referred to as Internet of things (IoT). In 2008, the CISCO report showed that the number of devices connected to the internet is more than the number of people living on earth. While in 2020, it will touch the 50 billion limit, which resulted in a remarkable increase in the digital world [CISCO, “The Internet of Things, Infographic”, May 24, 2015]. IOT on public transport but also to assist government and industry. This is because intelligent and intelligent public transport procurement requires the cooperation and comprehensive support of all sections, governments, industries and communities involved. In another aspect, IoT plays an important role and improves the quality of human life in health care, automation, and transportation, emergency response to man-made, and natural disasters where it is difficult for humans to make decisions. Moreover, most countries have implemented national strategies for the use of IoT at the service level. For example, Japanese broadband provides facilities accessing communication between people, people and objects, objects and objects [Srivastava, Lara. “Japan’s ubiquitous mobile information society”. info, vol. 6, no. 4, pp. 234-251, 2004.]. Similarly, South Korean smart homes allow their citizens to access long-distance goods [Giroux, Sylvain, and Hélène Pigot. From Smart Homes to Smart Care: ICOST 2005, 3rd International Conference on Smart Homes and Health Telematics. Vol. 15. IOS Press, 2005]. This is because the procurement of smart and intelligent public transportation requires the cooperation and comprehensive support of all involved sections, government, industry and society.

5. Limitation and Future Research

The limitation of this research is the absence of an integrated system in the platform. All researchers designed and recommended public transportation monitoring and monitoring systems. The priorities and focus of their research are limited to the security of public transport use. What about passenger needs? The future of this research will be developed by adding other features, such as bench locking system by first registering or paying online so that while on the bus, passengers need to scan the received code when making payment using RFID technology. The model to be developed is platform integration by utilizing IoT technology that can be used by passengers to search for public transportation schedule, choose the route to be used, choose bus and choose bench or place that is still available until payment process before boarding. bus. Passengers will be comfortable and save waiting time. By using the prediction feature of bus arrival then passengers can also wait according to bus arrival time. Efficient and very effective. Next research will be combining IoT technology, RFID, bus presence detection, bus scheduling monitoring and booking seat with online payment. The model will be developed will

combine the interests of industry in the government environment such as cooperation with all banks recognized by the government and the ministry of transportation and smart city managers.

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Cardiovascular response to simulated real and non-real life stressors - A comparative case study using heart rate variability and personality traits in a physically trained group

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Abstract

Heart rate variability (HRV) is often used as a reliable, noninvasive, objective measure of acute and chronic psychological stress. Studies on acute stress response usually involve the application of a stressor for inducing stress and then assessing the changes HRV in the participants. For this purpose, laboratory simulated, real life stressors and non-real life stressors are commonly used in different contexts. The suitability of various stressors in inducing remarkable stress response in different categories of participants is not well addressed. While enough attention has been paid to patient population and normal adults, studies on stress response characteristics in physically trained groups is not much undertaken. This study examined the cardiovascular response of a group of physically conditioned female participants, who have undergone nine months of aerobic conditioning, to an acute non real life stress and a simulated real life stress. The objective was to identify the better stressor in terms of adequacy in eliciting the stress response in a physically elite group. The stressors used were Stroop's color word test (SCWT) and a modified version of Trier's social stress test (TSST). Further the association of Eysenck's personality traits and the vulnerability to stress is also investigated in the same group. Results revealed that there was negligible physiological response in the recruits with the non-real life stressor. On the other hand, noticeable response was elicited by the simulated real life stressor. Also, the self-reported extraversion personality trait showed significant negative association with the stress response as measured by RMSSD ($\rho = -0.376$, $p = .042$), SDHR ($\rho = -0.566$, $p = .003$), correlation dimension D2 ($\rho = -0.314$, $p = .077$) and Sample entropy SampEn ($\rho = -0.416$, $p = .027$). The results established the supremacy of TSST as an acute psycho-social stressor in physically trained subjects. Further, the recruits who were socially confident exhibited least vulnerability to the acute simulated real-life stressor. Results have the potential of influencing the decision making in selection and training of recruits in high stress profession.

Keywords: Heart rate variability, linear and nonlinear features, psycho-social stress response, personality.

1. Introduction

Stress in all forms has been recognized as the leading cause of mortality world-wide (World Health Organization, 2011) and is manifested as a decreased ability to organize

resources to meet the demand put on an individual. Psychological stress culminates in cognitive disorder, cardiovascular dysfunction [1, 2] and is one of the first cause of poor performances on the work place and in daily life [3]. Mental stress disturbs the Autonomous Nervous System (ANS), which controls our ability to respond to internal and external challenges [4]. Majority of the objective studies on psychological stress is carried out by externally distressing the participant and then analyzing the physiological stress response such as heart rate variability (HRV), Skin conductance (SC), Blood pressure regulation etc. Low reactions to induced stress are generally found associated with lower risk for stress-related diseases [5, 6]. It is obvious that the effectiveness of each stress induction methods requires special attention, especially when physically trained subjects are monitored, as physically conditioned subjects are believed to be resilient to acute mental stress [7, 8, 9].

A personal factor that has received continued, albeit modest, attention in exercise and health psychology across the years is personality. Stress is a highly personalized process, not a simple, stimulus-response reaction. During exposure to an acute stressor, there exists an interaction between the individual and the environment, involving subjective perceptions and assessment of the stressor. Specific inherited characteristics, life experiences and learned cognitive predispositions make individuals more or less susceptible to the effects of stressors. While a number of studies have attempted to elucidate the pathways of personality and stress reaction, the results are inconsistent and the findings still not generalized.

1.1 Mental stress and Heart rate variability

The ANS plays a major role in modifying the heart rate according to the various demands put upon a healthy individual, while maintaining homeostasis. Among the two branches of ANS, the parasympathetic division is primarily involved in relaxation, helping the body to rest and recover. The sympathetic division prepares the body to fight or fly in response to stress by accelerating bodily functions. Both physical and mental stress are physiologically manifested in normal people as an increase in sympathetic cardiac control, a decrease in parasympathetic control, or both. As a result of the stress reaction, the flexibility of ANS is disturbed, resulting in the increased rate and force of contraction of the heart. This in turn reduces the variability or the capacity of the cardio-vascular system to adapt to the changing environment. It is well known that, general health is affected negatively by long-lasting sympathetic activation and slow recovery of the stress systems [10].

Heart rate variability (HRV) is a non-invasive tool for the assessment of variations in the beat-to-beat cardiac control of autonomic nervous system (ANS). HRV has extensively been studied in regards to exercise [11, 12] and stress [13]. Uusitalo et al. [13] reports lower work related stress in workers with high HRV. Systematic reviews on acute mental stress assessment via short term HRV analyses in healthy adult human sample support the fact of distinct HRV profiles in different states of the ANS [6]. A number of researchers have even successfully attempted to discriminate the states of ANS in stressful states from relaxed states [14, 15, 16]. Reports on health disparities in populations that are confronted with the recurring stress of everyday life [17] highlights reduced HRV as one of the bio-markers of this problem. Increased HRV has been related to reduced risk of the cardiovascular systems and greater adaptation to aerobic training [18]. Regular physical activity is also found associated with greater emotional resilience to stress [19]. The literature unanimously emphasize that physical conditioning potentially enhances HRV control on stress response [20].

HRV is usually evaluated in time domain and frequency domain to estimate the linear components of variability. More than 70 variables can be calculated from HRV analysis [21, 22], out of which the variables of interest in psychophysiological research [23] are shown in TABLE I. The time domain measures of HRV are based on either statistical or geometrical analysis of the HRV signal. Frequency domain measures usually estimate the spectral power in various bands of interest. A set of nonlinear features are also calculated in specific applications to describe the complexity of the HRV signal. Approximate entropy (ApEn) developed by Pincus [24] and sample entropy (SampEn) developed by Richman and Moorman [25] are two popular nonlinear complexity index used to quantify the randomness or irregularity of the HRV time-series. Detrended fluctuation analysis (DFA) is another technique used to determine the short term (dfa1) and long term (dfa2) correlations within the HRV signal. It also quantifies the nonlinear fractal scaling properties of HRV time series. SD1 and SD2 as obtained from Poincare plot quantify the short and long range variability of the HRV signal [26]. The factor d2 is a measure of the dimensionality of a set of random points that occupy the space.

Table 1: Summary of HRV features used

Domain	No:	Feature	Description
Time	1	HRVTRI	HRV index from NN interval histogram
	2	MeanHR (bpm)	Mean Heart Rate (bpm)
	3	MeanRR (ms)	Mean interval between QRS peaks
	4	NN50	Count of Normal RR intervals (NN) > 50
	5	pNN50 (%)	Proportion of NN50 divided by total number of NNs
	6	RMSSD (ms)	Root Mean Square of the Successive Differences
	7	SDHR (bpm)	Total variability in heart rate
	8	SDNN (ms)	Total variability in NN interval
	9	TINN	Triangular interpolation index of NN intervals
Frequency	10	pHF	Power of high frequency band(0.15 Hz - 0.4 Hz)(ms ²)
	11	pLF	Power of low frequency band(0.04 Hz - 0.15 Hz)(ms ²)
	12	LF/HF	Sympathovagal ratio
	13	TP	Total power of the FFT spectrum (ms ²)
Nonlinear	14	ApEn	Approximate entropy
	15	d2	Correlation dimension
	16	dfa1	Detrended fluctuation short term scaling exponent
	17	dfa2	Detrended fluctuation long term scaling exponent
	18	SampEn	Sample entropy
	19	SD1 (ms)	Poincare plot short term variability dimension
	20	SD2 (ms)	Poincare plot long term variability dimension

1.2 Mental stress and personality traits

Some individuals are inherently hypo- or hyper-reactive to general forms of stressors [27, 28]. People highly reactive to mental stress appear to be highly reactive to physical stress also [29]. Resilience and vulnerability to stressors as well as intensity of stress response are greatly dependable on the numerous characteristics of personality. For candidates vulnerable

to stress, prolonged stress with insufficient recovery lead to the development of adverse psycho-physiological health outcomes in future, through the defined physiological pathways related to cardiac regulation by the autonomic nervous system [30]. Personality and heart rate variability (HRV) are each strong predictors of psycho-physiological stress, cardiac health and longevity. There is evidence that high extraversion and low neuroticism are important personality characteristics to work and perform well under stressful conditions [31, 32]. Systematic and significant associations between personality traits and HRV at baseline are reported in literature [33]. This association is expected through the modulatory influence of brain structures implicated in personality. Eysenck, who developed the influential extraversion-neuroticism model, hypothesized neuroticism to be linked to high sympathetic and low parasympathetic activity leading to low thresholds for emotional responses [34, 35]. Thus individuals high in neuroticism are prone to experience stress. Extraversion, on the other hand, is hypothesized to be linked to low activation and high thresholds in the limbic system, leading to attenuated responses to emotional challenges [36, 34]. Although progress has been made in establishing the biological bases of personality [37], studies on physiological correlates of personality are still scarce and inconclusive [69].

1.3 Mechanisms of inducing psychological stress

A deep probing into the stress research has revealed that, real life, simulated real life and non-real life stressors are commonly employed to study the stress response. Fernandez et al. used simulated vehicle driving situation for evoking stress response. Whereas Healy et al. [38] studied cognitive stress response in vehicle drivers engaged in real-world driving using HRV and multiple physiological signals. Few other HRV based studies employed non real time cognitive stressors such as Stroop's color word test (SCWT). Examples are studies by Salai et al. [14], Karthikeyan et al. [39], Lambiase et al. [40] and Roemmich et al. [41]. Stroop's colour word test is an effective non real-time stress stimuli frequently used in the laboratory stress research [42, 9]. Authors like Salai et al. [14] obtained significant change in majority of time and frequency domain HRV features. Karthikeyan et al. [39] reports 79.17% discrimination accuracy between stress and relaxed states using time and frequency domain HRV features. In SCWT studies on patient population, the low HRV groups represented a low degree of neuro-visceral integration [43].

Few others like Melillo et al. [15] and Tarion it et al. [44] have used academic examination as real life stress induction method. A number of studies have also used psychosocial stress test such as Trier's social stress test (TSST) along with heart rate (HR) and HRV as psychophysiological indices of stress and vagal influence on stress reaction [45]. Trier's social stress test, extremely modifiable to the needs of the researcher, with strong neuro-physiological stress reactions is a well-recognized laboratory stressor with real life characteristics [46, 47].

An overall reduction of HRV have been reported for acute stressors such as mental arithmetic, reaction time tasks, Stroop interference task, or speech stress [48, 49, 50], real-life acute stressors such as college examinations [51] and road driving tests in general population. But very few studies have systematically attempted to compare the effect of more than one stressor in well trained healthy participants. While different mechanisms of inducing stress in individuals are reported in the literature, the suitability of a particular stressor in different categories of participants are not addressed well. Comparable effects in laboratory simulated social stress test and real-life stress has been demonstrated by Rajcani et al. [52]. They found analogical findings in stressful days during every-day life to laboratory stress protocol. They also demonstrated stronger effect of simulated real-life stress than real life stress. To the best

of our knowledge, except for the above mentioned study, a quantitative analysis using reliable and objective markers of stress on the effectiveness of an induced stressor, in a physically well-conditioned group is not carried out so far.

1.4 Objectives of the study

It is comparatively easy to induce stress in unhealthy subjects. Healthy individuals, who are supposed to have high vagal tone and highly adaptive ANS, can blunt the stress response and produce little or no effect, if the stressor is not adequate. While the SCWT is widely used to measure cognitive stress; it is rarely seen in real life. TSST on the other hand is a standardized simulated real life-like psychosocial stressor. The main objective of the present study is to test the adequacy of the two well-known stressors, the SCWT and TSST, in a sample of healthy and physically well trained subjects using measures of HRV. The other objective is to elucidate the association between the Eysenck's three factor personality traits with the stress reactivity.

2 Methodology

2.1 Sample

The participants were 27 women candidates. The mean height and weight of the participants were 58.4 Kg and 159 cm respectively. The average age of the participants was 27. All of them have completed rigorous physical training of aerobic type, uniformly for a duration of 3 hours weekly, except on Sundays for the previous nine months. The deliberate training was undertaken in the training camp of Kerala Police academy, under close observation of professional trainers and superior officers. None of the participants were suffering with medical conditions such as diabetic mellitus, hypertension, cardiovascular abnormalities or psychiatric depression. All the participants were instructed to be free from all sort of hardcore physical activities for 36 hours prior to the experiments.

2.2 Experimental design

The objectives and procedures of the study was explained to the participants clearly. Voluntary written informed consent was also collected from all participants. The procedures had been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. The Ethical clearance for the study was obtained from Jubilee Mission Medical College and Research Institute, Thrissur, Kerala. The data acquisition conditions such as time of the day and the sequence in which the participants turn up for the induction of stress were maintained the same for both stressors. Recruits were informed to refrain from drinking coffee and engaging in hard physical activity before the stress tests.

Preparations for ECG acquisition: Recruits were called upon to the recording room in turn. They were comfortably seated in rest for 30 minutes and disposable ECG electrodes were attached to the limbs of the subjects in lead II configuration. ECG was recorded for 5 minutes under spontaneous breathing condition before and during the stress induction. ECG signals were acquired by Vernier EKG sensor unit. The sensor unit was interfaced with a

myRIO™ (National Instruments). This re-programmable hardware unit was so configured to collect data from two analog input channels simultaneously at a sampling rate of 500Hz. Thus two recruits were monitored simultaneously, so as to save the total experiment duration, with one awaiting for the stress and other under stress. These two recruits were physically separated from each other by the walls of the waiting room and testing room.

Induction of non-real life stress: SCWT is a quick and easy to administer stress stimuli with high validity but rarely seen in real life. Immediately after the awaiting period the subjects were provided with a computerized version of 5 minute run of SCWT. The Participants were given color words written in color and are asked to indicate the color of the word (not its meaning) orally as fast as they can without making errors. The test displays congruent and in-congruent color-word combinations randomly in the computer monitor. For these random trials of color-words, an observer had to hit appropriate keys in the computer key board. This ensured muscle noises from hand movement of the participants are absent in the ECG signals. Simultaneous with the test, ECG was recorded and mean reaction time and performance of the subjects were noted down after the test. Mean reaction time is the average time elapsed for each recruit before hitting the correct key in response to the SCWT.

Induction of simulated real-life stress: A modified version of TSST was employed to evoke the social interaction stress and social evaluation threat among the recruits. The test composed of 5 minutes for relaxation and 5 minutes for a speech session and a mental arithmetic task. Upon arrival to an interview panel comprised of 5 superior officers (3 members anonymous to the trainees), they were demanded to introduce themselves and support with facts about their suitability for the law enforcement profession. Once half the test time is over they were given a mental arithmetic problem of serial subtraction which they had to repeat from beginning if a mistake is made. ECG was recorded and the performance was evaluated for each subject.

Personality profiling of the participants: The most popular and highly established, model of personality is the Eysenck's three factor model. It includes neuroticism (ie, tendency to be emotionally unstable, anxious, self-conscious and vulnerable), extraversion (ie, tendency to be sociable, assertive, energetic, seek excitement and experience positive affect) and psychotism (ie, risk taking, impulsiveness, irresponsibility, manipulativeness, sensation seeking, toughmindedness and pragmatism) traits to describe the various dimensions of personality. Personality assessment via the Eysenck's personality inventory consisting of 90 items with a binary scale is a usual profiling mechanism employed in the police training academies in Kerala. We hence used the Eysenck's inventory for assessing the personality traits of the participants. The scores over the three scales were then standardized and tabulated for further analyses.

2.3 Signal analysis

The ECG signals obtained for the two sessions were cleared of baseline wander and other noise interference for QRS complex detection. The interval between each QRS complex was verified for managing asystole, extra-systoles or misplaced heart beats using a 20% filter. The filter removed relative RR intervals which differ at least 20%. The HRV signal was then derived from beat occurrence instances of successive normal - normal QRS complexes. The

Task Force of the European Society of Cardiology and North American Society of Pacing Electrophysiology recommends analyzing HRV signal in time, frequency and complex domains [53]. To investigate the HRV in the frequency domain, each tachogram was interpolated to obtain equally spaced samples, which were then re-sampled at a rate of 4 Hz. RR interval signals contain baseline wandering, which results in inaccurate frequency analysis. The HRV signal was hence de-trended using db06 wavelet denoising technique and removed the trend below 0.015 Hz. Welch's periodogram with a Hamming window ($N = 512$) and 50% overlap was used for the estimation of power spectral density. The ranges of the spectral components used were: HF component 0.15-0.4 Hz and LF component 0.04-0.15 Hz.

All the pre-processing of the ECG signals were carried out using the ECG Feature Extractor VI and the HRV analysis is carried out using HRV analyzer application of the NI LabVIEW 2015.

2.4 Statistical analysis

Paired sample t-test was used for the comparison of mean stress responses in each case. As a first step, the test for normality was carried out for all measures of HRV to qualify the features for t-test. The features were found normally distributed except frequency domain measures. The frequency domain parameters were hence transformed to the natural log scale. The personality traits also exhibited non-normal distribution. Hence the association of personality and stress response were evaluated with Spearman's correlation (ρ) analysis. An alpha level of .05 was used for all the analyses.

3 Results and discussion

TABLE II shows the results of physiological response in SCWT and TSST. The level of significance in mean difference of HRV parameters at pre-stress and during stress is also tabulated.

TABLE II: Descriptive statistics of HRV parameters of both stress sessions (mean \pm S.E)

	Pre TSST	TSST	Sig	Pre SCWT	SCWT	Sig
MeanHR	77.5 \pm 2.854	88.968 \pm 3.575	0.001	69.629 \pm 7.73	74.785 \pm 8.753	0
MeanRR	808.415 \pm 29.337	711.865 \pm 30.833	0.009	881.51 \pm 101.358	821.734 \pm 98.058	0.767
NN50	109.875 \pm 14.209	79.584 \pm 12.898	0	123.643 \pm 56.482	116.965 \pm 62.117	0
pNN50	33.388 \pm 5.061	22.114 \pm 4.355	0.331	37.738 \pm 19.3	33.355 \pm 19.68	0.096
RMSSD	74.944 \pm 10.342	55.259 \pm 7.849	0.028	67.804 \pm 32.055	65.55 \pm 33.208	0.439
SDHR	7.03 \pm 0.986	6.853 \pm 0.432	0.019	5.369 \pm 2.596	5.362 \pm 1.516	0.29
SDNN	61.79 \pm 6.589	49.063 \pm 5.317	0.005	54.882 \pm 21.564	54.337 \pm 20.551	0.038
TINN	348.125 \pm 30.313	222.114 \pm 4.355	0	345.472 \pm 32.514	467.583 \pm 48.325	0.61
HRVTRI	13.075 \pm 1.2	79.584 \pm 12.898	0	12.19 \pm 2.236	16.68 \pm 4.1	0.055
pHF	2042.538 \pm 613.998	1149.243 \pm 362.875	0.013	1793.274 \pm 895.509	1690.573 \pm 738.645	0.6
pLF	1614.501 \pm 316.83	994.819 \pm 177.703	0.001	1514.653 \pm 664.987	1360.472 \pm 396.325	0.509
LF/HF	1.632 \pm 0.279	1.443 \pm 0.171	0.587	1.307 \pm 0.973	1.351 \pm 0.814	0.316
TP	849.472 \pm 941.427	2255.954 \pm 526.525	0.2	3503.323 \pm 4440.517	3151.529 \pm 3542.693	0.891
ApEn	1.157 \pm 0.019	1.173 \pm 0.017	0.028	1.161 \pm 0.057	1.178 \pm 0.073	0.75
SampEn	1.67 \pm 0.047	1.543 \pm 0.063	0.743	1.843 \pm 0.218	1.806 \pm 0.258	0.3
d2	2.515 \pm 0.38	2.004 \pm 0.318	0.732	2.949 \pm 1.601	2.56 \pm 1.837	0.585
dfa1	0.937 \pm 0.051	0.995 \pm 0.049	0.11	0.88 \pm 0.182	0.896 \pm 0.222	0.906
dfa2	0.408 \pm 0.035	0.423 \pm 0.027	0.17	0.322 \pm 0.099	0.281 \pm 0.084	0.376
sd1	53.076 \pm 7.327	39.129 \pm 5.561	0.265	48.018 \pm 22.706	46.417 \pm 23.521	0.909
sd2	67.739 \pm 6.281	55.82 \pm 5.535	0.458	60.411 \pm 21.852	60.465 \pm 19.518	0.076

3.1 Stress response in TSST

During TSST, HR increases, variability in time and frequency domains is reduced and complexity of the HRV time series is reduced in comparison with the pre-stress period. There is significant change in all time (except pNN50) and geometrical indices. The observation of increased heart rate is in agreement with other studies who used TSST as a stress induction method [54, 55]. In the frequency domain, except TP and LF/HF, the other variables differ significantly. In the frequency domain HRV parameters, vagal withdrawal during stress has leads to a significant reduction of power in both the bands ($p = 0.013$ for pLF and 0.001 for pHF). Similar results are obtained by Tharion et al. [44], Papousek et al. [56] and T. Marcello and A. Cataldo [57]. LF/HF ratio is generally seen increased during stress, but it is noticeable that the sympathovagal balance as measured by LF/HF is found decreased in our results. But the reduction in LF/HF has not differed up to a level of statistical significance under stress. Although a shift in autonomic balance is observed, it is not remarkable enough. Regarding the nonlinear indices, none of the HRV metric exhibited a significant reduction. Even though a direct comparison is not meaningful, due to the differences in the methodology and participant characteristics, Vuksanovic et al. [58] have observed significant reduction in SampEn and significant increment in dfa1 in a mental arithmetic task of serial subtraction. Melillo et al. also obtained significant reduction in the complexity of HRV signals during real life examination stress [15]. Both the studies do not report about the physical characteristics of the participants, except that they are healthy. Hence it turns out that physical activity level also could be an important factor to be considered in stress induction methods.

3.2 Stress response in SCWT

Overall the results of SCWT suggest parasympathetic dominance in the recruits even under stress. Except for MeanHR, NN50 and SDNN, none of the time HRV metrics at stress showed a significant change from rest. Similarly, none of the frequency domain features or nonlinear features showed a significant change. The results are in objection with the much reported results of SCWT on general samples. One of the reason for the contradictory finding could be the well-conditioned ANS of the participants due to the physical training.

The mean RT for the participants to respond to the congruent and in-congruent trials of SCWT is also analyzed, as there are reports suggesting possible association between HRV, working memory, performance and response control [9, 59, 60]. The reaction time (RT) is the time that elapses between a color-word stimulus and the motor response to hit the response key. It is usually on the order of 200 ms [61]. The mean RT in our case turned out to be 127.85 ms, much better than the general average. But our study, irrespective of showing an insignificant suppression in HRV, did not reveal any relevant bi-variate associations with mean RT. But it is noteworthy that the associations were in the expected direction, with high HRV connected with low mean RT and vice-versa. This different results on reaction time also could be due to the physiological modification of the ANS due to physical training. To reinforce the current knowledge, further studies are to be taken up, in cross-sectional design using trained and untrained participants.

It is to be noted that, as it is hard and extra stressful to perform both attention and speech tasks with respiration controlled simultaneously [62], breath rate of the participants was not

controlled. Depending on the breathing pattern, numerical values of pHF may be different. But correcting for respiratory frequency in healthy subjects does not appear to give a better estimate of vagal activity [63, 64]. Also other studies [65] have demonstrated that respiration is not related to HRV at rest in healthy participants. During both the sessions of stress induction, the rate of respiration is assumed to be a function of the appropriately perceived stress. So the pHF results are to be interpreted, keeping this aspect in mind.

3.3 Comparison of stress response in both stressors

A comparison of the stress response in both the stressors is tabulated in TABLE III. The table shows the paired mean difference of the stress response in SCWT and TSST along with the 95% upper and lower confidence interval and significance of the difference. As it can be seen, TSST could increase the meanHR of the participants more by 15 bpm, than SCWT. The meanRR is lower in TSST by 121.602 ms. In TSST, the other HRV time domain parameters such as NN50 is lower by 39.540, pNN50 is lower by 12.522, SDHR lower by 1.278 bpm, HRVTRIN lower by 60.124, and TINN lower by 321.602. All these time domain indices are significantly low compared to the stress response in SCWT. Further, TSST could reduce the complexity of cardiovascular neural control significantly better than SCWT (SD1, SD2, ApEn, SampEn, D2). This clearly shows the increased stress induction capability of TSST in physically conditioned subjects compared to SCWT. While this is true for the above said features, the other time domain features such as RMSSD, SDNN and the frequency domain features could not exhibit a significantly better stress response in TSST than SCWT.

TABLE III: Paired mean difference of HRV parameters of both stress sessions (mean \pm S.E)

HRV Feature	Mean \pm SE	Lower Confidence interval	Upper Confidence interval	t	Sig(2-tailed)
meanHR	-15.00843 \pm 4.45023	-24.26320	-5.75367	-3.373	.003
meanRR	121.60294 \pm 41.14939	36.02811	207.17778	2.955	.008
NN50	39.54545 \pm 20.03392	-2.11737	81.20828	1.974	.062
Pnn50	12.52270 \pm 6.42904	-.84722	25.89262	1.948	.065
RMSDD	10.91977 \pm 11.42337	-12.83643	34.67598	.956	.350
SDHR	-1.27831 \pm .56304	-2.44922	-.10741	-2.270	.034
SDNN	5.56495 \pm 7.63591	-10.31479	21.44469	.729	.474
HRVTRIN	60.12400 \pm 10.23000	18.23300	48.25900	-2.260	.035
TINN	321.60294 \pm 28.14939	26.05463	277.17355	2.955	.008
pLF	207.33159 \pm 275.88802	-364.82515	779.48832	.752	.460
pHF	519.34340 \pm 723.40841	-980.91383	2019.60062	.718	.480
TP	705.82430 \pm 975.91847	-1318.10673	2729.75532	.723	.477
LF/HF	-.11779 \pm .24815	-.63241	.39683	-.475	.640
SD1	2.11256 \pm 7.85597	-14.22482	18.44995	.269	.791
SD2	.45845 \pm 6.63524	-13.34029	14.25719	.069	.946
ApEn	.01516 \pm .02257	-.03178	.06210	.672	.509
SampEn	.25182 \pm .07947	.08655	.41709	3.169	.005
D2	1.08851 \pm .42865	.19707	1.97994	2.539	.019
dfa1	-.08249 \pm .06100	-.20934	.04437	-1.352	.191
dfa2	-.13542 \pm .03004	-.19789	-.07295	-4.508	.000

Even then, pLF, pHF and TP are all lower in TSST (207.331 ms^2 , 519.343 ms^2 , 705.824 ms^2 respectively), indicating the clear advantage of it over SCWT. All nonlinear indices, but detrended fluctuation parameters (dfa1 and dfa2) also indicates the superiority of TSST in reducing the flexibility of ANS. Further, these results are in accordance with

Klaperski et al. [54] and Rimmele et al. [55] who observed highly active women and men showing lowest heart rate reactivity and sedentary reporting highest reactivity in response to psychological stress. Figure 1 shows the Box-Whisker plots of the features which showed significant difference in stress response for the both the stressors. The response in TSST is remarkably higher than the SCWT session.

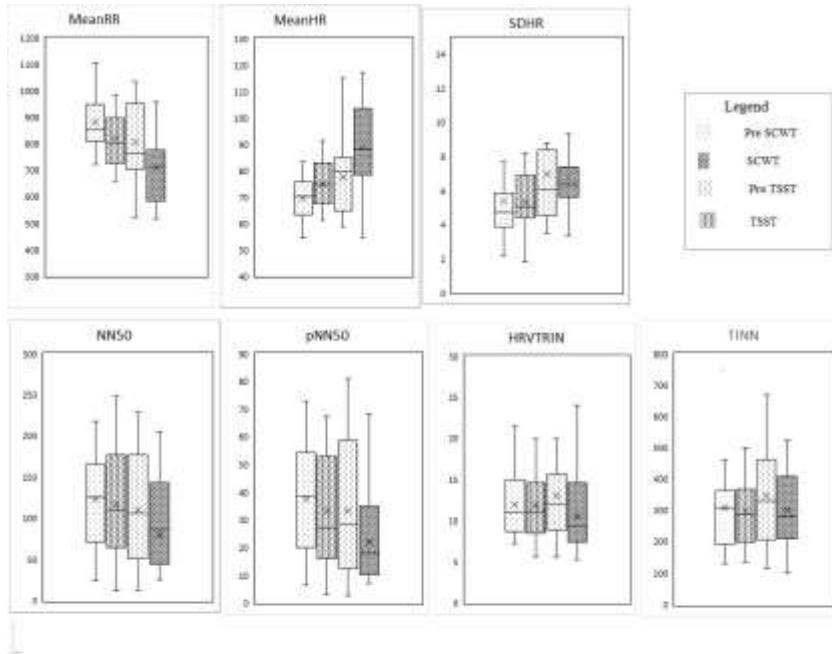


Figure 1: Box-Whisker plots of the features with significant change in response during SCWT and TSST (in appropriate units)

3.4 Association of personality traits and stress response

The scores obtained for each of the Eysenck's personality factor are given in Table 4.

Table 4: Eysenck's personality profile of the recruits

Trait	Mean Score	Std. Score
Extraversion	14.166	-2.892
Neuroticism	9.663	-1.1721
Psychoticism	4.22	-1.794

The non-parametric correlation analysis between the stress responses δ (the difference between preSCWT and TSST HRV features) and the Eysenck's traits of personality is illustrated in Table 5. It can be seen that the association of extraversion with the stress response is negative for majority of the HRV features. The result indicates that extraverts, who conversely possess the tendency to be sociable, assertive, energetic, and experience positive affect, perceived the lowest reaction in response to the acute psycho-social stress. Those high on extraversion experienced the lowest reduction in variability factor of heart rate during TSST. In

fact, the measures of parasympathetic modulation such as RMSSD and SDHR show a significant weak and moderate associations with the extraversion characteristics of the participants.

Table 5: Association of stress response and personality traits

	Extraversion	Psychoticism	Neuroticism
δmeanRR	-.019	-.323	-.300
δMEANhr	.091	.174	.179
δSDNN	-.266	-.225	.039
δsdHR	-.566**	.144	.325
δRMSSD	-.376*	-.214	.010
δNN50	-.326	-.150	.112
δPNN50	-.291	-.237	.003
δpLF	.080	.024	-.150
δpHF	-.134	.001	.042
δpTP	.017	-.075	.153
δLFHF	.162	.112	-.251
δSD1	-.279	-.091	.183
δSD2	-.268	-.315	.080
δApEn	.294	.151	-.171
δsampEn	-.314	.188	.233
δD2	-.416*	-.224	-.101
δdfa1	.061	-.257	-.245
δdfa2	-.503**	.280	-.144
Psychoticism	-.105	-	-
Neuroticism	-.126	.257	-

Note: ** p significant at $p \leq 0.01$, * significant at $p = 0.05$ (two-tailed).

The results are in accordance with the other studies, where people with low extraversion score showed high stress response in difficult mental tasks and mild electrical shocks [34, 66, 67]. Additionally, the long range correlation as measured by the detrended fluctuation analysis dfa2 and correlation dimension D2 also show moderate negative association with extraversion. That means, the complexity of cardiac control of the ANS experienced the lowest reduction for people high on extraversion. Extraverts still maintain the dynamic complexity of HRV even under stress. It is worthy to note that both psychoticism and neuroticism traits are not significantly associated with the stress response in our study. This is in line with other studies which failed to find a valid relation between neuroticism and cardiovascular reactivity [68, 69]. Even then, the connection of physiological stress response and these two personality traits in physically conditioned groups still need to be established with more samples and cross-sectional study designs.

4. Conclusions

PA and exercise have been demonstrated to promote positive changes in one's mental health and ability to cope with stressful encounters. In light of the results furnished from the stress tests, it is clear that physically well trained participants of this study exhibited stress

buffering effect on the non-real time cognitive stressor. It is to be noted that the obtained result is contrary to the findings of others who have used the same stressor. At the same time, it is to be noted also that, these studies have not reported on the physical activity level of the participants. Compared to SCWT, noticeable response above the resting level is elicited by TSST. The results have further proved the efficiency of TSST as a stressor in physically conditioned subjects. The cardiac control of autonomic nervous system during both stressors were well balanced, indicating the buffering role of physical fitness in stress response. The results show lights in to the benefits of exercise training in transforming the recruits to handle psycho-physiological stress in high stress occupations. Thus highly active law enforcement trainees who conversely possess higher physical fitness, are found to be more resilient to non-real life cognitive stress. This needs to be established with comparative studies in cross sectional design on trained and sedentary groups in large size. In this study, we only found an association in the expected direction between extraversion and stress reaction as defined by HRV. TSST led to a stronger reduction in baseline HRV among low extraversion individuals compared to high extraversion. HRV based physiological measures may be a valuable addition to the questionnaire tools to establish an individual's personality dimensions such as extraversion and vulnerability to stress, in police selection procedures. The results point out that personality traits and physical activity level are two important factors to be considered in stress research.

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Automatic Language and Text Independent Speech Emotion Recognition using MFCC and DWT for ATM Security System

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Abstract

Speech is the expression or the ability to express thoughts and feelings by articulate sound. Now day speech emotion recognition is most interesting area in human computer interaction. In this article four emotions (Angry, Happy, Scared, and Neutral) are recognized from speech which is the language and text independent. Two different algorithms MFCC and DWT are used for the emotion recognition with SVM classifier. Automated Teller Machine (ATM) is most commonly used commercial application by people for their money transactions. The proposed system used to enhance the execution in ATM machine security upgrade. At present security of client record is ensured by the Personal Identification Number (PIN). Yet, PIN can be imparted to others. Here the emotions are used for the security system in ATM as second level security.

Keywords

SER; MFCC; DWT; SVM.

1. Introduction

Speech is the assertions of the ability to express considerations and assumptions or sentiments by well-talked sounds. Speech hail contains the information about message, speaker, vernacular and emotions. Speech is made from a period moving vocal tract system empowered by a period fluctuating excitation source. Feeling on inverse side is an individual mental express that rises abruptly rather than conscious effort. Speech contains the distinctive sorts of emotions like Happy, Angry, Neutral and Scared. [1,11,12] Voices vary for men and women in a few perspectives such as talking pitch, pitch run, and the space between the vocal folds, formant recurrence, and the rate of voice issues. Females talk with a higher major recurrence (voice pitch) when contrasted with guys. The higher contribute ladies contrasted with men implies the vocal folds vibrate or met up twice the same number of times each second in females than in guys. The normal basic recurrence of talking for the most part falls between 100 Hz to 146 Hz for men also, 188 Hz to 221 Hz for women. [5,13]

The principal inconvenience in the speech emotion recognition (SER) is finding the database. The database is recorded by the microphone. Keeping up the opening among beneficiary and record emotions is the basic inconvenience. The emotional speech contains the information about the distinctive sentiments and promotes progressively the physical state of individual from voice. Feeling acknowledgment is having the no matter how you look at it applications in various ranges like detecting disappointment, frustration, surprise or amusement. There are numerous systems towards feeling acknowledgment from speech utilizing different methods like MFCC, DWT, Dynamic time wrapping, pitch, energy. After the component extraction the following stride is order. For grouping there are various classifiers are used like HMM, GMM, ANN, KNN, SVM and other. [1,11]

From the literature, analysts are utilized a few component extraction strategies for speech classification. In any case, Mel frequency cepstral coefficient (MFCC) is one of the normal highlight extraction technique generally utilized as a part of emotion recognition. The principle favorable

position of MFCC is that it utilizes Mel frequency scaling which approximates the human sound-related framework [1,12]. MFCC has two sorts of channel which are divided straightly at low recurrence (beneath 1000 Hz) and logarithmically at high recurrence (over 1000 Hz). [5] This gives the better result in emotion recognition but the MFCC with DWT helps to improve the performance of the emotion recognition. In addition to the feature extraction method, classifiers also play a major role in improving the classification accuracy in the emotion recognition.

C.Sunitha Ram used the DWT and MFCC with Stability-Plasticity Dilemma Neural Network. In this work, three different types of Daubechies wavelets (db4, db6 and db8) were analyzed. Features such as range, pitch average, intensity, pitch change, maximum value, minimum value and a fusion of all the specified features were used to obtain the feature vector. [11] K.V.Krishna Kishore features are extracted from audio characteristics of emotional speech by Mel Frequency Cepstral Coefficient (MFCC), and Sub band based Cepstral Parameter (SBC) method. Further these features are classified using Gaussian Mixture Model (GMM). In the experimental results, SBC method out performs with 70% in recognition compared to 51% of recognition in MFCC algorithm. [1] Dipti D. Joshi uses the MFCC and DWT with SVM classifier. [13] M Murugappan used two features extraction methods such as Discrete Wavelet Transform (DWT) and Mel Frequency Cepstral Coefficients (MFCC) are used for extracting the statistical features from the emotional speech signals. Three different value of MFCC coefficients (13, 15, and 20) and daubechies wavelet function with three different orders (dB4, dB6 and dB8) in Discrete Wavelet Transform (DWT) were studied and compared to analyze their effect on emotional speech classification. [5]

2. Research Method

2.1 Data collection:

Our data is from the emotional speech which is language independent and also text independent. Here three different languages (Marathi, Hindi, and English) are used for data base creation. The data base containing four different emotions Happy, Angry, Neutral, and Scared. Twenty five undergraduate students (12 boys, 13 girls) uttered 2 sentences for every emotion. The recording was done in the sound proof room using a high quality microphone with sampling rate 48 kHz/16 bit to obtain speech signals with minimum noise and distance between mouth and microphone was adjusted nearly 25 cm..

2.2 Feature Extraction:

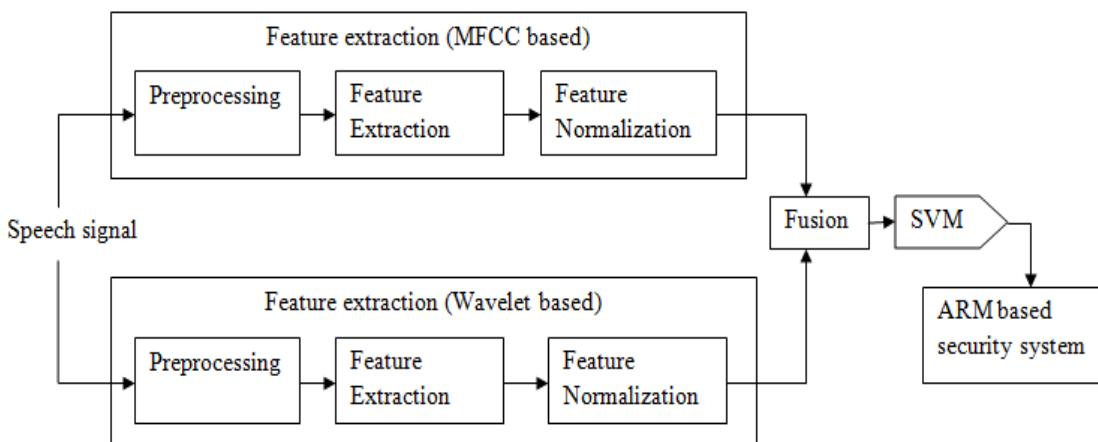


Fig.1 Proposed speech emotion recognition system

The fig.1 shows the proposed speech emotion recognition system. In this paper the emotional speech tests are taken as data. The feature extraction can be done using two special algorithms MFCC and DWT. These two obtained feature vectors are concatenated and final feature vector is obtained.

The final vector can be classified using SVM classifier. The output of SVM classifier is different emotions. These emotions are used for ARM based security system in ATM.

2.2.1 Mel Frequency Cepstral Coefficient (MFCC):

In sound processing, the mel frequency cepstral (MFC) is a representation of the short term power spectrum of a sound, based on a linear cosine transform of a log power spectrum on a nonlinear Mel scale of frequency. MFCCs are coefficients that all in all make up a MFC. The difference between the cepstral and the mel-frequency cepstral is that in the MFC, the frequency groups are similarly divided on the Mel scale, which approximates the human sound-related framework's reaction more nearly than the straightly separated frequency groups utilized as a part of the typical cepstral. This frequency warping can allow for better representation of sound.

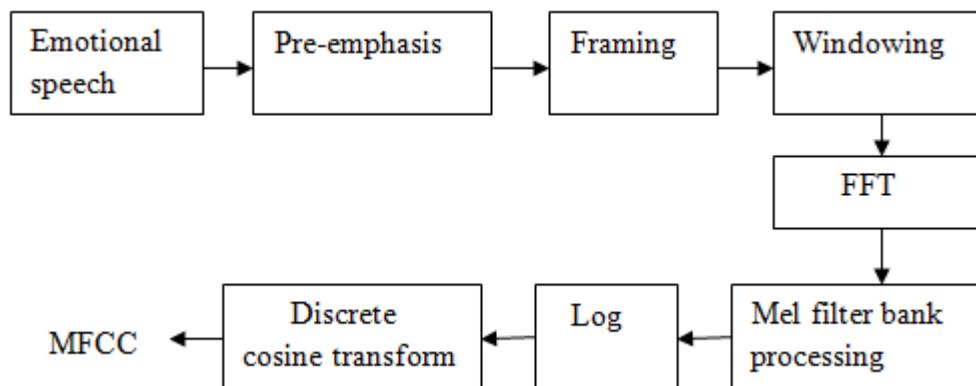


Fig.2 Mel Frequency Cepstral Coefficient

Fig. 2 illustrates extraction of MFCCs consists following steps. Each step has its own function and mathematical approaches as discussed briefly in the following: [2,6]

1. Pre-emphasis – it is having the input of emotional speech. The spectrum of speech has more energy at lower frequency than higher frequency. So, boost the energy in the high frequency. [12]

$$Y[n] = X[n] * 0.95 X[n-1] \quad (1)$$

In eq. 1 0.95, which make 95% of any one sample is presumed to originate from previous sample. [11]

2. Framing –The process of segmenting the speech samples obtained from analog to digital conversion (ADC) into a small frame with the length within the range of 20-30 ms. With the 50% overlapping. The voice signal is divided into N number of samples in each frame. The framing is required because speech is not a stationary signal to get in quasi-stationary divide the signal in to the short time frames. [11,13]

3. Windowing – To minimize the signal discontinuities of frame at the beginning and at the end perform windowing step. Hamming window is used here which is given by, [5]

$$w(n) = \begin{cases} 0.54 - 0.46 \cos\left(\frac{2\pi n}{N-1}\right), & 0 \leq n \leq N-1 \\ 0, & \text{otherwise} \end{cases} \quad (2)$$

Here, N = number of samples in each frame

W(n) = Hamming Window

4. FFT – Fast Fourier Transform converts each frame of N samples from the time domain into the frequency domain. The Fourier Transform converts the convolution of the input pulse and the vocal tract impulse response in the time domain. [2]

5. Mel filter bank and frequency wrapping – The frequencies range in FFT spectrum is very wide and voice signal does not follow the linear scale. The mel filter bank consists of overlapping triangular filters with the cut off frequencies determined by the center frequencies of the two adjacent filters. We multiply the magnitude frequency response by a set of 13 triangular band-pass filters to get the log energy of each triangular band-pass filter. The filters have linearly spaced center frequencies & fixed bandwidth on the mel scale. [7]

$$F(\text{Mel}) = [2595 * \log 10 [1+F] / 700] \quad (3)$$

6. Log – this step involves calculation of the logarithm of the mel-scaled filter bank energies. [2]

7. Discrete cosine transforms – Discrete Cosine Transform (DCT) is used to convert the log Mel spectrum into time domain. The result of the DCT is called Mel Frequency Cepstrum Coefficient. [3]

2.3 Discrete Wavelet Transform (DWT):

Wavelet transform decreases the quantity of signs required to represent the emotion, henceforth helpful in separating the emotion features. In DWT, signal is decomposed into two frequency bands, for example, low frequency band (approximate coefficients) and high frequency band (detail coefficients). The choice of mother wavelet is a prime role in the DWT. In DWT energy, mean, standard deviation, skewness, kurtosis and a combination of all the predefined components were utilized to get the feature vector.[1,8,14]

Wavelet transforms reduces the number of signals required to represent emotion, hence useful in extracting the emotional features. The DWT is given by the following formula, [1]

$$W(j,k) = \sum_j \sum_k x(k) 2^{\frac{-j}{2}} \psi(2^{-j} n-k) \quad (4)$$

Where, $\psi(t)$ – mother wavelet is a time function with finite energy and fast decay , which is given by eq. 5

$$\Psi_{a,b}(t) = \frac{1}{\sqrt{a}} \psi\left(\frac{t-b}{a}\right) \quad (5)$$

Where, a- Scaling parameter

b- sifting parameter

DWT is the transformation which provides both the time & frequency information of signal. The signal is computed by low pass filtering and high pass filtering to compute multi resolution time frequency plane.

$$Y_{\text{high}}[k] = \sum X[n] g[2k-1] \quad (6)$$

$$Y_{\text{low}}[k] = \sum X[n] h[2k-1] \quad (7)$$

Where, $Y_{\text{high}}[k]$, $Y_{\text{low}}[k]$ are output of high pass and low pass filters subsampling by 2. The speech signal can be decomposed in sub bands by using DWT with 3 levels. Mean energy was calculated for each sub band. The original signal can be represented by the sum of detailed coefficients in every sub bands, which is cD3, cD2, cD1. These feature vectors are obtained from the detailed coefficients applying statistics mean, standard deviation. Also features such as mean, standard deviation, skewness, and kurtosis were used to obtain the feature vector. [5] After the feature extraction we can get the two feature vectors Fmfcc and Fwav. The final feature vector is obtained by augmenting the normalized feature vectors Fmfcc and Fwav. [10]

2.4 SVM Classifier:

SVM classify the different emotions. It is a binary classifier to break down the information and perceive the examples for grouping also, regression analysis. The normalized feature vector is used for the classification. SVM are built by mapping the training patterns into a higher dimensional feature space where the points can be separated by using a hyper-plane. The SVM is a numerical method to compute a hyper plane for separating a two class dataset. [10] It can easily be extended to multiple-class problem. In SVM approach, the main aim of an SVM classifier is obtaining a function, which determines the decision boundary or hyper-plane. This hyper-plane optimally separates two classes of input data points. This hyper-plane optimally separates two classes of input data points. SVMs pick best separating hyper-plane according to some criterion e.g. maximum margin Training process is an optimization Training set is effectively reduced to a relatively small number of support vectors. In SVM, the data points can be separated two types: linearly separable and non-linearly separable. For a linearly separable data points, a training set of instance label pairs (X_k, Y_k), $k = 1, 2, 3, \dots, t$ where $X_k \in R^n$ and $Y_k \in \{+1, -1\}$, the data points can be classified as,

$$w^T x_i + b \geq 1 \text{ if } y_i = 1 \quad (8)$$

$$w^T x_i + b \leq -1 \text{ if } y_i = -1 \quad (9)$$

When classification step will perform us get the different emotions when scared emotion will be present this is used for the ARM based security system in the ATM. [4,9]

3. Experiment and Discussion:

The database containing four different types of emotions: Happy, Angry, Neutral, and Scared. The recording was done in the sound proof room using a high quality microphone. The proposed system is implemented in MATLAB R2013a and tested on Intel(R) Core(TM) i5-2450M CPU @ 2.50 GHz 4GB RAM machine. Feature extraction using MFCC and DWT contains the three steps feature vector generation, feature normalization and classification.

Emotion	Emotion recognition % using MFCC			
	Angry	Neutral	Happy	Scared
Angry	66	14	12	8
Neutral	4	68	16	12
Happy	16	4	64	16
Scared	14	14	8	64

Table1. Emotion recognition in % using MFCC

Emotion	Emotion recognition % using MFCC and DWT			
	Angry	Neutral	Happy	Scared
Angry	88	4	0	8
Neutral	0	86	10	4
Happy	8	0	90	2
Scared	4	10	0	86

Table2. Emotion recognition in % using MFCC and DWT

Table1. illustrate the emotion recognition in percentage using only the MFCC algorithm. Emotions Angry, Neutral, Happy, Scared having percentage recognition 66%, 68%, 64%, 64% respectively. Table 2. illustrate the emotion recognition in percentage using MFCC and DWT. Emotions Angry, Neutral, Happy, Scared having percentage recognition 88%, 86%, 90%, 86% respectively. Tables shows that percentage recognition is increased with MFCC and DWT algorithm used together. The following fig.3 & fig.4 respectively shows the performance graph of % recognition of SVM classifier with MFCC and MFCC & DWT used together.

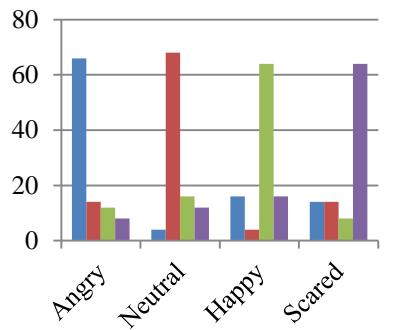


Fig.3 Performance graph of % Recognition of SVM classifier with MFCC

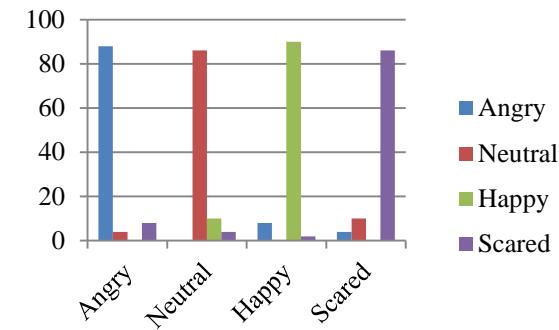


Fig.4 Performance graph of % Recognition of SVM classifier with MFCC & DWT

4. Conclusion

In this paper feelings are perceived from speech. Speech elements are extracted from two distinct calculations MFCC and DWT. These separated components are characterized utilizing the SVM classifier, which order the feelings of various sorts (Happy, Angry, Scared, and Neutral) these feelings are used for the security reason in bank or ATM. When we use only MFCC for emotion recognition we get the average accuracy up to 68% and when MFCC and DWT are used together that time the 88% average accuracy obtained. In addition to the feature extraction method, classifiers also play a major role in improving the classification accuracy in the emotion recognition.

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Critical Components of Security Framework for Cloud Computing Community: A Systematic Literature Review

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Abstract

Currently, cloud computing plays a very important role in the development of Information Technology. Every cloud user continues to expect maximum service, especially in security. The absence of standardizing standards in the security framework of the cloud world, especially in cloud computing community becomes an endless problem. This paper presents a Systematic Literature Review (SLR) which sharpens the critical components of the security framework that exists in the Cloud Computing community that will help users and cloud computing service providers determine their service standards. The framework analysis is extracted by comparing the existing security framework when dealing with its implementation in the cloud computing community. The major security components that can be applied in the cloud security framework are found in this paper. Another finding is that critical security components have been adopted in some security frameworks.

Keywords: Cloud Computing Community, Cloud Security, Security Framework, Security Component, Security Standards.

1. Introduction

Nowadays, the use of cloud computing in the industry continues to increase. Implementation of cloud computing in private, public, hybrid and community becomes a common feature in information technology solutions to evolving business needs [2][7]. Cloud computing communities allow the use of cloud services in combination, which combine services hybrid, public or private simultaneously [7]. The main problem that is still often complained by the Chief Information Officer in the implementation of the cloud is security [7][14]. Another thing is the lack of security standards that can be used by the cloud computing service providers in providing services to users of the cloud [1][9][11][17][23]. The current security standards are only used by each the institutions that make these standards [3][16][20][21]. This paper is intended to search for important security framework components in the cloud computing community. We identify the current security framework by deepening its security components in the cloud computing community. Thus the contribution in this paper demonstrates the critical component of the security

framework within the cloud computing community that will help cloud users and cloud service providers have similar requirements in terms of security during implementation.

The structure of writing the paper as follows: section 2 describes the research methodology conducted, accompanied by the sources of paper used and demography. Section 3 presents the results of extraction data from selected papers and further discussion of the findings data in the discussion. Finally, the conclusions are in section 4 and the limitations of the study are in Section 5.

2. Research Methodology

This paper uses the methodology systematic literature review [24][25] to review existing literature related to security framework, the security component of cloud computing, especially in cloud computing community.

2.1 Research Question

At this stage, the identification and planning of the research question are identified. Research questions aimed at writing this paper are: What security components on security framework are the most critical in cloud computing community?

2.2 Defining the Review Protocol

With that research question, we developed a way to search for appropriate topics using keyword was extracted. Keywords used for this literature review are a cloud, cloud computing, cloud computing community, security, security framework and security component.

To present a systematic literature review, research was conducted on:

IEEEExplore Digital Library (<http://ieeexplore.ieee.org>)

Emerald Insight (www.emeraldinsight.com)

Science Direct (www.sciencedirect.com)

ACM Digital Library (<http://dl.acm.org>)

Google Scholar (<http://scholar.google.com>)

Springer (www.springer.com)

Research is emphasized through a combination of exclusion and inclusion criteria. Only scientific writing in the English language of the journal, conference proceeding on a specified topic, is published from 2010 to 2017. The search period is conducted from October to November 2017. Quality Assessment Checklist (QAC) is made for internal research needs. QAC is a collection of questions according to Kitchenham [24]. Questions are made such as a) Does the selected paper have a clear research methodology? b) Does the research methodology fit the issues discussed? (c) Is the analysis correct? If all the questions answered 'yes' paper can be used.

2.3 Data Extraction and Synthesis

Acquired 99 papers are appropriate based on the keywords used and filtering on QAC, these are included in the Found papers group. After screening the suitability of the topics written in the abstract, 49 papers were identified and grouped in the candidate papers. Deepening of conformity is done again to get results in accordance with the research questions that have been set above. Through this process filter 23 papers and grouped as selected papers as shown in Table 1.

Table 1
Number papers in selected sources

	Found	Papers Candidate	Selected
ACM	14	9	3
Emerald	10	6	1
Google Scholar	13	8	2
IEEE	18	8	4
Springer	25	8	5
Sciedirect	19	10	8
Total	99	49	23

Types of the 23 selected papers consist of 10 journal papers and 13 conference papers as listed in the reference section. As shown in Table 2, it shows paper title, type, and sorting by year of publication.

Table 2
Source of Publications

No	Title	Year	Type
1	Cloud Security...[3]	2017	J
2	Security and...[5]	2017	J
3	Big Data...[1]	2016	J
4	Cloud Migration...[7]	2016	J
5	A Conceptual...[10]	2016	J
6	Cloud security ...[2]	2015	C
7	Cloud Computing...[4]	2015	C
8	Security Requirement...[6]	2014	C
9	Empirical Evaluation...[8]	2014	J
10	Cloud Computing...[11]	2014	C
11	An Enhanced...[12]	2014	C
12	Cloud Security...[13]	2014	C
13	Addressing Security...[14]	2014	J
14	Data Security...[15]	2014	J
15	The Roles...[9]	2013	C
16	An Analysis...[21]	2013	J
17	A Collaborative...[18]	2012	C
18	A Secure...[19]	2012	C
19	Research on...[20]	2012	C
20	A Novel...[22]	2012	C
21	Cloud Computing...[16]	2011	J
22	The Research...[17]	2011	C
23	Cloud Computing...[23]	2011	C

Distribution / demographics of authors and publishing year already represented in the desired time range that is 2010 - 2017, started when the implementation of cloud computing runs at the industry level, no longer in the academic / researcher only. Table 3 illustrates the year of paper publishing and table 4 of the author country.

Table 3
Publication Year

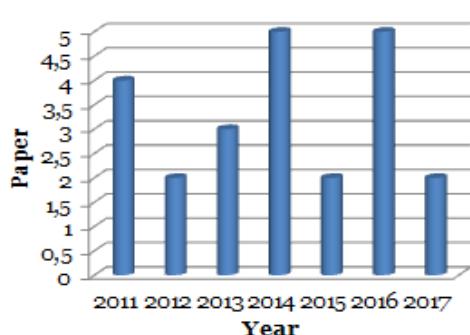
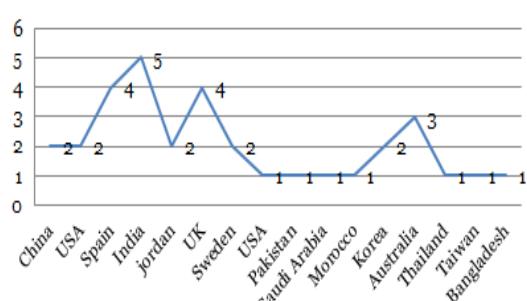


Table 4
Author Country



3. Results and Discussion

Based on the analysis of all selected papers, 14 components are of special concern to the users when implementing the cloud computing community. The list obtained from all selected papers is as follows in Table 5.

Refer to the data in table 5 below, the five most common security components appear in the selected paper for further analysis. These five components are always the main choice of previous papers, especially on cloud security topics. Therefore we chose it as a critical security component.

3.1 Authentication and Authorization

Authentication and authorization of cloud consumers using pre-defined identification schemes as defined by [1][6]. One of the big issues that become a constraint is account hijacking [2][9][14]. Entity authentication is not too difficult on a centralized system but poses a potential security risk to the shared system [3][9][10][13][15][18][23].

3.2 Confidentiality, Integrity and Availability (CIA)

Refer to [1] is defined as provides security of data objects, modifications of authorization data and ensures availability of data when to be used. In shared computing environments, it may be possible to collect user information that may violate the privacy and integrity of users by other users, even worse perform data retrieval without permission [3][6][13][14][15][19][23]. Data is a valuable asset that must be maintained properly [9][10][21].

3.3 Identity and Access Management

The concept of cloud computing community allows access to resources shared by all users who have the right to access without any interference with each other. Absolute identity and permissions management must be done properly [1][9][14] to avoid the occurrence of service hijacking [2][9]. Mechanisms for identifying and managing user identities, object clouds, organizational accounts and providing access authorization for resources in accordance with their proprietary rights when not done properly into serious security issues [3][16][18][19][21].

3.4 Security Policy and Management

The suitability of legal aspect in the enforcement of regulation and applicable law and audit process to the implementation of the system in cloud become one of important thing in security [1]. Governance issues occur when the cloud user loses its administrative, operational and security controls to systems placed in the cloud [3][7][11][14][23], this is due to the lack of regulation and standards associated with cloud computing [9][18].

3.5 Multi-tenancy

Cloud computing community allows the use of physical and virtual devices together between different users [1][6]. Some of the risks that arise with this condition include the potential attacker doing a co-location attack to take over other customer services [3], the migration process between cloud providers is done on the cloud computing community scheme due to the standard adjustment between different cloud providers [7] [14] [16] [19], disaster recovery scenario handling and business continuity on multi-cloud providers [11]. These are some of the security issues that arise in multi-tenancy.

Table 5
Security Components from selected papers

Security components	[1]	[2]	[3]	[6]	[7]	[9]	[10]	[11]	[13]	[14]	[15]	[16]	[18]	[19]	[20]	[21]	[23]	References
VM-Level attacks	•	•	•												•	•	•	
Abuse and Nefarious use of cc						•					•					•		
<i>Insecure Interface and APIs</i>	•	•				•	•	•	•	•					•	•	•	
Malicious Insides						•										•		
Sharing Technology	•	•	•	•	•	•	•	•	•	•					•	•		
Data loss or leakage	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Account or service hijacking	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Unknown risks								•							•			
<i>Authentication and Authorization</i>	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
<i>Identity and access management</i>	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
<i>Confidentiality, Integrity, and Availability (CIA)</i>	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Security Monitoring and Incident Response	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
<i>Security Policy Management</i>	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
<i>Multy-tenancy</i>	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

Refer to R. Bose, X. (Robert) Luo, Y. Liu [9] and M. Gholami, F. Daneshgar, G. Low et al [17] there is no standard security framework that can be used in the cloud computing community. We found 7 security framework approaches from selected papers. Each author makes security framework with a different approach.

We analyze the security components that are of particular concern in Table 5 in the preparation of each stage of the security framework in cloud computing. It is necessary to describe the stages in each of the existing security frameworks, as shown in table 6.

Chang and Ramachandran [4], developed a framework for the name Cloud Computing Adoption Framework (CCAF) with the goal of helping organizations adopt and deliver every cloud service and project success. Naveed and Abbas [6] designed the framework called as Cloud Security Assurance Framework (CSAF) with the purpose of

assisting users by providing a methodology to identify their asset security requirements in the early stages of cloud implementation. ISGcloud framework is intended to prove the author's theory can be applied in order to evaluate and validate its utilization [8]. The generic framework that may help users protect the cloud services used and the datacenter becomes the goal of the security framework created by Aljawarneh and Yassein [10]. The certainty of data storage security in the cloud environment became the main focus of security framework design by Chindamani and Punya [12]. The security framework modeling varies according to the purpose of each author as shown in table 6.

Table 6
Security Framework Cloud Computing

Security Framework	Level/stage
Cloud Computing Adoption Framework (CCAF) (Chang, Ramachandran 2015) [4][13][18]	Access Control, Password, Firewall ; IDS, Identity Mgt, IPS; Message & File Encryption/Decryption.
Cloud Security Assurance Framework (CSAF) - (Naveed, Abbas 2014) [6]	Identify functional Requirement; Identify security goals; Identify security requirement.
ISGcloud Framework (Rebollo, Mellado, et al 2015) [8]	Planning / Strategy Definition; Cloud Security Analysis; Cloud Security Design; Cloud Implementation/Migration; Secure Cloud Operation.
Security Framework 1#(Aljawarneh, Yassein 2016)[10]	Application Security; Application Server, Middleware & backend database Security; Remote System Security; Hypervisor Security; Storage Security; Datacenter Security; Data Transmission Security; ISP Security.
Security Framework 2#(Cindhamani, Punya et al 2014)[12]	data storage in cloud; retrieve the data in cloud.
Cloud computing security framework (Yan, Zhang, et al 2011)[17]	Firewall; Security Measures of SaaS; Security Measures of PaaS; Security Measures of IaaS; CC Security Standard Authentication.
Security service framework (Cho, Lee 2011)[19]	Leak of personal data; vague insecurity; multi-tenancy; confidentiality; Identity fraud.

The purpose of this research is to deepen the selected paper and to identify critical components in the security framework. The question most often submitted cloud users in terms of security have focused on certain components only. When it is associated with the current cloud computing community security framework, it is found that these five critical components have been adopted by the majority of existing framework in consideration of creating a standard security framework. CSAF is focused on cloud security in certain environments such as private and public clouds, so it does not include explicitly multi-tenancy components [6]. While the security framework proposed by Cindhamani and Punya [12] only sharpens data security in the cloud. The concept of the security service framework proposed by Cho and Lee [19], emphasizes the security and confidentiality of data, so as not to affirm the position of regulation, governance and policy issues in its security framework.

Table 7 shows the adoption of the current security framework against the critical components previously presented. Compared to other security frameworks, design framework security proposals from Xiaowei, et al is the most complete. Scenario trials are also performed on this framework [17]. The Security Service Framework is designed to move key security functions such as authentication and identity management from cloud to user cloud [19].

Table 7
Critical component of security framework model

Critical Security Components	Security Framework					
	[6]	[8]	[10]	[12]	[17]	[19]
Authentication and Authorization	•	•	•	•	•	•
Identity and access management	•	•	•	•	•	•
Confidentiality, Integrity, and Availability (CIA)	•	•	•	•	•	•
Security Policy Management	•	•	•	•	•	•
Multy-tenancy	•	•	•	•	•	•

4. Conclusion

The main purpose of this paper is to find out the important components of the security framework when implementing cloud computing community. We have applied the SLR methodology to identify key components in 23 selected papers from 99 papers found. The focus of the study and analysis lies in the issue of security in the cloud computing community. Five important security components have been generally adopted within the framework of the security of the cloud computing community.

5. Limitation and Future Research

The reference sources used in this paper are limited to journal papers and conference papers only. Of course, it would be better if also equipped with the implementation standards that have been running in a country for further research. The lack of a standard security framework used becomes a challenge in itself and shows great opportunities for researchers to contribute to this area. The solution to critical security issues in the cloud computing community is also an advanced topic of this research.

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Savior: A Mobile Application and Companion Device for Ensuring Individuals Safety

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Abstract

For the last couple of years, the safety issues are being the most threatening factor in Bangladesh. Individuals safety is not assured in spite of several laws which has already been imposed. In this paper, a suitable solution is being proposed to this problem where an Android application naming ‘Savior’ is embedded with its companion device ‘Buddy’. The total system can notify the emergency contacts of a user, nearby ‘Savior’ application users and the consent law enforcing authority about the user/victim’s location by a ‘double tap’ from the proposed application and assures safety during staying at home and traveling. It can also be used as anti-theft. Even, if the mobile device is snatched from the victim, ‘Buddy’ can activate the application within 10 meters distance. The total system is tested in various conditions and the cumulative success rate of the applied features is found approximately 93%. This paper describes how the total security system works and how it can assure the safety of a user.

Keywords: Savior; Travel Safety; Safety Band; Personal Security; Sexual Harassment; Arduino

1. Introduction

1.1 Background

Bangladesh is a very densely populated country. A small country with a huge population tends to bear much more negativities than others. Despite strict laws and efforts of raising awareness; harassment, molestation, rape, snatching, kidnapping, abduction, murder etc. are increasing alarmingly. But this country has shown very positive response towards technology. Among many technologies, mobile phone technology has grown the most as it's a low cost and convenient system of communication. The users have grown to a great extent throughout the years [1]. At the end of September 2017, the total number of mobile phone subscriptions has reached 140.713 million [5]. And the total number of internet subscribers has reached 79.227 million at the end of September 2017 [6]. The number of mobile phone subscribers increased from 557,000 to 133.7 million in December 2015 in Bangladesh [7]. Most of the users use Android-operated smartphones. A survey on a random sample of different age groups of mobile phone users in Dhaka- the capital of Bangladesh, shows that the percentage of Android Operating System user is 57 [8]. Most of them use various applications on their phone based on their interest and convenience. However, the safety issues in this country are very acute. A college girl had been killed after being gang-raped on a moving bus by the helpers of that bus while she was traveling from Sirajganj to Mymensingh on 25th August 2017 [9]. Another girl named Tonu was murdered after rape on March 20th in 2016 [10]. Yaar Hossain, Tonu's father, said to a daily newspaper, "We are disappointed as the killers are yet to be identified in two months [11]. Dr. Mubashar Hasan, a teacher of School of Humanities and Social Sciences of North South University has been missing since 7th November and has no trace yet [12]. This kind of incidents might not have occurred if the victims got proper help at that time. The situations worsen for the lack of proper evidence. So, we tried to find an easy, cheap and user-friendly solution to the safety issues. The App is very user-friendly and it can run in the background while using minimal power. The companion device is very cheap and easy to use.

1.2 Related Works

In Bangladesh, several groups of people are working on finding easy solutions to the safety issues. Among them, one notable work is ‘Protibadi’ [4]. In ‘Protibadi’, they focussed mainly on sexual

harassment of women and gender security in urban Bangladesh. By using the ‘Protibadi’-Android App, a user can send SMS to her ‘Emergency Contacts’ with her location if available through GPS. In our proposed work, we added that feature along with many other extra features which can ensure more safety for the users of both the genders.

2. Proposed work

2.1 System Design

In our proposed system, ‘Savior’- an Android application is incorporated with Arduino Nano which is an open-source electronics prototyping platform [3] and Bluetooth module (HC-05) to build the companion device and connect it with the App through wireless communication [2]. ‘Savior’ needs some specific access for working such as mobile device’s location access, Bluetooth, data connection, make and manage phone calls, send and view SMS messages and storage permission. At the time of installation and in terms of first use it asks for these permissions from the user to operate.

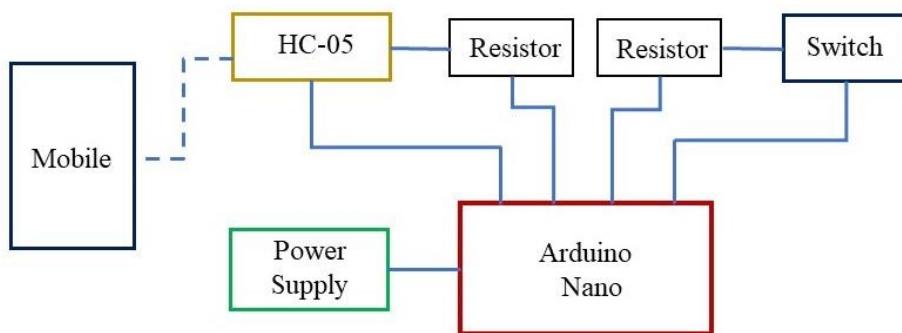


Figure 1: Block diagram of the proposed system

At first, it tries to pair with its companion device ‘Buddy’ via Bluetooth. After the first time, it connects automatically if the Bluetooth of the mobile phone is turned on. The Bluetooth module transmits a signal from ‘Buddy’ to mobile via Bluetooth if the button of ‘Buddy’ is pressed. ‘Buddy’ is powered by a 9V battery. The total area of it is 6 square inches.

2.2 Tools and Resources

For the Android Application ‘Savior’ –

- Android OS 4.1+
- Java
- XML
- MySQL
- Google Maps API

For the Companion Device ‘Buddy’-

- Arduino Nano (ATMega 328)
- Bluetooth Module HC-05
- Switch
- Resistors (220 ohm, 10k ohm)
- 9V Battery and Connector

2.3 Features of ‘Savior’

The App provides the user with the following features:

- It can save and make call to the saved emergency contact numbers

- It can send SMS to the emergency contacts with user's current location and a link of Google map pointing the victim's location
- If there is no data/internet access, it can get and send GPS data (latitude, longitude) along with the link of Google map containing the victim's location
- It can send notification alerts to the nearby 'Savior' users. It works properly if the application is installed on the other devices which are nearby (GPS location needed) and the internet connection is available.
- Using current location, the App can provide the mobile number of the nearest Police station and can call
- User can also call 999 (National emergency help desk number of Bangladesh [13])
- A travel note (contains starting point and destination point) can be saved, which is also sent through the SMS
- It can run in the background consuming very less battery power of the mobile phone
- User can see his/her current location through the App
- It can sync its data with the server
- Automatic paring is possible with the companion device- 'Buddy' while the Bluetooth is 'ON' on the mobile and 'Buddy' is in range.
- User can also send voice mail if necessary through email to the emergency contacts

It will work perfectly with all these features if the mobile device has internet connection, GPS and Bluetooth turned on.

2.4 App Options Menu

In order to use this application, the user needs to sign up first. It will take only four information (name, mobile number, email address and password).

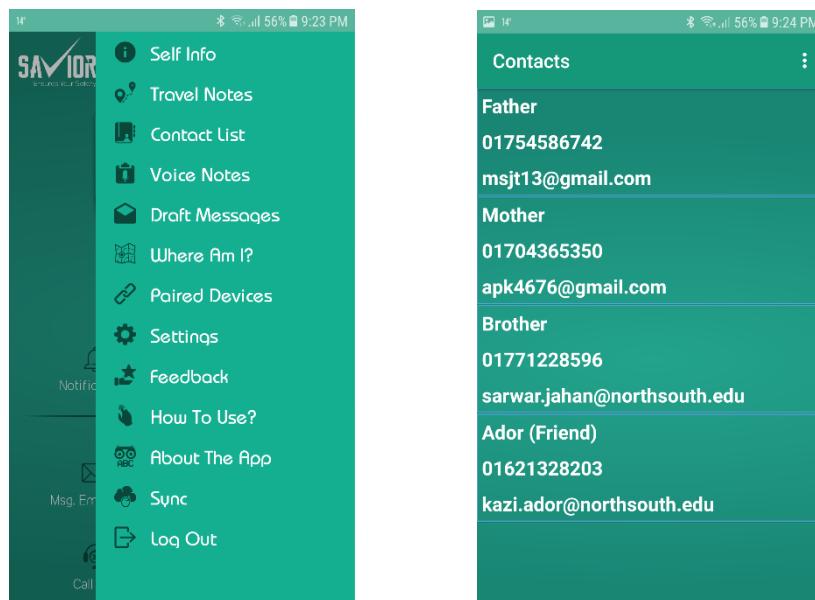


Figure 2: (a) Options Menu, (b) Example of 'Emergency Contacts'

There is a set of several options in the App options menu. They are-

- i. Self-info: It will take the personal information of the user which were given while signing up. One can change his/her info later if necessary by providing the correct password.
- ii. Travel Notes: User can set his/her starting and destination point here just prior to going out of home.

This will be sent along with other information via SMS to the emergency contact numbers and to the contact number of the nearest police station from the victim's current location.

iii. Contact list: Here, a user can save multiple emergency contacts (name, mobile number, email address). The contacts are used to send SMS and email. User can also call to the emergency contact numbers from here.

iv. Voice Notes: This feature is used for keeping voice notes instantly using the App.

v. Draft Messages: Several messages can be saved here as draft. It can be easily sent to the emergency contact numbers.

vi. Where Am I: It shows the current position of the user. It needs the GPS to be turned on. 'Savior' uses Google map to show the location.

vii. Paired Devices: Here a user can check if 'Buddy' is paired or not and can control it.

viii. Settings: User can configure sound and some additional settings here.

ix. Feedback: A user can send feedbacks after using this App and device environment. Suggestions and criticisms would be collected from here to update and upgrade the App in future.

x. How to Use: This option shows a short slide show about how to use 'Savior' and 'Buddy'.

xi. About the App: In this section, the App version, release date, new features and other details are shown.

xii. Sync: The App has both offline and online features. Sync is for the synchronization between the App data and the server data. The App will sync automatically when connected to a Wi-Fi network. The user can also sync manually by tapping on the sync option.

xiii. Log Out: The user can log out from the App if s/he needed. When s/he log on to another device, the App will sync his/her previous data from the server. So, there is no hassle of inputting the previously saved data again.

2.5 User Interface

On the home page, there are seven different buttons for different works. Those are-

i. Message Emergency Contacts: This button will retrieve the location name of the user from GPS and attach it with the travel note along with a link of that location and send it to the emergency contact numbers and the nearest police stations 'Duty Officer'. If the data connection is not 'ON' on the mobile device, the App will send the latitude and longitude of that location and the link of that location to the persons mentioned above.

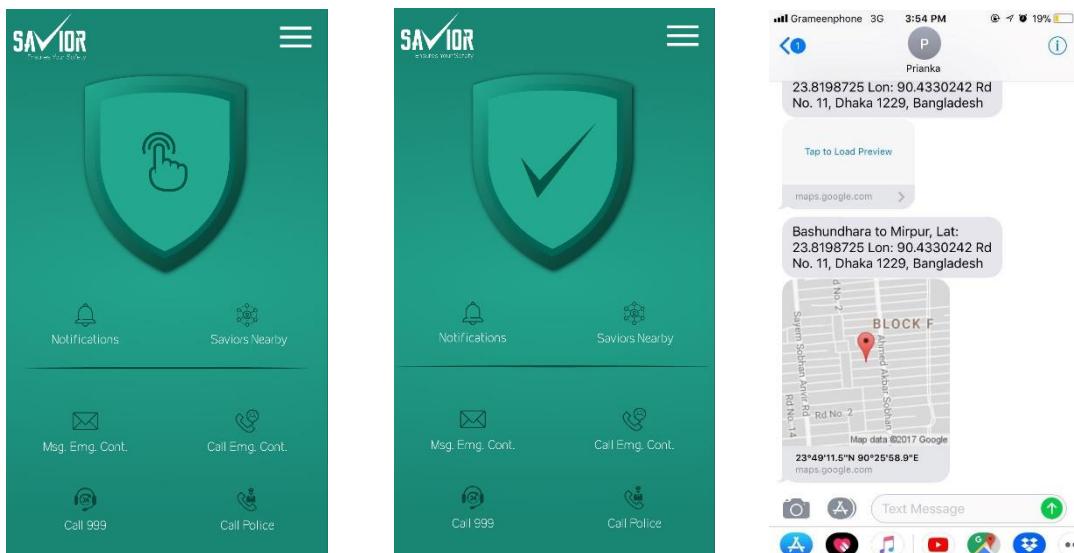


Figure 3: (a) Homepage of the App (b) After double tapping the main button (c) SMS sent by the App with victim's location

ii. Call Emergency Contact: By tapping this button the user can quickly call to the first person in the emergency contacts list.

iii. Call 999: User can call instantly to the National Help Desk number of Bangladesh from the App.

iv. Call Police: From GPS data the App can find the nearest police station. By finding the nearest police station the App will set the mobile number for calling the ‘Duty Officer’ of that police station.

v. Saviors Nearby: In critical situations, the people those who are nearby can help the most. By tapping this button, the App will send notifications with the location of the victim to those ‘Savior’ users who are within 500-meter radius (GPS should be ‘ON’), asking for help (up to 10 people). If the internet connection is not available on victim’s mobile device, it will send SMS to the nearby ‘Savior’ users containing latitude, longitude and location’s link. The SMS will be sent from Savior’s SMS server masking the sender's name as ‘Savior’. By this, the privacy of the victim will be completely maintained. But, it will need a paid subscription to use this feature.

vi. Notifications: The notifications store here when a victim taps the button- ‘Saviors Nearby’ and the internet connection is available. A user will get notification if s/he is in 500-meter radius of the victim. By clicking a particular notification, the App will head a user to that victim.

vii. Main button: This is the master button. In an emergency situation, a user can do all the 6 tasks at once by double tapping this button. The icon changes if the double tap is successful. This work can also be done by the companion device ‘Buddy’.

2.6 Features of ‘Buddy’

‘Buddy’ is the companion device which can pair with the mobile device using Bluetooth technology. It has a push switch. By pushing the switch, certain tasks can be done with the help of the App. It can also work if the App is running in the background. Pushing the switch of ‘Buddy’ ignites the main button of the App by which it can simultaneously send SMS to all the emergency contact numbers and to the contact number of the nearest police station, call the nearby police stations Duty Officer and send a notification alert to the nearby ‘Savior’ users with victim’s location.

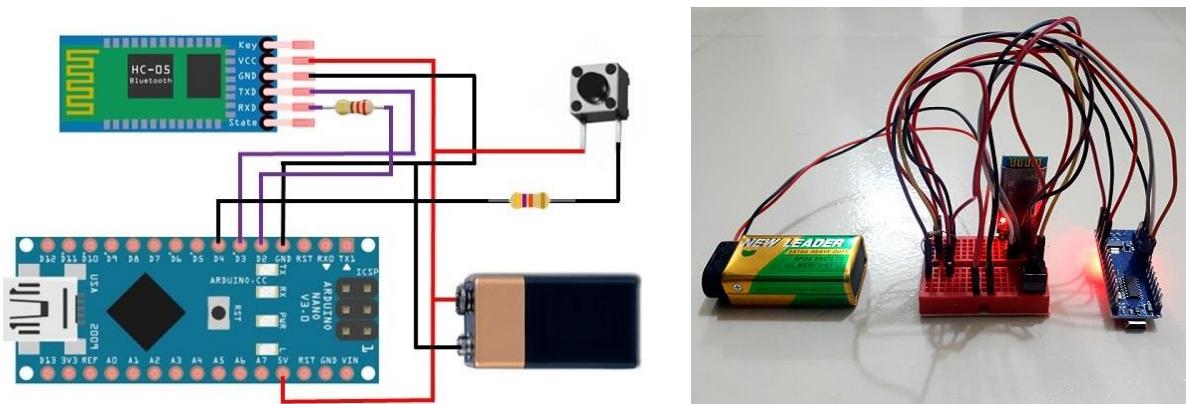


Figure 4: (a) Circuit of ‘Buddy’, (b) The prototype of ‘Buddy’

As in some situations, a fraction of a second can save a life. For those kinds of situations, ‘Buddy’ is designed and made. A user doesn’t need to open the App and click since only one press on the switch of ‘Buddy’ does it all. But we prevented unwanted multiple clicks within 10 seconds of the first click is done by the user.

3. Results and Discussion

We examined the range in which the companion device works perfectly with the App. The range is approximately 10 meters, but it works better within 8 to 9 meters. We tested the whole system in the moving vehicles, rural areas and also in urban areas by 50 attempts.

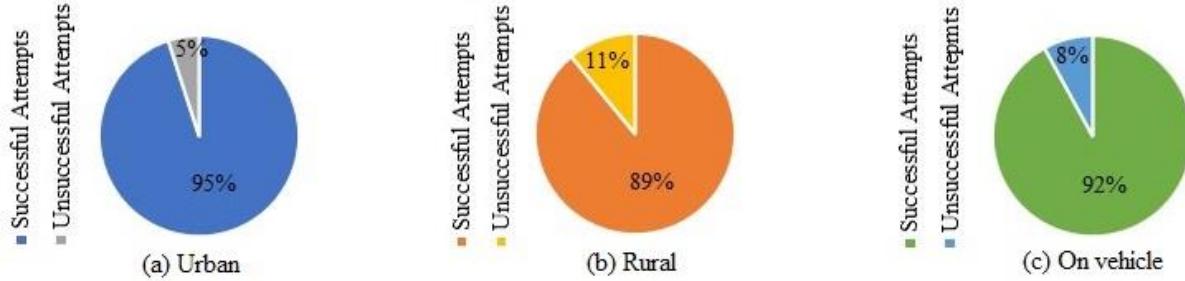


Figure 5: Success rate of the whole system at different places

In Figure 5, three different pie charts have been shown. The first one is for urban areas where 95% attempts were successful while 5% attempts were failures. In the rural areas, the system failed 11% times to produce the expected result for the poor network there. In the moving vehicles, the system failed 8% of the times as location changes too fast. So, the optimal result of the ‘Calling Police’ feature did not produce the expected result each time in moving vehicles.

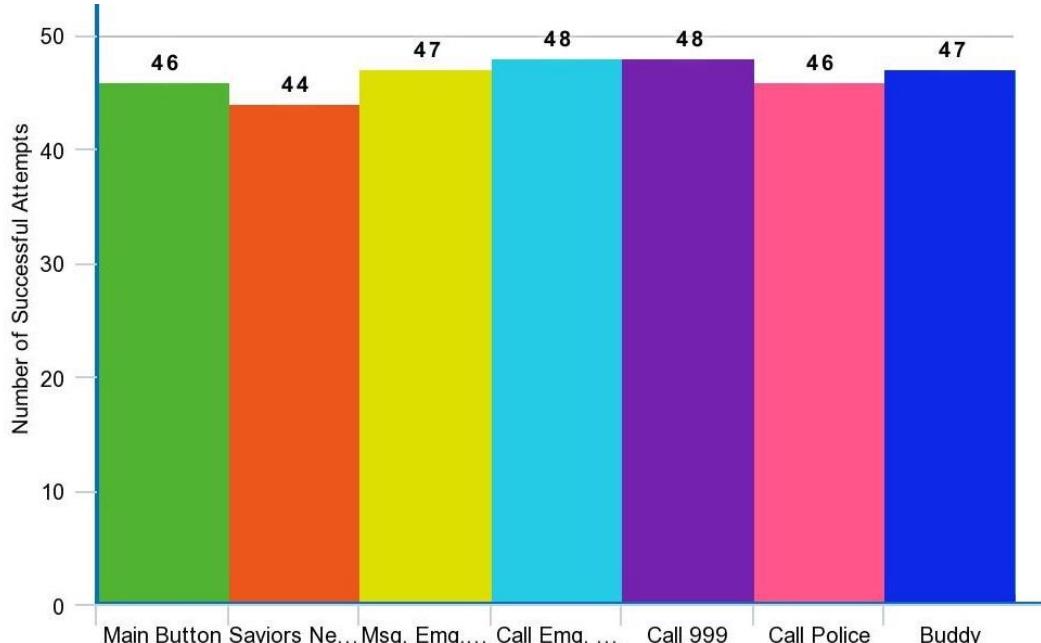


Figure 6: Success rates according to the test results of each feature

In Figure 6, the average success rate of individual features has been shown. For 50 attempts, the average success rate of all the features is approximately 93% achieved. All the calling features worked extremely well. Only a few times it missed for whether the network condition was poor or there was less balance for calling. ‘Buddy’ worked well in its range and also worked perfectly while the App was running in the background. We also surveyed on 57 persons of different age, sex and workgroup about the user-friendliness of the whole system on vocal interviews. 52 of them responded that the system is very easy and convenient to use. Three of them said it’s easy but it’ll take some time to be familiar with the environment. And two people said they are not interested in the App.

4. Conclusion

As the number of users of smartphone is growing day by day, this application may work as a constant safeguard. The proposed project provides security and safety to its users while staying as well as going out of the home. Mobile device, which a person keeps always with him/her can become a friend in the time of emergency. In the worst cases, the App data, messages, emails etc. could be used as evidence by the law enforcement agencies which might save a lot of time. The system also gives a user all the rights to decide to which extent s/he wants to share his/her information. The App is tested

and 93% success rate was achieved. ‘Buddy’ works smoothly and seamlessly which makes the system more trustworthy as it ensures instant readiness of the system. The use of this whole system can increase awareness by which the rate of safety issues could be lessened. As a whole, this system can be the one-stop solution to the safety issues and many other unwanted situations.

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Effective and Efficient Design for 2D Mesh Network-on-Chip Router

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Abstract

On single chip, Integration of storage and computational block has become viable due to continuous shrinking of CMOS technology. On-chip routers provide necessary routing functionality with low complexity and comparatively high performance, for effective global on chip communication. Designed router gives higher quality performance with reduced area and power consumption. This paper renders complete design and implementation of network on chip (NoC) router architecture. High level of parallelism has been attained by allowing router function for each input port and distributed arbiter which results in low latency, high speed and maximum performance.

This paper presents an On-chip routers design using First In First out (FIFO) buffer. The concept of virtual channels (VCs) is removed from the previous designs by using a systematic flow control scheme that uses the storage already present in pipelined channels in place of direct input virtual channel buffer. The designed router shows power improvement of up to 66.66% with reduced delay of up to 99.80% in comparison with generic router while power improvement of up to 60.48% with reduced delay of 90.88% in comparison with virtual channel router.

Keywords- NoC, VCs, FIFO

1. Introduction

Advancements of deep submicron technology emphasized the necessity of the on-chip interconnects. As diminishing features sizes have led increases in global wiring delays. NoC architectures are look up as possible solution to the wiring challenges. Both NoC performance and energy budget depends mostly on the router buffer resources. Technology scales continuously increasing number of components and complexity for soc design. Commonly used shared bus on chip interconnect is not a good choice for large systems due to global wiring delays, noise, power dissipation and complexity of arbitration. With the advancements in IC technology, the gate delay reduces which lead to relatively increase the wire delay. The wire delay decides the overall performance of the system. Many researchers are trying to solve long global wire problem through the buffer insertion. Many SoCs use a system bus to connect several functional units. SoC system bus can support only limited number of functional units and there may be a scalability problem in heterogeneous multiprocessor system on chip (MPSoC).

In order to solve these long global wire delay and scalability issues, many researchers suggested Packet based communication Network which is known as Network-on-Chip (NoC). NOC is used to connect many functional units (IP) with a universal communication network [1, 9, and 10] global synchronization becomes harder to achieve due to costly clock skew [2, 11]. Under such circumstances, on chip global wires begin to behave like transmission lines, which requires higher power consumption and chip resources in order to meet timing constraints.

To overcome the above problem, here use the communication centric approach to integrate functional elements in complex SoCs. This new design allows the decoupling of the processing element from the network. Therefore global synchronization is not required.

2. Related Works

NoC design assumes data routing network consisting of communication paths and routing nodes to provide a shared, segmented global communication structure within the on chip. Wiring required

to form communication paths is very short because wires have to travel only local distance between routing nodes instead of global distances of an entire on chip system [3].

Buffering is essential in most on-chip routers to provide temporary storage of packets that are in transit, and also helps to control traffic of transmitting data. Buffering is implemented mostly with first-in, first-out (FIFO) memory and can be expensive in terms of area for on-chip application [12]. As storing of packets requires more power in comparison with transmission, so it is better to transmit packets for developing cost effective system, the improved system performance can be achieved by reducing the buffer in quantity and size which reduces area and power consumption. Hence the design consideration focuses on two aspects i.e. Buffer size and the buffering scheme [4].

To minimize the size of buffer, iDEAL (inter –router Dual Function Energy and Area efficient Links) proposed and utilize repeaters with inter router channels as storage units. This design reduces the number of input buffer to half but with the cost of increased latency and complexity [6, 14]. Dynamic buffering resources allocation ViChaR (Virtual Channel Regulator), focused on efficiently allocating buffers to all virtual channels, by deploying a unified buffering in spite of separated buffers with minimum Size [6, 15]. Buffer less routing is another approach which eliminates all input buffers without utilizing channel buffering [6]. The wormhole router splits the packets into several flits which can be transfer in a single transmission. Buffer allocation and flit control are performed in a flit level in wormhole routing since wormhole routing does not allocate available buffers to whole packet [5,6]. Therefore the wormhole routing is a method which can minimize overall latency and may decrease buffer size compared to others. In addition, VCs are used to avoid deadlock problem and thus increase throughput. The main purpose of VCs is to decouple the allocation of buffer space to allow a flit to use a single physical channel and competing with other flits. There are existing two router techniques based on wormhole and other based on Virtual channel as below.

2.1 Wormhole Router- This router is generic NoC router. Wormhole (WH) switching reduces the buffer requirement in each router by dividing packets into smaller segments called flits (flow control units) and pipelining them through the network. The header flit is interpreted and immediately forwarded when there is space for that flit in the receiving router. The remaining flits of the same packet are forwarded in the same way as the header as they arrive [16]. As a result, a packet occupies buffers in several routers and the links between them; hence WH switching increases the level of blockage in the network in case of a stall [10]

2.2 Virtual Channel Router- This switching does not wait for a packet to be received entirely before making routing decisions [16]. Transfer latency can be reduced by interpreting the header as soon as it is available, without waiting for the data payload to be received after the header. The packet is forwarded to the next router only when there is available buffer space for the entire packet, otherwise the packet is buffered at the local node.

2.3 Parallel Computing

The router is the heart of an on-chip network, which performs crucial task of coordinating the data flow. The router operation consists of two basic fundamental regimes first the data path and the second associated control logic. The router is main component for the design of communication back-bone of NoC system. In a packet switched network, the router functionality forwards an incoming packet to the destination resource if it is directly connected to it, or forwards the packet to another router connected to it [4]. In router architectures functional blocks communicate with each other with the help of intelligent switches. Here crossbar is used as switch, crossbar switch provide full connectivity between all available links [12]. Crossbar routes data from input channel to output channel depends on routing decision make by control logic [12]. Crossbar is controlled

by the switch arbiter module [12]. There is a central arbiter which establishes necessary connections between various channels. The bottleneck occurs at the central arbiter, which follows a round-robin approach of service. Theoretically, there are five possible parallel connections out of the total of twenty five combinations in a five port router. This architecture gives high-performance parallel computing systems.

3. Proposed work

Fig.1 shows the block diagram of proposed router which has three main blocks, First in First out (FIFO) buffer, crossbar Switch and arbiter. The Router is packet switched and it provides five input/output ports namely local, North, East, South and West, to communicate with the local logic element and neighboring routers [8]. In proposed architecture, data transfers by segmenting longer messages into smaller data packets, and forwarding these packets individually from sender to the receiver possibly with different routes and delays for each packet. Packet switching offers the potential for scalability.

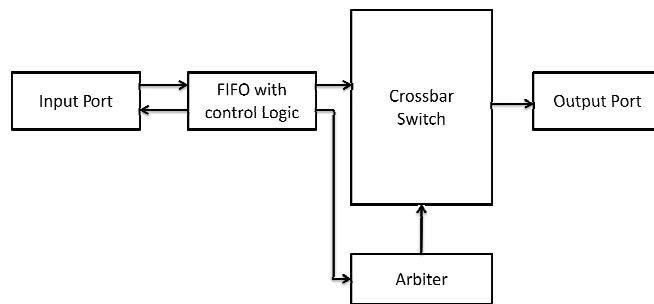


Fig.1 Block Diagram of Proposed Router

Packets are composed of different fields, each field carrying specific information. Here packet size is of 40 bits. The first part is the header which carries three bit source address. Second part is destination address of three bit and remaining bits indicate data portion in which user specify its contents. Packetization of data allow to use wide interconnects for on-chip networks, thus increases the performance.

3.1 FIRST-IN, FIRST-OUT Buffer

In proposed router buffering is required to provide temporary storage of packets that are in transit. There is one input channel at each port, each running its own finite state machine (FSM) control logic. Each input channel has a first in first out (FIFO) buffer of depth 4 and data width of 40 bits and a control Logic which has been implemented as a FSM. Complete transmission of packet occurs if and only if FIFO buffer of that input channel is not full and width of the buffer storage and the on-chip interconnect equal to the packet size. Thereby avoiding the need to transfer a packet in segments [7]. In this manner, the requirement for full packet reception is easily met with reduced complexity. The input channel sets the acknowledge line high, as long as there is a transfer taking place. The packet of data received from the previous router is stored locally in the FIFO buffer thereby implementing a store-and-forward data flow.

3.2 Crossbar Switch

Crossbar switch is designed with 5 multiplexers. A single large crossbar switch is used in this router which decreases router latency. Crossbar switch connects the 5 inputs port to 5 outputs port in a matrix manner. Five, 5:1 multiplexers are used, one at each input to the crossbar. All five inputs to the crossbar is fed to each multiplexer. As five input packets of 40 bits each from five input ports of router, therefore five, 5:1 multiplexers used inside the crossbar. All five inputs are connected to all the multiplexers. Which input is forwarded to the output is decided by the select lines generated by the control logic of arbiter. Header information of receiving packets will

provide arbiter control logic. Outputs of multiplexers are the output ports of router. From that information arbiter computes the number of multiplexer i.e. select output channel. Once multiplexer is selected for outputting data out of router, then three select lines as a input to that multiplexer decides which input will be outputted among five inputs coming to that selected multiplexers.

3.3 Arbiter

Arbiter controls the arbitration of the ports and resolves contention problem. It keeps the updated status of all the ports and knows which ports are free and which ports are communicating with each other [8]. Packets with the same priority and destined for the same output port are scheduled with a round-robin arbiter. Suppose in a given period of time, there were many input ports request the same output, the arbiter is in-charge of processing the priorities among many different request inputs. The arbiter will release the output port which is connected to the crossbar once the last packet has finished transmission [8]. So that other waiting packets could use the output by the arbitration of arbiter. In this work, round robin arbitration algorithm is used to assign priorities when many input ports request the same output. A round-robin arbiter operates on the principle that a request which was just served should have the lowest priority on the next round of arbitration.

3.4 XY Routing

In XY routing, a packet is forwarded horizontally till the target column is reached and is then forwarded vertically to the destination router. This means that there is no request for the East or West output ports by the North or South input ports. This fact is exploited and the FSMs of the mentioned output channels are simplified, as they need not service the mentioned input ports. This translates to significant area saving and reduction in number of clock cycles in servicing requests. For the implementation of a light weight router XY routing scheme is simple and easy with minimum area overheads and with good level of performance.

3.5. Implementation

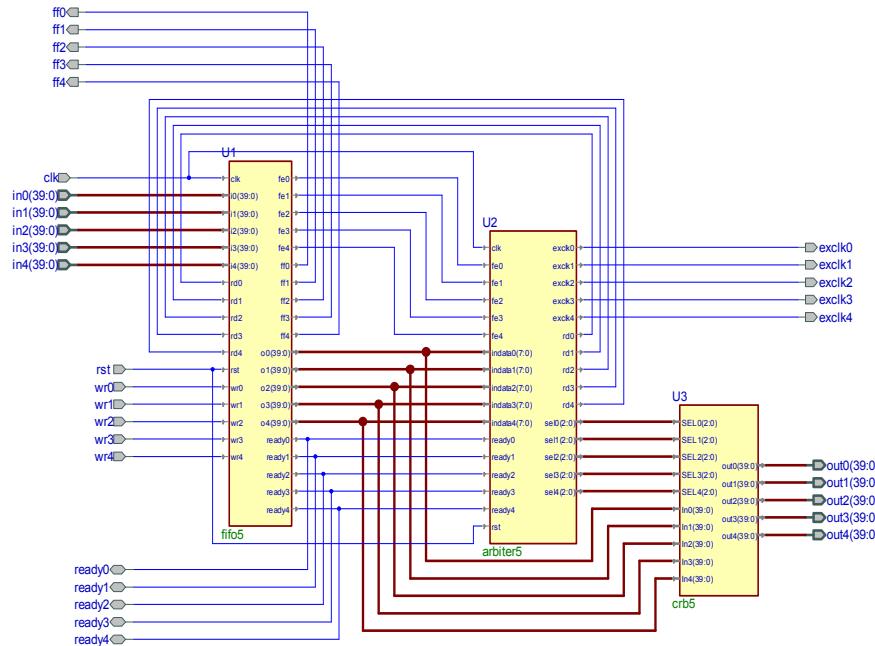


Fig. 2 Main Components of Router Architecture

Design of NoC router with single crossbar architecture has been implemented in verilogHDL and is synthesized for FPGA technology. The router designed consists of four stages; routing, arbitration control logic, crossbar traversal, and four places FIFO buffer for each input channel. The functionality of each stage is replicated at each port to support concurrent connections for overall router. Fig. 2 illustrates the three components that implement the functionality of each stage; crossbar switch, arbitration unit, and four places FIFO buffer.

Five Read signals are generated by considering current status of FIFO buffer signals of that particular port only.

4. Conclusion

NoC router is implemented on FPGA, design and Simulation is done on ActiveHDL 9.3. The design is tested in Synopsys 45nm and 90nm technology and the results are as in table 1

Table 1: Parameters result in Synopsys

Parameters	45 nm Technology	90 nm Technology
Total Cell Area	32464.76 μm	75593.31 μm
Net Switching Power	3.66 mw	954.93 μw
Delay Slack	0.171	0.001

The overall router design provides general Network on Chip support with reduced complexity, thereby achieving area efficiency in conjunction with field programmable gate array device. A Network on Chip Light weight parallel router architecture is implemented on FPGA. For significant area saving, Router has been designed with FSM control logic. A majority of the efficiency for router comes from adaptation of single crossbar design. Such a design allows the switch module to be more area-efficient than other equivalent module. The routing algorithms adapted for crossbar design provide low-complexity implementation of their logic. Complexity is further reduced by using the store-and-forward switching technique. A handshaking signal is used to provide low-overhead link-level flow control for reliable communication between router's ports. FSM description control logic has been used to test the router with different scenarios to ensure correctness. The operational results have shown the functionality of the router to reflect the fact that the router design is suitable not only as an embedded module in future FPGAs, but also as a conventional programmable design in existing FPGAs.

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HCI applied to the management of parking lots using SURF algorithm programmed in free software.

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Abstract

The presented work consists of a system implementation that allows the human-computer interaction HCI in order to manage parking lots which allows detecting available places of parking and also to determine if the space is being used by another vehicle previously assigned to that place, this is done by analyzing a video signal sent by an artificial vision system. To achieve this goal, the SURF algorithm ("Speeded-Up Robust Features") programmed in free OPENCV software was implemented, which is used to determine availabilities of the parking located in the University of the Armed Forces ESPE in Latacunga city. The system consists of the installation and configuration of a video surveillance system which allows to acquire an image of the different parking spaces, for its later analysis and processing.

Keywords: Free software; image processing; SURF algorithm; recognition of images.

1. Introduction.

At present, the number of vehicles is very large, the demand for transportation is high and almost every family has a car, this generates a great demand for parking [1]. By requiring parking for a large number of vehicles, adequate management is necessary, which in many cases can no longer be done with human skills [2] and requires automatic and computational systems. The search for a parking lot can create several problems: demand a long time, fatigue, frustration and pollution among others [3]. The parking management systems must be consistent with the mentioned problems and must be carried out with unconventional methods such as intelligent systems [1] [2] [4] [5] [6] [7].

The computer and sensors [8] or the computer and video surveillance systems currently used are useful tools to implement parking management systems [9], as well as the use of free software is more suitable because cost and license uses [10] [11] [12], the free software provides several algorithms which eases its programming. [13] [14] [15] [16] [17] [18] [19] [20]

Parking management goes beyond detecting if a space is free or not, it also indicates to a possible user where to go if he looks for a place to park, also seeks to plan a system that improves and facilitates its use. There are also other uses beyond controlling if the space is free or not, but it is also necessary to determine whether or not it is used by the vehicle for which it was assigned.

Currently a widely used tool for various applications is the computer, it works together with accessories such as sensors, cameras, microphones and others to create a system that allows human-computer interaction HCI which in many cases is the right solution [21] [22] [23] [24], with the functionality mentioned before it is easy to recognize that it will provide a solution to parking management.

2. Related Works

In [1] it presents a concept of an autonomous parking management system implemented using sensors, actuators and screens, all connected to a network and supported by a microcontroller. In [3] the use of texture descriptors is proposed to analyze images to determine if a parking lot is free or not with a very high recognition rate. In [5] it is mentioned the modeling of systems to optimize management of spaces in a parking lot, as much of its occupation, time of arrival, time of service, etc.

In [6] the maneuverability in small spaces in parking lots is analyzed, the solution is proposed using algorithms for analysis of parking maneuvers presenting a modernized model of a multi-store parking lot. In [8] for parking management, a Fiber Bragg Grating sensor is used to detect the tension on a sensor that measures the weight of the vehicle, thus, it determines whether the vehicle correctly occupies a parking space.

In [9] it is shown that computer vision is applicable along with other numerical methods to reduce the complexity of some algorithms and eliminate the problems associated with the loss of precision and normalization. It also shows its applicability in a parking management system. In [10] [11] [12] the applicability of free software is demonstrated. In [14] [15] [16] [19] [20] image pairing work is developed using the SURF algorithm. In [21] [22] [23] [24] papers are presented that demonstrate the high applicability of solving various problems using human-computer interaction systems HCI.

3. Proposed work

The present work consists in a parking management system implementation based on HCI, which allows to detect available places to park vehicles, using a video signal sent by an artificial vision system with a low cost camera, as well to identify whether the parked vehicle is correct or not. To achieve this goal, the SURF algorithm programmed in the free software OPENCV is implemented, this is used to determine the parking lot availability which is located in the University of the Armed Forces ESPE in Latacunga city. To do this, a video surveillance system is installed and configured, which allows the acquisition of images for analysis and processing.

3.1 Design and implementation of a parking availability recognition system

In order to analyze an image, a process of discovery, identification and compensation of relevant patterns when processing a series of images must be carried out. The recognition of images is based mainly on the descriptors existence where it can differentiated the objects or describe the representation of them. The images recognition of this project is based mainly on the SURF algorithm application, because this algorithm is used for the extraction of points of interest.

In order to accomplish this project, Visual Studio developed in C++ language is used and OpenCV is installed in Windows 7 or Windows 8 operating system. Once installed, a new project is created, it does as follows: First, it starts the image processing and comparison when pressing the button to turn on, once pressed, the stored images of each empty parking saved in the database will be automatically loaded. Once the images are loaded, a video frame transmitted in real time is captured and subsequently, using the algorithm it cuts and defines the sections of the parking lots, with these sections and the initially loaded images, a pixel to pixel subtraction of the images is done, the obtained value from the subtraction is compared with a threshold of 1,000,000 points. If the comparison is greater than the established threshold it is determined that the parking section is occupied, otherwise it is unoccupied.

If the parking lot is occupied, the respective image stored also in the database is loaded and then the comparison of the images characteristic points using SURF algorithm in order to recognize and determine if the parked car is or is not the correct, the status will be visualized in the parking window by using messages such as UNOCCUPIED_PARKING, OCCUPIED_INCORRECT or OCCUPIED CORRECT which can be seen in figure 1.

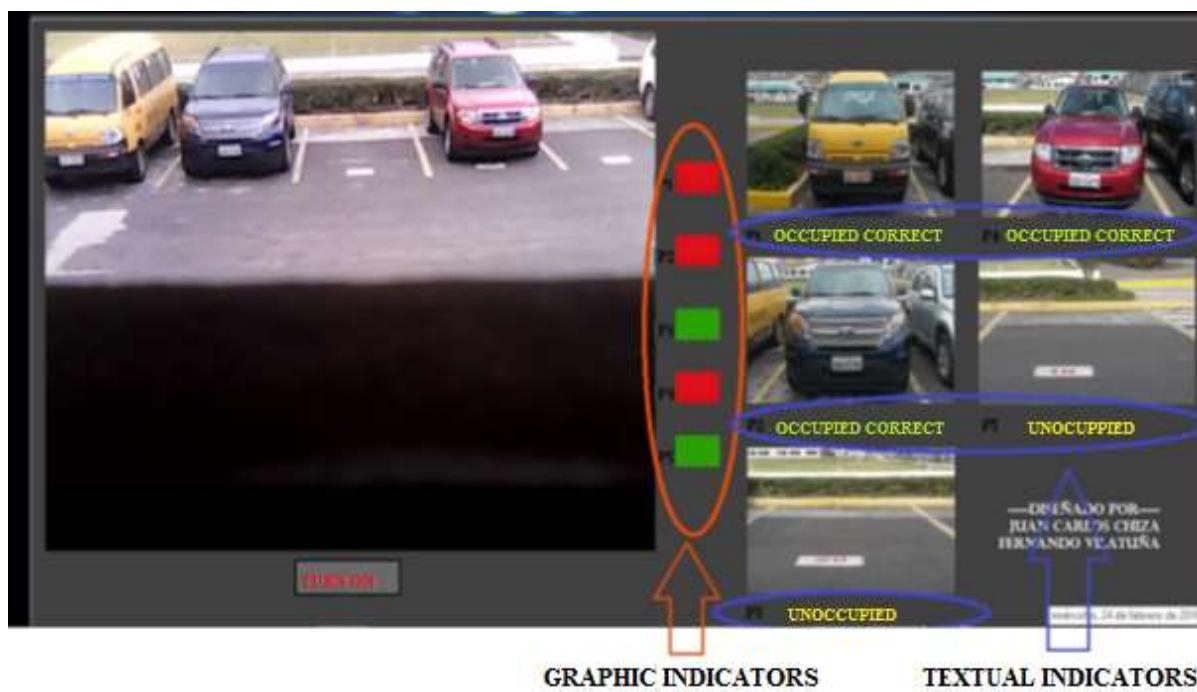


Figure 1
Parking system window with graphic and textual indicators

In Figure 2, the surfing algorithm development can be observed by detecting the characteristics and relevant points of the database loaded image and the captured video frame video transmission, if the matches are greater than an established value within the programming, it is determined that the parked car is the correct one, otherwise it is not.



Figur2 2
Images comparison using SURF algorithm.

3.2 Design and implementation of parking lot availability recognition system

Several tests are carried out at each one of the five parking lots during 20 days at different times of day, in figure 3 the result of this tests can be observed.



Figure 3
Results of tests carried out

3.3 Results

The tests carried out to determine the efficiency of the parking system are described below. The different tests are carried out at different times and in different lighting environments, in order to check both the correct functioning of the system and the performance of the algorithm.

The design behavior and the algorithms implementation carried out in the programming are analyzed to be used in the parking of the University of the Armed Forces - ESPE Extension Latacunga and for future works related to the subject.

The tests are performed during the course of the day and therefore at different illumination levels, some examples of the tests performed with their respective results are shown below:

In Figure 4 you can see a test performed at 6:53 am, and their results are shown in Table 1, there are no errors which happens in most tests performed at different times



Figure 4
Test realized at 6:53 a.m.

Table 1
 Data of the test realized at 6:53 am

Parking number	Parked correctly	Incorrectly parked	Empty parking	Observations
P1	x			No error
P2	x			No error
P3			x	No error
P4			x	No error
P5			x	No error

In Figure 5 you can see a test that has error, this test was performed one day at 7:05 am, the probable reason for the error is the illumination level.



Figure 5
 Prueba realizada a las 7:05 am

The data about the test realized at 7:05 a.m. and that has an error can be seen in table 2.

Table 2
 Data about the test realized at 7:05 a.m.

Parking number	Parked correctly	Incorrectly parked	Empty parking	Observations
P1	x			No error
P2	x			No error
P3			x	No error
P4			x	Error
P5			x	No error

In this way several tests are performed for several days and at different times, the summary of the results obtained is shown in table 3.

Table 3
Error percentage at different times of the day

TIME	ERROR (%)
7:00	0
8:00	0
9:00	8
10:00	0
11:00	8
12:00	18
13:00	16
14:00	17
15:00	0
16:00	0
17:00	9
18:00	16
19:00	46

Also tests were performed at different levels of illumination considering the pixels values that are modified when sunlight affects the system, these data is the result of the pixel to pixel sum and averaged for the size of the matrix (120x140), this size is defined for each parking section of the parking lot for the video captured frame in real time, the values below are classified by high brightness, medium brightness and low brightness with their respective range of values. See table 4



Figure 6
Pixel values for average illumination level

Table 4
Variation of luminosity levels at different levels of sunlight

SOLAR LIGHT LEVELS	PIXEL RANGE
High brightness	From 181 to 255
Medium brightness	From 70 to 180
Low brightness	From 0 to 70

Below, in table 5, it can be seen the errors that appear at different levels of illumination.

Table 5
Percentage of error of each parking place according to the luminosity levels

LIGHTING LEVEL	ERROR
High	22
Medium	4
Low	13

3.4 Discussion

It can be seen both in table 3 and table 5 that biggest errors occur at low and high day lighting, this indicates that light is a very important factor to discriminate the correct occupation of a parking site. Other affecting factors are rain and clouds because they directly influence the level of lighting.

There should be corrections when using a camera with greater resolution, but when all parking lots are covered and the illumination level is constant, the error would be minimum. In this case, a single low cost camera was used to cover five parking spaces, which compared to the use of sensors, it represents very low cost.

4. Conclusion

A low-cost parking management system can be implemented using a video surveillance system, a computer and a free software. The errors presented at low and high lighting levels can be drastically reduced by applying the parking management system to covered places and using a camera with better resolution.

To process images using the SURF algorithm, several factors must be considered, such as illumination, distance and the image resolution, since it may affect the recognition decision.

By sectioning the parking lots we can determine if they are available or occupied, but in order to analyze each section, the illumination level conditions must be medium intensity which allow to obtain the adequate response by the system, since for high or low levels of pixels, the results of the process may be altered.

Greater Hessian values allow to obtain a more precise value when selecting the most relevant points of the image, in this way the recognition of the selected image will be safe.

To ensure the proper system functioning, work must be done to improve the comparison and pairing of images by sectioning the parking lots, since when comparing an image provided by the database with a photograph, the system could respond with false positives which can ruin a recognition that could pass as valid when in fact it is not.

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He was born in Latacunga province of Cotopaxi on December 9, 1998, he is the second of three brothers. From an early age he is passionate about studies and sports, standing out in every activity that I participate. He is Electronics and Instrumentation Engineer, he graduated from the University of the Armed Forces. Performed research studies based on artificial vision at the Polytechnic University School of Teruel in Spain, he developed his degree project based on parking management.

Computer Self-Efficacy in Programming Language for Non-Technical Students using Scratch Programming

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Abstract

The purpose of this study is to measure the level and difference of self-efficacy of computer in programming for non-technical students using Scratch. Programming skills can be the basis of problem solving skills and it is important for both technical and non-technical students. Quantitative studies in this survey were carried out using questionnaires containing 21 items measuring the student's self efficacy. A pilot study of 23 respondents showed that the reliability of the instruments was at the level of $\alpha = .935$. The respondents of the study consists of 48 non-technical undergraduate students selected based on simple random sampling technique. The data obtained were analyzed descriptively (frequency and percentage) and inference (mean analysis, *t*-test and pearson correlation) using SPSS v23. The findings show that the self-efficacy level of non-technical students on Scratch programming as a whole is quite high. The findings of the *t*-test analysis show that there is no statistically significant difference in self-efficacy based on gender and the background of the program study. Correlation analysis also found that there was no self-efficacy relationship between computers in Scratch programming with academic achievement. Research shows that the level of self-efficacy of non-technical students is relatively high capable of providing an alternative problem solving skills using Scratch programming.

Keywords: Self-efficacy; Scratch Programming; Visual Programming;

1. Introduction

Computer programming skills are known as a difficult skill to learn [2]. This is coupled with the negative perception of students towards computer programming which using letters and texts. This negative perspective create a low student's self-efficacy towards programming. According to [21] someone who has low self efficacy, having a difficulty to complete the assignment given. Computer programming skills is an important skill. [5]; [18]; [8] described computer programming skills as a way to contribute to the development of higher skills such as problem solving skills, logical thinking, resourcefulness and creative thinking. Therefore, it is important to make the method of studying programming more interesting and easy. MIT Media Lab has developed a method of visual programming that is said to be easier and more interesting called Scratch.

A study conducted by [12] and [7] explained that Scratch has helped primary school students learn the basics of computer programming. Visual programming makes students more motivated in learning programming language compared to traditional method using texts where students are forced to deal with syntax errors [19]; [13]. Based on previous studies, Scratch programming has given good results to kindergarten, primary and secondary students, there is still less research done to look at the impact of this Scratch programming on college and university level students [9].

Therefore, this study will focus on how visual programming using Scratch can improve the self-efficacy of a non-technical students at Kolej Universiti INSANIAH (KUIN). The objectives of the study are:

1. Identify the level computer's self-efficacy in programming for non-technical students using Scratch.

2. Review the differences in student's self efficacy in programming by gender and background of the program of study.
3. Review the relationship between self efficacy of programming with student academic achievement.

Self-efficacy is a theory introduced by Albert Bandura in his writings entitled "Self-efficacy: Toward a Unifying Theory of Behavioral Change" [15]. [21] defines the concept of self efficacy as a perception of an individual toward his or her ability to complete and perform the tasks required to achieve a target. While [17] defines self-efficacy as a feeling of sufficiency, efficiency, and ability to cope with life. [20] give a definition to self-efficacy as an individual's assessment towards their own ability or competence to perform a task, achieve a goal and produce something. Self-efficacy will also reflect one's confidence in controlling their motivation, self-esteem and social environment. [14] concludes that the efficacy theory is a generalization of individual behavior based on two factors, the action of the individual and result; and the individual's self-esteem to accomplish certain tasks.

Self-efficacy is formed from social cognitive theory that affects four primary sources that interact with humans naturally. According to [21] these sources are vicarious experiences, individual performance achievements, verbal sequences and the rise of emotions and physiology. Details are described as follows:

1. Mastery Experiences: Refers to the individual experience of doing the assignment.
2. Verbal Persuasion: Refer to persuasion and words that can inspire or vice versa to do a task.
3. Vicarious Experience: Refers to individual observations towards the successes and failures of other individuals in carrying out similar tasks.
4. Physiological State: Refers to the physical state of self that will affect the spirit of the individual in doing a task.

Individuals with high self-efficacy always have a commitment to solve their problems and will not easily give up when they find that the strategies being used are unsuccessful while those with low self-efficacy will be easily discouraged and the task will fail.

There are several programming language software developed to facilitate software development and avoid errors in programming writing such as syntax error and logic error. Aside from typing, the development of software programming revolution uses blocks. Each programming language element such as operator, control structure, variable and function can be combined with drag and drop method. It is also an intuitive method of translating logical thinking into a computer program. In this study, the Scratch programming language has been used. Scratch can be downloaded from (<http://scratch.mit.edu>). Scratch was developed by the Lifelong Kindergarten researchers group from MIT Media Lab. Scratch can be downloaded and used for free. Scratch can facilitate the process of software development, animations, car apps, games, musical compositions and numerical simulations interactively.

2. Related Works

The efficiency of computer programming not totally depends on cognitive skills and basic knowledge of computer software, but it also refers to individual's attitude and their personal self-efficacy towards computer programming. [1]; [4]; [10]; [11]. A study conducted by [4] found that there were a correlation between the achievement of students in computer-based tasks and their attitude towards computer technology. Additionally, students with negative self-efficacy in programming may find it difficult to learn programming-related courses and will likely fail the course. [3] conducted studies on engineering students in Turkey by looking at gender factors, computer experience and computer usage in the family and linked them with self efficacy. [6] also believes on self-efficacy to be one of the most important basic things for pre-graduate students to

improve the self-efficacy programming. [22] found that the self-efficacy of programming will affect the achievement of new programmers.

3. Proposed work

This study was conducted on 48 randomly selected students from Kulliyyah of Islamic Studies and Kulliyyah of Muamalat, KUIN. Two Scratch programming teaching sessions were conducted in a computer lab with the help of lecturers. 23 students in the first session and the remaining 25 students in the second session. After completing a 3 hours lab session, the Self-Efficiency Questionnaire Form is distributed to students to measure individual perceptions in knowledge, skills related to the ability of students to learn Scratch programming. The questionnaire was adapted from the self-efficacy study of Java programming by [3].

Generally, there are 21 items in the questionnaire which divided into two parts. Part A contains 6 respondents' demographic items which are gender, age, kulliyyah, year of study, CGPA and previous school. Section B contains 15 items measuring self-efficacy of a student with 7 likert scales ranged of values from very low (1) to very high (7). Mean descriptive interpretations or equations are shown in Table 1.

Table 1: Mean Descriptive Interpretations

Scale	Scale Weighted Mean Interval	Mean Descriptive
7	6.23 - 7.00	Very High
6	5.35 - 6.21	High
5	4.48 - 5.34	Above Average
4	3.61 - 4.47	Average
3	2.74 - 3.60	Below Average
2	1.87 - 2.73	Low
1	1.00 - 1.86	Very Low

Pilot study of 23 respondents on the first session was held to test the reliability of instrument with alpha cronbach (α) valued at .935. According to [24], alpha (α) = .80 - .90 is a good and acceptable value. The results of the pilot study show that the reliability of the instrument is high and acceptable. Next, descriptive statistics (frequency and percentage) and inference analysis (mean test, t-test and pearson correlation) are used to analyze data and present research findings.

3.1 Research Findings

Respondents consisted of 42% male students and 58% female students with a majority of students aged between 20 to 21 years old (73%). Respondents from the non-technical background from Kulliyyah of Islamic Studies (90%) and Kulliyyah Muamalat (10%). Majority of the respondents are in the 1st year (81%). In terms of academic achievement, 60% of the respondents were in excellent category (CGPA 3.00 - 3.66). 77% of the respondents came from Religious Secondary School.

The first experiment done to measure the level of self-efficacy computer in programming towards non-technical students. Mean analysis on 7 likert scales shows that the level of self-efficacy score of non-technical students on Scratch programming is 'relatively high' (mean = 5.21, sd = 1.07). The item 'I can complete a game if I have a guidebook on using Scratch' shows the highest efficacy level (mean = 5.67, sd: 1.28). The result are shown in table 2.

Table 2: Mean Comparison by Item

Item	Respondents	Mean	Standard Deviation (sd)
B1	48	4.90	1.309
B2	48	4.96	1.398
B3	48	5.02	1.263
B4	48	5.27	1.455
B5	48	4.98	1.480
B6	48	5.10	1.574
B7	48	4.79	1.713
B8	48	5.40	1.349
B9	48	4.62	1.782
B10	48	5.58	1.485
B11	48	5.67	1.277
B12	48	5.48	1.384
B13	48	5.46	1.429
B14	48	5.25	1.551
B15	48	5.65	1.280
Efikasi	48	5.21	1.070

Second experiment conducted to evaluate the difference in student's self-efficacy by gender. Null hypothesis (H_0) stated that there is no difference between the student's self-efficacy in Scratch programming by gender. An independent sample t -test was conducted to measure the difference in self-efficacy by gender and the findings shows that mean was different between male respondents (mean = 5.43, $sd = .85$) with female respondents (mean = 5.04, $sd = 1.19$). The t -test shows no significant difference between the two groups of respondents, $t(46) = 1.24$, $p > .05$. The findings found that $p = .222$ ($p > .05$), therefore null hypothesis failed to be reject or H_0 was accepted. Studies shows that there was no self-efficacy differences between male and female. The result are shown in table 3.

Table 3: t Test Analysis by Gender

Gender	Respondents	Standard Deviation (sd)	F value	t value	Degree Freedom (df)	Significant (p)	Result
Men	20	5.43	.85	1.468	1.238	46	.222 Null Hypothesis
Women	28	5.04	1.19				is rejected

Table 4 shows a result from third experiment to review the differences in student's self-efficacy in Scratch programming by looking at background of the program study. H_0 stated that there is no difference between the student's self-efficacy in Scratch programming in the background of the program study.

Table 4: Self-Efficacy t -Test Analysis According to the Background of Program Study

Kulliyyah	Respondents	Standard Deviation (sd)	F value	t value	Degree Freedom (df)	Significant (p)	Result
Islamic Studies	43	5.22	1.029	.587	.164	46	.871 Null Hypothesis
Muamalat	5	5.13	1.528				is rejected

Independent sample *t*-test was conducted to review the difference in self-efficacy according to the background of the study program. The findings showed that mean was different between Kulliyah of Islamic Studies (mean = 5.22, *sd* = 1.03), respondents from Kulliyah Muamalat (mean = 5.13, *sd* = 1.53). The results showed that there were no significant differences between the two groups of respondents, *t* (46) = .164, *p* > .05. The findings found that *p* = .871 (*p* > .05), the null hypothesis failed to reject and *H*₀1 is accepted. The result shows that there was no self-efficacy difference according to Kulliyah of Islamic Studies and Muamalat.

Last experiment was to evaluate the relationship between self-efficacy of Scratch programming with student academic achievement. *H*₀3 stated that there is no relationship between computer self-efficacy in Scratch programming with student academic achievement.

The Pearson correlation is analyzed by referring to [23] which proposes a valuation guideline of the relationship between two variables with *r* = .10 to .29 or *r* = -.10 to -.29 is a 'Small' relationship, *r* = .30 to .49 or *r* = -.30 to -.49 is 'Moderate' and the value *r* = .50 to 1.0 or *r* = -.50 to -1.0 indicates the 'Large' relationship.

Pearson correlation analysis showed that there was a 'small' correlation between self-efficacy variables in Scratch programming and student academic achievement (*r* = -.061, *p* = .679). The findings were not statistically significant (*p* > 0.05), so the null hypothesis failed to reject which meant there was no self-efficacy relationship between computers in Scratch programming and academic achievement.

Table 5: Pearson Correlation Analysis Of Computer Self Efficacy In Scratch Programming And Academic Achievement

		Efficacy	CGPA
Efficacy	Pearson Correlation	1	-.061
	Significant (p)		.679
	Respondents	48	48
CGPA	Pearson Correlation	-.061	1
	Significant (p)	.679	
	Respondents	48	48

4. Conclusion

The findings show that the self efficacy level of non-technical students is quite high capable of providing an alternative to problem solving skills through Scratch programming. It is clear that although the respondents are not from the technical programme of a Higher Education Institution, students gain confidence to learn Scratch programming provided they have guideline on how to use Scratch.

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An improved Artificial Electrolarynx

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Abstract- The people who have undergone a laryngectomy lose their speech and they are presented to many substantial challenges. A number of devices have been developed to assist these patients, ranging from the electrolarynx to the unidirectional valve used in tracheoesophageal speech. Although all of these devices have focussed on producing the sound from the patient's vocal tract, they were found to be less effective .This is because the speech produced by them accompanies with a noise which is probably more than the speech. This leads to the inefficient regain of the lost speech for laryngectomy patients. Hence, a new device to provide powerful and satisfactory communication to a speech lost-person has been presented.

Keywords- Artificial vocal cord, Laryngectomy, Tracheoesophageal speech, Electrolarynx

1. INTRODUCTION

The ability to communicate vocally is considered as an important skill for a human to make them feel complete. However, some people lose their ability to talk due to a laryngectomy. A laryngectomy is a surgery in which the larynx (generally known as voice box) is removed from a patient due to laryngeal, esophageal or pharyngeal cancer. This basic problem of a commoner who have undergone a laryngectomy, has been considered in our research. This to be applicable not only for a laryngectomy patient but also for a person who have lost their ability to speak due to various other reasons. A number of alternatives are available to the patient to give them a means to communicate, however these devices are produce speech with noise. So, we have proposed a solution to overcome the disadvantages of the already existing devices. The main purpose of our innovation is to contribute to the affected peoples' voice restoration, rehabilitation in a more efficient manner after losing their speaking ability.

2. REVIEW OF RELATED WORKS

It has been found in the literature that there are various solutions introduced to provide speech to the speech-lost people to attain rehabilitation. Each device with their own disadvantages makes it difficult for the users to use them. The various existing solutions and their drawbacks are discussed below.

2.1. Artificial Electrolarynx:

The main drawback of this equipment is the assembly of the magnet over a cup-shaped pole piece present in it. When the device is dropped the magnet may become dislodged and off-center from the cup-shaped pole piece. Hence, if dropped, the performance of the speech aid device will be destroyed and complete failure of the device is possible. Also, its weight is more due to the presence of the magnet and makes it difficult for the users to handle and hold it for a longer time. It also includes high amount of noise along with the speech [1-6, 13]. The pictorial view of Electro larynx and its usage are depicted in Figure 1 and Figure 2 respectively.



Figure 1: Electrolarynx
Source: www.MaxiAids.com

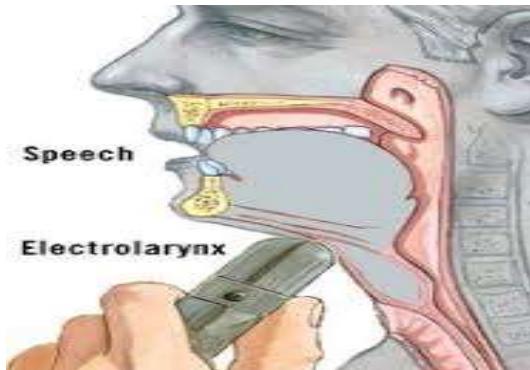


Figure 2: Usage of Electrolarynx
Source: Anna Katharina Fuchs

2.2. Passy-Muir valve (Tracheotomy):

Tracheotomy is a surgical opening into the trachea in which a plastic or metal tracheotomy tube is placed. This Passy-Muir valve is considered as a tracheotomy speech enabling device. This device becomes difficult to be used by the people with breathing problems and non-ventilator dependent persons [14]. The pictorial representation of Passy-Muir valve and its usage are depicted in Figure 3 and Figure 4 respectively.



Figure 3: Passy-Muir valve
Source: www.passy-muir.com



Figure 4: Usage of Passy-Muir valve
Source: www.passy-muir.com

2.3. Esophageal Speech

Esophageal speech is a very common way people learn to speak after laryngectomy. However, it requires intense speech therapy and might take a long time to learn how to do it successfully. Speech is produced by taking air into the esophagus and letting it out so the top of your esophagus vibrates and produces sound. The sound is manipulated as usual by your mouth, tongue and lips to create speech; however, the sound will be of a lower pitch. It's kind of like a belch, but different—the air isn't coming from the stomach. Air is inhaled right below that vibrating segment, and then it comes out. However, it is familiar only by certain pathologists and it is difficult to adopt. The other limitation also depends on whether this is the best speaking option, as it depends on the patient's post-operative healing and outcome. The other drawbacks include Time and financial commitment to learn, Pitch, loudness and intelligibility problems.

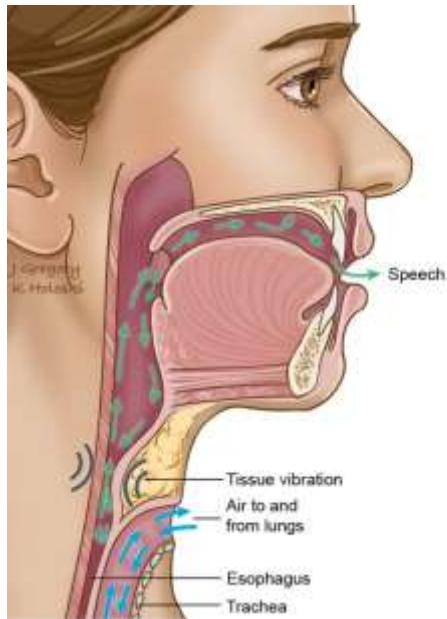


Figure 6:Speech through Esophageal
Source: www.headandneckcancerguide.org

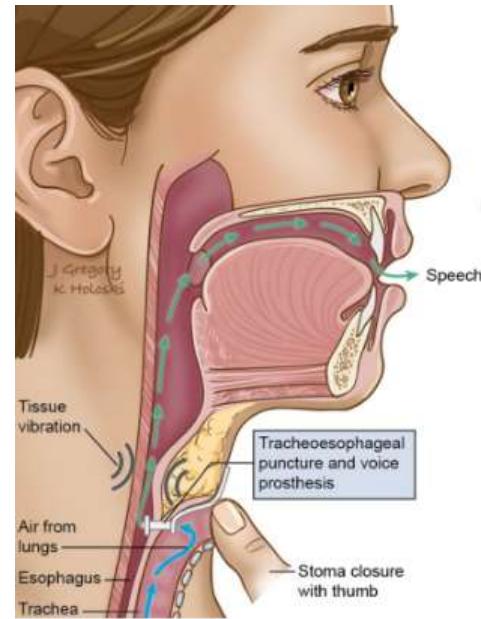


Figure 7: Tracheoesophageal voice Prosthesis
Source: www.headandneckcancerguide.org

An important note in other devices is that those devices need proper and good handling of the device and once the usage of such device goes wrong they cannot be re-assembled and hence, it turns out to provide huge loss for the customers [12].

3. PROPOSED ARTIFICAL ELECTROLARYNX

In order to overcome the various disadvantages in different speech aiding devices, this is a new proposed concept which provides best solution and comfort for the affected people. This new innovation is designed in the form of a neckband which supports the comfort ability of the users.

3.1. Initiation of the design:

A method of solving this problem have been undertaken in which an EMG signal is picked up and an Instrumentation amplifier is used to obtain an amplified version of the input signal. Then the amplified signal is assumed to be passed through an Analog To Digital Converter (ADC) and it is converted into a digital signal and further it is processed by a DSP Processor for noise removal. Then the processed signal is sent to the Bluetooth Low Energy (BLE) and then it is received in the laptop which is Bluetooth enabled. Finally the features are extracted from the processed signal and it is mapped onto the corresponding word by using an artificial neural network (also, feature extraction can be used). During all the processes vibrations are used. Since this design includes the concept of feature extraction and mapping the uttered word with the sound it is becomes little difficult for the users to handle and also this affects the performance and quality of the product. After designing it in this way, we have found out another model which is realized to offer increased efficiency, less cost as less number of components are used with increased performance [7-11].

3.2. Proposed solution:

In this new proposed design, only less number of components are used which are easily and readily available and does not require individual design for each and every component to be used in the product. The block diagram of the proposed system is shown in figure 8.

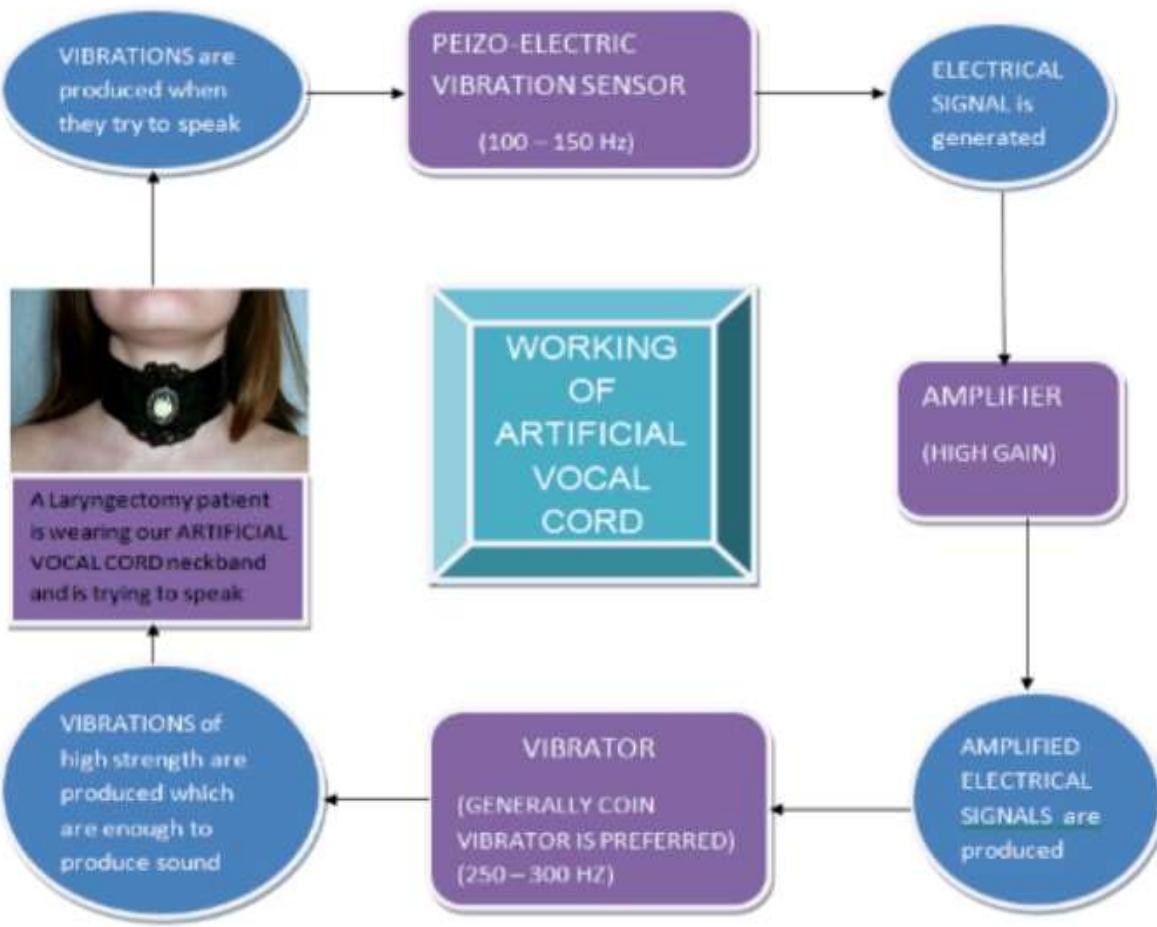


Figure 8: Block diagram of the proposed system

The various segments that are made use of in this proposal are a piezoelectric-vibration sensor, an amplifier and a coin vibrator (LRA). While using this product, when the user tries to speak, he/she produces vibrations due the movement of the tissues which are sensed by the peizo-electric vibration sensor and a certain voltage will be generated by the voltage comparator present inside of it and it guarantees an excellent measuring performance that are converted to electrical signals. These signals are passed to the amplifier where the low-power signals are strengthened and the noise is reduced. The amplified signals are received by the coin vibrator that detects the signal thus producing enhanced vibrations which is fed to neck near the voice-box and enables the user to speak casually with their own natural voice with less noise unlike the other vocalizing mechanisms which produce unnatural voice with more amount of noise. An ON/OFF Switch is attached at the exterior part of the device which ensures the easy using and handling of the product for the user. The user can speak by turning ON the switch and this

induces vibrations and can be turned OFF when the user does not speak. Thus, this results to provide an extraordinary speech aid device that facilitates the production of substantially natural sounding speech by the user helping in their rehabilitation.

4. IMPACT OF THE PROPOSED SOLUTION

The proposed system has been realized in hardware as shown in figure 9 and its performance has been analyzed. The impact is that which creates a huge difference in the market and makes it to be more beneficial to the customers and users.

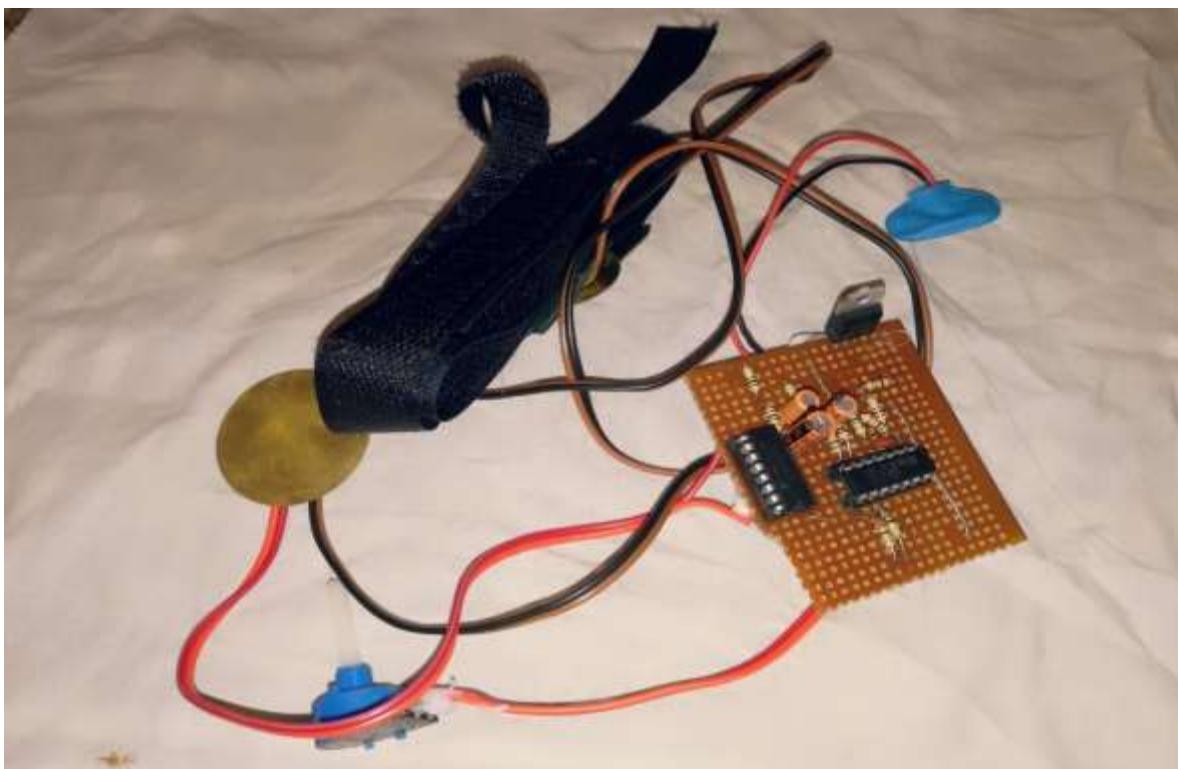


Figure 9: Circuit connected diagram of the proposed system

5. CONCLUSION AND FUTURE SCOPE

In the market, our product will create huge response because of its efficient rehabilitation by reshaping the existing devices in the market. The characteristics of our product will have a significant impact on both the occurrence and nature of competitive reactions. Our product launch strategies on competitive reaction in industrial markets which makes to enhance our device and to fill the gap between new product strategy and the determination of market value.

One of the most important things is to satisfy the user needs by our service and to help them by making them to feel convenient and comfortable with our product. This will create more impact on our product with the marketing strategy to enable the speech aid device in world wide. Our new design, once implemented will reduce the amount of inefficient speakers in our country and it is assured to create our country **'a country with no speechless people'**.

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Umbilical Cord Acid-Base Analysis: A Fuzzy Diagnosis Technique

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Abstract:

Fuzzy logic and System provides an important structure in analyzing the inaccuracies and uncertainties in accurate medical diagnosis system by enhancing the said system to heighten its performance. This paper presents an optimized Fuzzy system model that detects medical problems in a newborn infant through Acid-Base testing and Interpretation. The method of testing acid-base concentration of the blood present in the Umbilical Cord of newborn by using expert fuzzy system is described in this paper. In the majority of the applications of Fuzzy logic all Fuzzy sets [1] are characterized by limits normalized to unity. However, in the presented application it is shown that a diminution in the normalization limit of the fuzzy set is effective in optimizing the performance of the diagnosis system.

Keywords: Acid Base-balance; Fuzzy modeling; Etymological Variables; Sigmoid Function; Acidemia.

1. Introduction

Among few challenges in the field of medicine is the existence of uncertainty and imprecision in records and facts [2]. In reality, it is essential to deal with these uncertainties to develop the performance of Medical Expert System. Fuzzy logic has been one of the most prominent solutions that have provided some framework to ease the complication of these Systems.

Fuzzy Logic is a complex multi process system which when implemented gives a number of strategies that can be applied to achieve a successful system [3]. This system can be modified to be user friendly and purely sample and data based such that it can give results in formats that are precise and easy to understand.

A successful Crisp Expert Diagnosis System that interprets the balance in acid-base concentrations in the blood samples recorded from the umbilical cord of an infant is already in existence [4]. However, there is still debate on which system or implementation is the “Correct” one. Thus, a Fuzzy Expert System (FES) existed in literature; input to which was the data for 50 abnormal cases and ranked them from “worst” to “best”. It was observed that the FES performed worse than the already existing Crisp System. Now, using this knowledge the system is being tuned to perform better such that it shows expected correct and accurate results. In this application, the aim is to modify the FES so that it indicates the results that can later be implemented in the field of medical science.

1.1 Evolution of an Effective Optimization Technique

A. Development of the Fuzzy logic

The fuzzy logic implementation using Fuzzy Tool Box in MATLAB is an easy way to go. The system before its implementation needs some basic parameter sets. Before understanding the development of fuzzy logic, we need to know about the Fuzzy System [5].

B. Introduction to Fuzzy logic

Fuzzy logic is a several valued logic in which truth values variable may be any real number between 0 and 1. This means that the value of truth of a variable in fuzzy logic lays between “absolute truth”, that is 1 to “absolute false” that is 0, unlike a Boolean Logic that has either 0 or 1. This is what makes the fuzzy logic system so precise [6], [7].

C. Acid base interpretation of umbilical cord

MEDICAL BACKGROUND – Why it is necessary to test the umbilical cord [8] of an infant?

The Umbilical Cord is a duct connecting the embryo or fetus to the placenta. In the prenatal development phase, the umbilical cord is essentially a part of the fetus and normally consisting of two arteries (Veins and Arteries).

Testing of illicit drugs in high population has resulted in significant prevalence that is up to 10-40 % of usage. Identification of new-born imperiled to proscribed drugs during pregnancy helps alert the medical officer of problems one might stumble upon during the process of delivery and aid as an opportunity to identify and assess families with 'substance-abuse' disorders which can endanger the newborn after medical release. But the self-acclaimed reports are usually inaccurate and misleading [9]. To ensure the safety and health of a new-born child the umbilical cord testing is highly advised. Blood gas analyzer is used to measure the pH, the partial pressure of carbon dioxide (pCO_2) and the partial pressure of oxygen (pO_2) of blood in the umbilical cord of new born. The pH and pCO_2 parameters [10] are used for the derivation of base deficit of extracellular fluid.

The parameter BD_{efc} helps to distinguish reason for low pH concerning the distinct biological circumstances of respiratory acidosis caused by temporary amassing of CO_2 and a metabolic acidosis because of lactic acid from a durable period of oxygen inadequacy [11]. During labor, the balanced information on the harshness and any deficiency of O_2 is provided from the assessment of the acid-base stability of blood samples from the clinched umbilical cord. However, such procedure is erroneous.

In confined association with numerous skilled clinicians, an instruction centered expert system was developed to authenticate and deduce umbilical cord blood to check the status of acid-base balance and was implemented in many local hospitals of U.K. The pH and the BD_{efc} are examined to categorize the arterial and venous blood samples into one of the analyses extending from "normal" to "severe metabolic acidemia". Then the reports are distinguished between the respiratory acidosis and metabolic acidosis. The aforesaid method has been executed in labor ward at various hospitals to sample data from individual deliveries.

2. Need for the fuzzy system

Many problems were faced while implementing the conventional rule - Based Expert System. The system follows some rules which were featured with some sharp boundary cut-offs, like – "If arterial $pH < 7.05$ and arterial $BD_{efc} >= 12 \text{ mmol/l}$; then severe arterial metabolic acidemia" that does not focus on the actual decision-making process and do not represent some kind of ambiguity in the result to point towards an imprecise diagnosis. Therefore, a fuzzy-logic based expert system was required which can offer a more accurate and satisfactory demonstration. The purpose of studying the Fuzzy logic were-

- To define practicability by transforming the prevailing instructions into fuzzy instructions devoid of the requirement of any further skilled awareness.
- To examine if the proposed fuzzy system might suggest some development in performance against the prevailing rule based system in its elucidation of result.

3. Proposed work

The initial rule-based (crisp system) system follows such an arrangement, which is based on four essential input parameters venous pH (pH_V), venous base deficit (BD_V), arterial pH (pH_A)and arterial base deficit (BD_A). The Fuzzy Expert System was restricted to only analyze the true paired samples because all these guidelines were the subset of the initial rule based system. There were many rules functioning for the four input variables that require translation to the corresponding Fuzzy system.

The assumptions made are as follows:

- a) *Extrapolation Procedure:* The creation of composite fuzzy with data that can be worn to deduce an assurance in the result was the initial cause to execute a Fuzzy Expert System. Determination of the fuzzy model was necessary to attain crisp outcomes. Earlier, centroid-fuzzification was in use to obtain crisp results on a random gauge of 0 to 100 for individual fuzzy output variables.

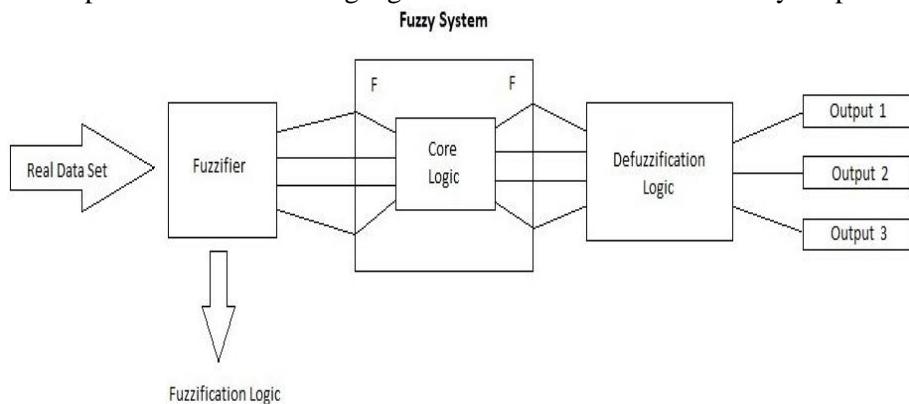


Figure 1: Overall Logic Diagram of the System

- b) *Etymological Variables and Fuzzy Terms:* All the input factors were allotted an etymological variable and analysis of the basic instructions revealed that all the terms can be classified into three fuzzy terms i.e. low, medium, and high. The fuzzy output parameters, the severity of acidemia was classified into five conditions: harsh, temperate, noteworthy, easy-going, and none and the variable period of acidemia (duration) were divided into three categories: chronic, intermediate, and acute.

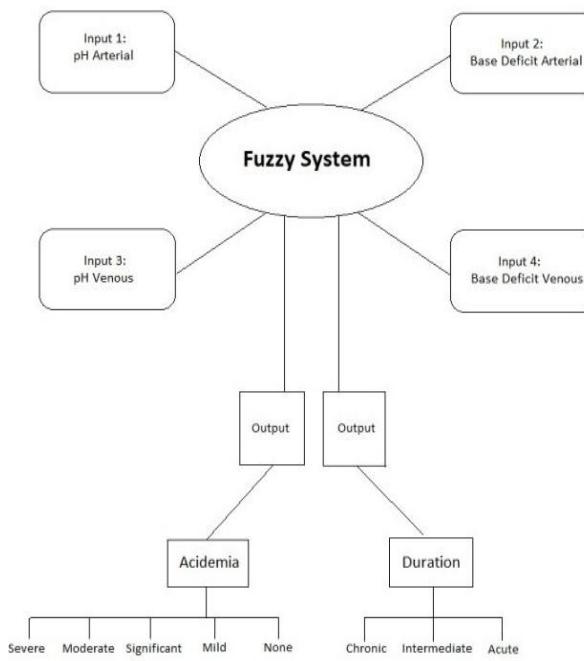


Figure 2: Input and Output parameters of Fuzzy System

- c) *Instruction Set:* Instructions for the basic logic based system were found as an outcome of knowledge elicitation assembles with multiple foremost doctors capable of acid-base analysis in umbilical cord blood. As the basic logic system had grasped medical application, the instruction set was directly accepted and therefore was recorded into fuzzy equivalents. The impartial hedgerow and the identical hedgerow were considered for instance the square-root operator and the square operator respectively.

- d) *Fuzzy Operators:* Group of operators (probabilistic approach) were chosen because the entire fuzzy convention feature by combining all the four etymological variables as follows: "If pH_A is low AND BD_A is high and pH_V is low AND BD_V is high then acidemia is severe metabolic"

The minimum operator can be drawn on for the combination of complete values just by its lowermost member. For example, the instruction mentioned above is represented by the values given in Table 1, the minimum operator would turn out in general truth the same for both cases regardless of the truth that case 2 is poorer to case 1, as the pH of the artery is less and the deficits of both the bases are high. The operator impersonates the perceptive of the specialist to make an allowance for the parameters so that the complete reality for 2 is higher.

Table -1: Justification of Probabilistic combination to be fair than the Minimum combination operator [12]

Case	pH _A μ ₁	BD _A μ ₂	pH _V μ ₃	BD _V μ ₄	min (μ ₁ ,μ ₂ ,μ ₃ ,μ ₄)	(μ ₁ * μ ₂ * μ ₃ *μ ₄)
1	7.05 0.5 ^[12]	11.5 0.9 ^[12]	7.10 0.5 ^[12]	9.5 0.9 ^[12]	0.50 ^[12]	0.20 ^[12]
2	6.95 1.0 ^[12]	15.0 1.0 ^[12]	7.10 0.5 ^[12]	11.0 1.0 ^[12]	0.50 ^[12]	0.50 ^[12]

e) *Membership Functions:* The effect of the values shown in the above table can be validated if the membership of any terms of the given parameters plateaus at 1.0. *Sigmoid* membership function which approaches 1.0 asymptotically is found to be the easiest way to escape this problem. Each and every fuzzy set was demonstrated with “sigmoid” membership functions; extreme left-side values were displayed using a declining “sigmoid”

$$\mu(x) = \frac{1}{1+e^{(x-m)/\alpha\sigma}} \quad (1)$$

Whereas right side sets were displayed by accumulative “sigmoid”

$$\mu(x) = \frac{1}{1+e^{(m-x)/\alpha\sigma}} \quad (2)$$

In addition, the middle sets were displayed by the conjunction of the two mentioned sigmoid

$$\mu(x) = \frac{1}{(1+e^{(x-m-\sigma/2)/\alpha\sigma})(1+e^{(m-\sigma/2-x)/\alpha\sigma})} \quad (3)$$

Where,

μ=0.5 is the sigmoid for the position of midpoint values for middle sets

m=the position μ

σ=0.1 is the breadth parameter of the sigmoid [12].

This σ is equivalent to the breadth of middle sets that prevails the sigmoid slope so as to set the utmost value of the middle term to be nearly equal to one.

The terms of the four input variables of the fuzzy system had their location and width calculated by the cut-offs encrypted to the crisp instructions. So, as an instance, the input of the artery (pH values) at 7.05 was changed from lower values to higher values as at this point the information is cast off completely well through the crisp instructions. Array of input parameters for the fuzzy system was produced from the equations (1)–(3) using the creation of dissertation and values from Table 2 and Figure [3 (a), (b)] and Figure [4 (a), (b)] given below. Sigmoid membership functions were also used to display the output variables with the foundation parameter as well as with the crossovers of all term were determined randomly on a universe of dissertation of 0 - 100. Figure [3 (a), (b)] shows the array of terms for output variables.

Table-2: Table showing the parameters for generating initial sigmoid membership functions for the input parameters [12]

Variable	Universe	Low		Mid		High	
		m	σ	m	σ	m	σ
pH _A	6.60 - 7.60 ^[12]	7.05	0.15 ^[12]	7.10	0.10 ^[12]	7.15	0.15 ^[12]
BD _A	0 - 20 ^[12]	8	6 ^[12]	10	4 ^[12]	12	6 ^[12]
pH _V	6.60 - 7.60 ^[12]	7.10	0.15 ^[12]	7.15	0.10 ^[12]	7.20	0.15 ^[12]
BD _V	0 - 20 ^[12]	6	6 ^[12]	8	4 ^[12]	10	6 ^[12]

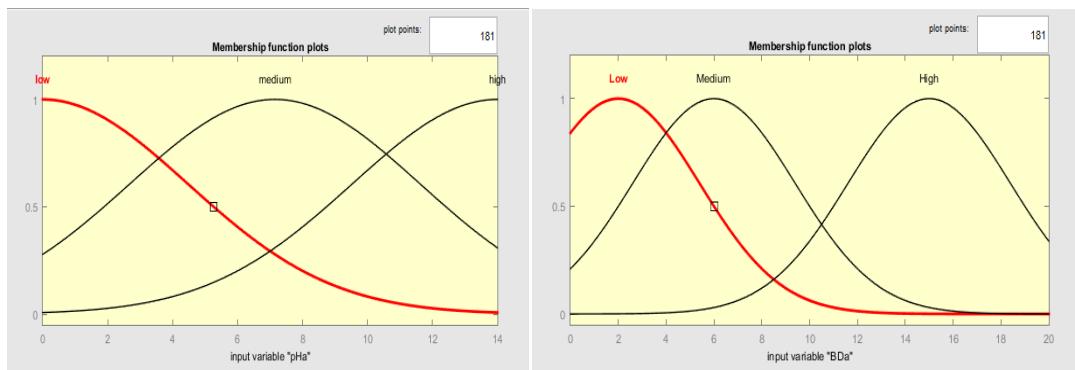


Figure-3 (a): The input variable of Arterial pH (pH_A) (b): The input variable of Arterial BD (BD_A)

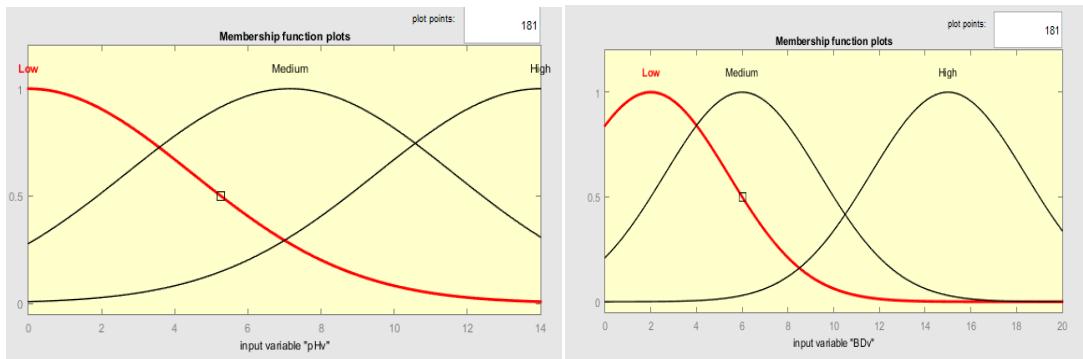


Figure-4(a): The input variable of venous pH (pH_V) (b): The input variable of venous BD (BD_V)

The two outcomes of the FES were united into a single term representing the severity of acidemia is of primary importance and the period of acidemia is of lesser importance. This is given by:

$$\text{Condition} = \text{acidemia} + \frac{\text{duration}}{10} \quad (4)$$

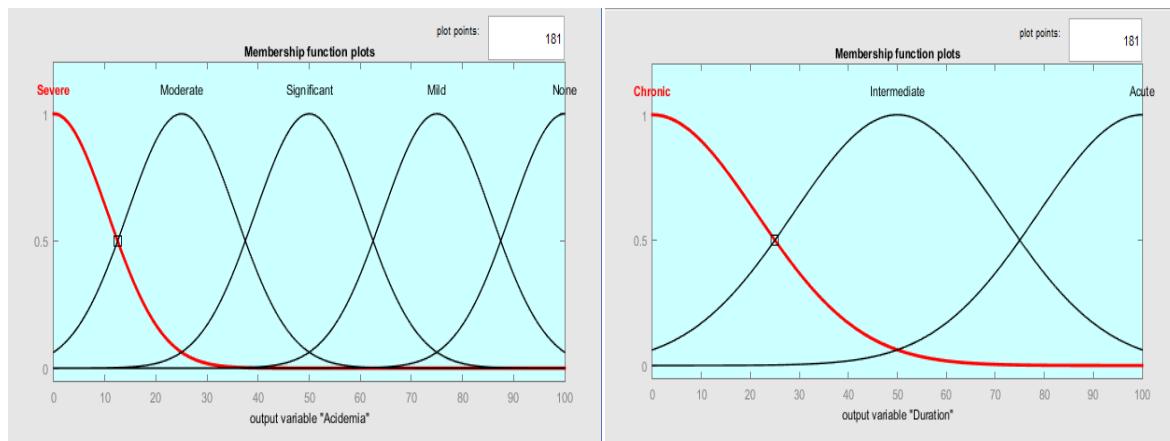


Figure-5(a): The output variable of academia (b) Duration of the output variable

These outputs indicate the medical difficulties with the maximum accuracy so that the exact problem can be pointed without any delay reducing the chances of fatality.

4. Conclusion

Few rules were implemented to test the accuracy of the system. The three rules that were taken as an example were:

- If pH_A is low and BD_A is high whereas, pH_V is low and BD_V is kept high then Acidemia will reach an unembellished stage with a chronic duration.

- If pH_A is medium and BD_A is high whereas, the pH_v value is kept low with high BD_v , then Acidemia is in the moderate state with an intermediate duration.
- If pH_A value is kept high with a low BD_A and pH_v is medium and BD_v is medium, then Acidemia is in quite a Significant state with an acute detection and Duration is Acute.

The above logic are taken as examples to test the proposed Fuzzy system and values for inputs were given.

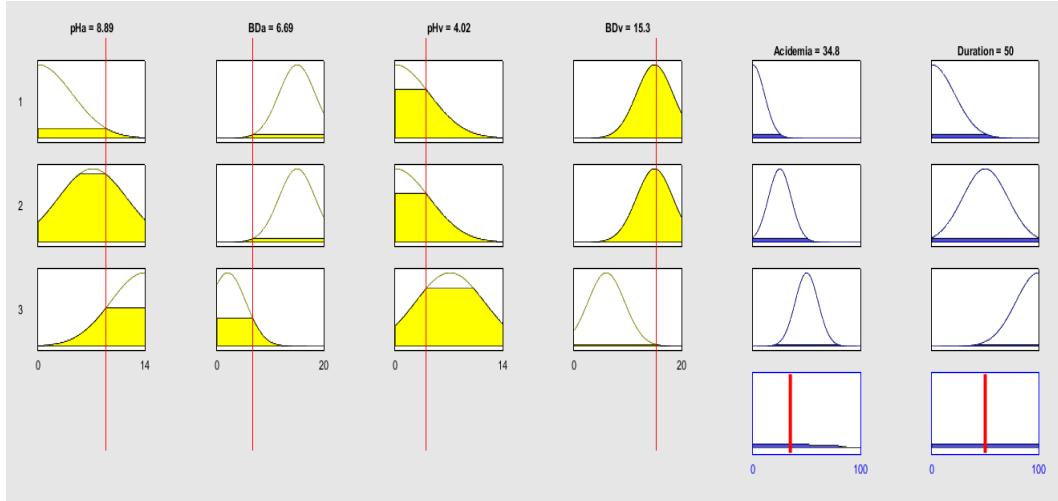


Figure-6: Different values for Inputs of pH_A , pH_v , BD_A , BD_v

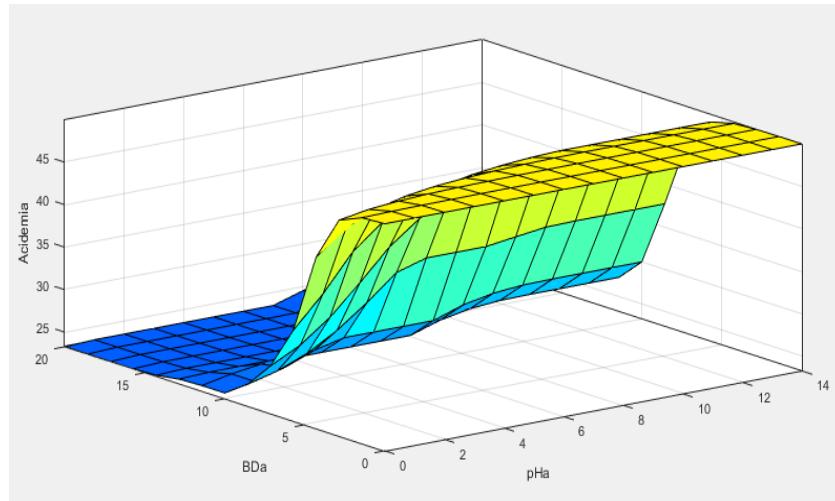


Figure-7: The 3D Interpretation for the set of rules considered

Table-3: Result of Clinicians', crisp and Fuzzy Systems' Agreement [12]

Agreement	Correlation Coefficient (ρ_s)	Sigmoid (p)
Clinician \leftrightarrow Clinicians ^[12]	0.91 ^[12]	<<0.001 ^[12]
Crisp Sys \leftrightarrow Clinicians ^[12]	0.80 ^[12]	<<0.001 ^[12]
Fuzzy Set \leftrightarrow Clinicians ^[12]	0.93 ^[12]	<<0.001 ^[12]

The outcome of the concord with clinicians of Fuzzy system is revealed in the above table. It is seen, the usual correlation coefficient among the clinicians is around 0.91(very high). This indicates that the doctors contracted with one other well enough in terms of outcome. The crisp structure which among clinicians did significantly well (0.80) but the Fuzzy System did significantly higher (0.93) than the other aforementioned two. This is so because some assumptions made in Crisp system were

reconsidered for the Fuzzy Model for it to work better and more accurate.

The Fuzzy System is more accurate because the Crisp System had drawbacks that were corrected during the designing of the Fuzzy Model. Thus, the acid-base concentration of the umbilical cord's blood sample can be reliably interpreted using the fuzzy model. Results provided by the proposed fuzzy model will give precise knowledge on the health of new born infants.

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Performance Improvement of Cloud Storage by Adopting Non-volatile Buffer Cache

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Abstract

Buffer cache plays an important role in improving cloud storage performances. However, data may be lost if the system crashes before updated data in the buffer cache is reflected to storage. Thus, pdflush is used to periodically flush the updated data into storage. However, pdflush degrades the cloud storage performance significantly as most writes are directly transferred to storage. We show that pdflush accounts for 64-78% of the total write traffic to storage. To alleviate this, we present a new buffer cache architecture that adopts non-volatile memory to maintain updated data. This novel architecture removes a bunch of storage writes caused by pdflush without loss of reliability. Experimental results show that the proposed buffer cache reduces the storage write traffic by 40%, leading to the improved cloud storage performances.

Keywords: Non-volatile memory; buffer cache; pdflush; cloud storage.

1. Introduction

In this paper, we analyze the performance improvement of cloud storage systems by adopting non-volatile buffer cache. Buffer cache maintains file data in a certain portion of main memory, thereby servicing subsequent requests without accessing slow storage media. As traditional buffer cache uses volatile media like DRAM [1], inconsistent or out-of-date states may happen when the system crashes before the changes are reflected to permanent storage. To relieve this problem, pdflush is used, which transfers the updated data to permanent storage within a short time period [2]. Modern file systems also use journaling for more reliable updates to storage. Unlike pdflush that reflects the updated data directly to its original location in the storage, journaling writes the changes to separate storage area first and then reflects them to the original location later. Though journaling provides more reliable data updates because it withstands system crashes during storage updates, it generates a bunch of additional storage writes. Thus, most systems adopt journaling only for metadata and pdflush for regular data. Though journaling and pdflush improve the reliability of file systems, they degrade the effectiveness of the buffer cache significantly due to frequent storage accesses even when the cache space is not exhausted [3], [4].

Recently, high performance non-volatile memory such as PCRAM or STT-MRAM is anticipated to be adopted in the design of future cloud storage systems [5], [6]. However, as non-volatile memory will not completely replace DRAM due to cost, it is considered only as an add-on component to enhance performances [7]. This paper investigates how much performance gain can be obtained if we add non-volatile memory as the buffer cache of cloud storage systems. To do so, we first analyze the source of storage writes in file system workloads and show that pdflush accounts for 64-78% of total write traffic to storage. In order to eliminate these excessive storage writes, we propose a new buffer cache architecture that only adds a small amount of non-volatile memory to the buffer cache and stores modifications to this non-volatile buffer cache.

As we use non-volatile buffer cache, pdflush is not needed because the contents of the buffer cache are retained even when the system crashes. We show that this novel buffer cache architecture removes a bunch of storage writes caused by pdflush without any loss of data via efficient management techniques. By replaying representative file system workloads, we show that the

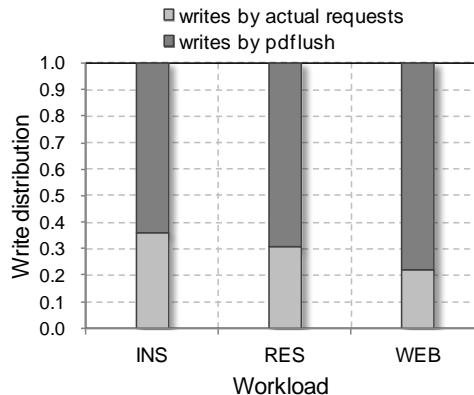


Fig. 1. Analyzing the source of storage writes using INS, RES, and WEB workloads.

proposed buffer cache reduces the write traffic to storage by 45% on average and up to 73%. A number of previous studies have also attempted to relieve the overhead of storage writes by making use of non-volatile memory technologies [8], [9], [10]. Our work is different from theirs in that we reduce the pdflush overhead incurred by regular data rather than journaling overhead for metadata. Furthermore, we use only a small amount of non-volatile buffer cache.

The remainder of this paper is organized as follows. Section 2 analyzes the overhead of pdflush in the write traffic to storage. Section 3 details our buffer cache architecture and algorithm. Section 4 presents a brief description of the experimental conditions and discusses the performance evaluation results. Finally, Section 5 concludes the paper.

2. Analyzing Pdflush Overhead

In this section, we analyze the overhead of pdflush by showing the amount of write traffic from the buffer cache to storage. We use system-call traces collected in the NOW project at UC Berkeley, a popular I/O workload traces [11]. Fig. 1 shows the write traffic to storage when INS, RES, and WEB traces are replayed. In the figure, storage writes are categorized into those by actual write requests, and by pdflush, which periodically performs backup to storage for consistency of file systems. As shown in the figure, storage writes are dominated by the pdflush rather than actual requests. Specifically, pdflush accounts for 64-78% of total writes to storage. When pdflush is not used, storage writes occur only when updated data in the buffer cache are evicted or when there is an explicit sync operation. This implies that pdflush accounts for a considerable portion of storage writes, and is thus a potential source of performance degradation in cloud storage.

Based on this observation, we adopt non-volatile memory for the purpose of absorbing the writes of pdflush so as to reduce the amount of data written to storage by more than a half. As non-volatile buffer cache maintains data on it against power failures, it reaps the same effect as pdflush without incurring frequent storage backups.

3. Buffer Cache with Non-volatile Memory

We now describe an efficient buffer cache management scheme that adopts non-volatile memory in conjunction with DRAM as buffer cache. Fig. 2 shows the basic architecture of the proposed buffer cache that consists of volatile-buffer cache and non-volatile buffer cache. Our non-volatile buffer cache is placed in standard DIMM slots to access it through a byte-addressable interface. There exist several types of non-volatile memory media, such as PCRAM, FeRAM, and STT-MRAM. Recently, PCRAM and STT-MRAM have been drawing considerable interest from the research community due to their rapid improvement in micro-fabrication processes [12]. However, PCRAM has critical weaknesses to absorb writes in our buffer cache as it has limited write endurance and slow write performance compared to DRAM. For this reason, PCRAM is usually adopted to absorb read-intensive workloads in memory systems [5]. We use STT-MRAM as our non-volatile buffer cache because it does not have such limitations in write operations.

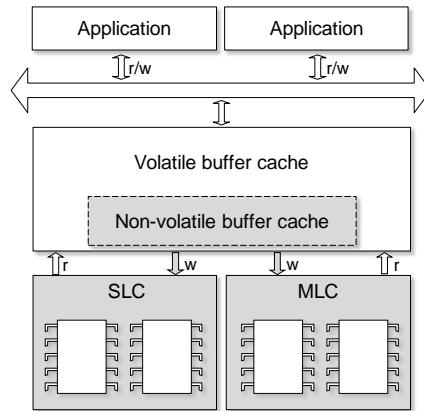


Fig. 2. System architecture of the proposed buffer cache

Volatile buffer cache manages cached data by the block as a unit, whereas non-volatile buffer cache does this by the byte. In our buffer cache, the volatile buffer cache behaves exactly the same as the existing buffer cache upon all read and write requests. In contrast, the non-volatile buffer cache maintains only the modified part of a block (which we call fragment) upon a pdflush. Thus, modifications are reflected to both the volatile and the non-volatile buffer cache. Data reflected to the volatile buffer cache is used to service normal requests. For example, read requests for dirty blocks are serviced through the volatile buffer cache. Data in the non-volatile buffer cache is used only when a system crash occurs to restore the recent image of the file system. This eliminates the large storage write traffic caused by traditional pdflush operations.

For now, as the capacity of non-volatile memory is limited, a space-efficient management for the non-volatile buffer cache is needed. In this paper, instead of storing an entire block to the non-volatile buffer cache, we only maintain the modified part of a block, thereby improving the space-efficiency of the non-volatile memory. Instead, as the modification is also reflected to the volatile buffer cache, all read/write and flush operations can be performed by referencing the volatile buffer cache. Note that the non-volatile buffer cache is used only when a power failure occurs. When free space is needed in the volatile buffer cache, we basically use the LRU algorithm, the most popular replacement algorithm used in the buffer cache. When a dirty block is selected as the victim block in the volatile buffer cache, it is first written to storage, and then discarded. As all modifications of a block are also maintained in the non-volatile buffer cache, we also remove the fragments of the victim block from the non-volatile buffer cache. Note that these fragments have already been reflected to storage, and do not cause inconsistencies any longer.

When free space is needed in the non-volatile buffer cache, modified fragments belonging to the same block should be merged and replaced together. This is because fragments in the non-volatile buffer cache need to be flushed to storage before their eviction and the minimum unit of storage writing is a logical block. Instead of generating a logical block to be flushed by merging dirty fragments in our scheme, the corresponding block maintained in the volatile buffer cache is searched and that block is written to storage. This is possible as all modifications were already reflected to the block maintained in the volatile buffer cache. By so doing, we need not merge fragments in the non-volatile buffer cache to generate a block to be flushed.

After storage flushing, all fragments belonging to this block are discarded from the non-volatile buffer cache. The corresponding block in the volatile buffer cache does not change its priority but its state is changed from dirty to clean. Thus, even though a block is evicted from the non-volatile buffer cache, it is possible that the same block still has a high caching priority in the volatile buffer cache if it is a read-intensive data. Accordingly, our buffer cache guarantees the same cache hit ratio of existing buffer cache architectures, but eliminates the writing overhead of pdflush.

4. Experimental Results

To assess the effectiveness of the proposed buffer cache with respect to the write traffic to storage, we perform trace-driven simulations. We developed a hybrid buffer cache simulator that

Table 1. Characteristics of the traces used in the experiments.

Workload	Total # of references	Total # of distinct blocks	Ratio of ops. (read : write)
INS	12,473,845	162,588	17.2 : 1
RES	750,303	46,820	1 : 2.53

employs non-volatile memory along with DRAM as buffer cache. The size of a block in the volatile buffer cache is set to 4KB, which is common to most operating systems including Linux. Though non-volatile memory such as STT-MRAM or PCRAM allows byte-addressability, main memory can be accessed with a unit of word. Thus, the minimum operation unit of the non-volatile buffer cache should be at least 4 bytes in 32 bit machines and 8 bytes in 64 bit machines if a memory architecture similar to DRAM is adopted. Moreover, as writing to our non-volatile buffer cache occurs when the last-level cache memory flushes its dirty block to main memory, the fragment size should also be of this cache block size. We assume a 32 bit architecture and the 128 byte block of the last-level cache in this paper.

The traces used in the experiments are one of the representative file I/O traces collected in the NOW project of UC Berkeley [11]. They are extracted from the general-purpose workstations using HP-UX. They consist of undergraduate instructional workload (denoted as INS) and graduate research workload (denoted as RES). Characteristics of the traces are described in Table 1. We compare the amount of data written to storage for our scheme, which we call DF-LRW (Delta write & Fragment-grouping LRW) and the legacy buffer cache that uses the LRU algorithm with pdflush. As in most operating systems, pdflush in our experiments is invoked every 5 seconds and flushes all the data updated more than 30 seconds ago.

In our experiments, the size of the non-volatile buffer cache is changed from 1MB to 4MB. Note that the size of STT-MRAM used in our simulation is configured by considering the footprint of the workload traces. Thus, the relative size of STT-MRAM in comparison with the DRAM size and the workload footprint size needs to be the focus of interest rather than the physical STT-MRAM size. In addition, as the hardware technology of STT-MRAM is not mature yet, it is difficult to estimate the exact capacity of STT-MRAM products for now. Even if the capacity becomes larger than that used in this paper, investigating the effectiveness of our scheme with a small size of STT-MRAM is valuable. Specifically, as the multiprogramming degree of modern computer systems is being increased, their working-set would also become larger than the workload used in our experiments.

Fig. 3 compares the storage write traffic for the legacy buffer cache with pdflush and DF-LRW under the RES workload, where the *x*-axis represents the size of the volatile buffer cache ranging from 3% to 100% of total footprint and the *y*-axis represents the amount of data written to storage for the given cache size. For DF-LRW, the size of the non-volatile buffer cache is also varied from 1MB to 4MB as shown in Figs. 3 (a)-(b).

Our buffer cache reduces the storage write traffic of pdflush significantly for all cache sizes. Specifically, the amount of data written to storage is decreased by 70% on average only with a small amount of non-volatile memory. The reason for this large reduction lies in the elimination of pdflush traffic introduced in Section 2. When the size of the non-volatile buffer cache is very small, the storage write traffic is expected to be large due to frequent cache replacement. However, as shown in the figure, for all of 1MB, 2MB, and 4MB cache sizes, the storage write traffic is consistently small. The write traffic is slightly large only when the size of both volatile and non-volatile buffer caches is extremely small as shown in the leftmost graph of Fig. 3(a).

Fig. 3(b) shows the write traffic of pdflush and our scheme under the INS workload. Similar to the result for the RES workload, our buffer cache with DF-LRW reduces the amount of data written to storage significantly. Specifically, the write traffic is decreased by 30% on average compared to pdflush. The improvement under the INS workload is relatively smaller than that under RES because INS is a read-intensive workload while RES is write-intensive. As shown in Table 1, the ratio of read to write operations is 1:2.53 in the RES workload, but it is 17.2:1 in the INS workload. As under RES, we can observe that the size of the non-volatile buffer cache needed to reduce this write traffic is very small.

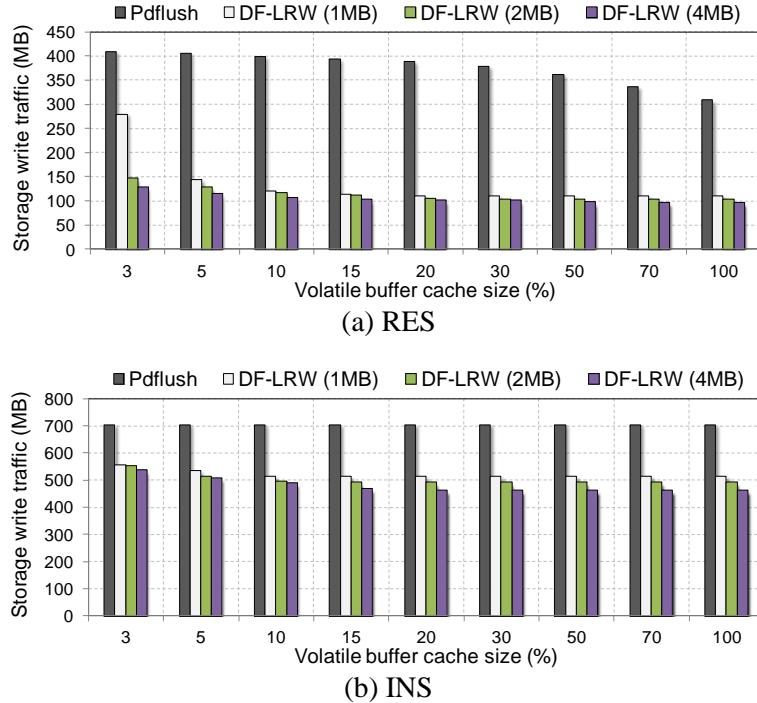


Fig. 3. Comparison of DF-LRW and pdflush with respect to storage write traffic.

Considering the results in Fig. 3 and the work-load characteristics, we conclude that a small STT-MRAM size of 1-4MB is sufficient in general systems. However, we do not believe that our cases can be generalized to all environments. In reality, the size of the non-volatile buffer cache should be configured based on the scale of target system's workloads as well as the relative DRAM size of the system. Our current conclusion is that only a small amount of 1st generation STT-MRAM products will be sufficient to eliminate pdflush regardless of their density and capacity, if our software technology is utilized.

5. Conclusion

Pdflush improves file system reliability but it degrades the effectiveness of buffer cache significantly. This paper showed that pdflush accounts for 64-78% of total write traffic to storage. To eliminate this inefficiency, we proposed a new buffer cache architecture that uses only a small amount of non-volatile memory and stores modifications to the non-volatile buffer cache. This buffer cache architecture removes almost all storage accesses due to pdflush without any loss of reliability. It also improves the buffer cache performance via space-efficient cache management with only a small amount of non-volatile memory. Our simulation results have shown that the proposed scheme reduces the number of storage writes by 44% on average for the specific workloads we tested.

6. Acknowledgment

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Prediction Model of Dengue Hemorrhagic Fever Outbreak using Artificial Neural Networks in Northeast of Thailand

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Abstract

The predictive model is used to calculate artificial neural networks algorithm factor of relationships for dengue hemorrhagic fever outbreaks in Northeast of Thailand can use analysis factors for dengue outbreaks by using data in past from 2007-2016 (total of ten years). Furthermore, the factor is complex and contains fourteen variables (temperature or weather, rainfall and humidity, mosquito growth periods, areas and residence and population) for dengue hemorrhagic fever. Data analysis objectives were (1) to factor analyzed climate change for dengue hemorrhagic fever outbreaks in Northeast of Thailand and (2) to create a model optimization for prediction by neural network statistic which is called Artificial Neural Networks. The evaluation model results is prediction of error values mean square error (MSE). This model is accurate to more than 80%.

Keywords: Dengue Hemorrhagic Fever (DHF), Neural Networks, Prediction

1. Introduction

In recent years, dengue hemorrhagic fever (DHF) are one of six diseases within Thailand and physical countries as they are transmitted by aedes mosquitoes, which are in the area. Dengue fever has increased dramatically in the past decades and has now become a global threat, according to the World Health Organization (WHO), an estimated 500 million cases of DF and 250,000-500,000 cases of DF occur annually [6]. Dengue is an acute, febrile infection widespread in many tropical and subtropical regions of the world. In Malaysia dengue has been considered as endemic since 1971. [4] In DHF and DSS, there is an acute increase in vascular permeability that leads to leakage of plasma into the extravascular compartments, resulting in haemoconcentration and hypotension. [10]. Dengue is one of the main problems of public health in the world. It is estimated that about 2.5 billion people are now at risk of dengue. [11]. In recent years, dengue fever are six diseases of Thailand and other physical countries as they are both transmitted by Aedes mosquitoes, which are in area Thailand [12].

Nearly 75% of all dengue cases worldwide occur in Asia and the Pacific. This threat has been recognized by countries throughout the region and have taken action to protect their population. One of the main forces driving regional preparedness for health threats such as dengue is the association of Southeast Asian Nations (ASEAN). Before 1970 only nine countries had experienced epidemics of dengue hemorrhagic fever. This has increased more than fourfold by 1995. Today, about two fifths of the world's population are at risk for dengue. In 2010, Member States of the South-East Asia Region reported 293868 cases, with 1896 deaths (CFR 0.65%). This represents the highest reported number of cases in the last 5 years. (Bhutan and Nepal started reporting dengue in 2007). India, Indonesia, Myanmar, Sri Lanka, and Thailand all reported more than 10000 cases in 2010. Dengue is an emerging public health problem in Bhutan, Maldives and Nepal. Which deals with this by way of regional programmers on emerging infectious diseases, formulated by the ASEAN Medium Term Plan on Emerging Infectious Diseases (2011-2015). Included in this plan is a focus area on addressing specific diseases such as dengue. [7]

In 2010, Brunei saw 298 dengue cases and two deaths, a significant increase from the 38 dengue cases that were reported in 2009. Dengue has been a challenge in Malaysia and 2010 saw the country's highest number of dengue cases, with 46171 cases reported and 134 deaths. An estimated 500000 people

with DHF require hospitalization each year, a very large proportion of whom are children. About 2.5% of those affected die. [6]. During the period 2000–2010, the annual incidence rates of dengue cases per 100,000 populations in Singapore increased from 17 in 2000 to 332 in 2005 before declining to 106 in 2010. [8].

From first to third paragraph. We were data analyzer from DHF of ASEAN and of Thailand in the present case. We then found an algorithm which we used to analyze data on DHF in Thailand. An optimization algorithm can be used on artificial neural networks (ANN).

ANN is a powerful nonlinear statistical paradigm for recognition of complex patterns with the ability to maintain accuracy even when some input data is missing. [1] Neural networks provide a closer approach to human perception and recognition than traditional computing. When inputs are noisy or incomplete, neural networks can still produce reasonable results. [2] In ANN computational units called neurons replace the nerve cells and the strengths of the interconnections are represented by weights, in which the learned information is stored. [3] Moreover, there was no validation technique implemented in this study to eliminate the bias associated with the random sampling of the training and testing data. [4] Therefore, neural network has the attractive potential and real-values called multilayer perceptron (MLP) can be naturally used in the fields where complex values are indispensable, or a complex values MLP can naturally fit a periodic or unbounded function. The model of a complex-valued MLP. Here f_i^μ and z_j^μ are output values of output unit i and hidden unit j for data point μ respectively. [5]

This research paper is implement as follows. Secondly, we have described the framework DHF Outbreak using ANN prediction in northeast of Thailand. Thirdly, we describe the methodology calculated of sum weight and sigmoid function or transfer function and result for neural network. Fourthly, an implementation model of neural network. We propose table of evaluation model for prediction by neural network (i.e., MSE, SSE). Finally, we have proposed conclusions and related work in the future.

2. Related Works

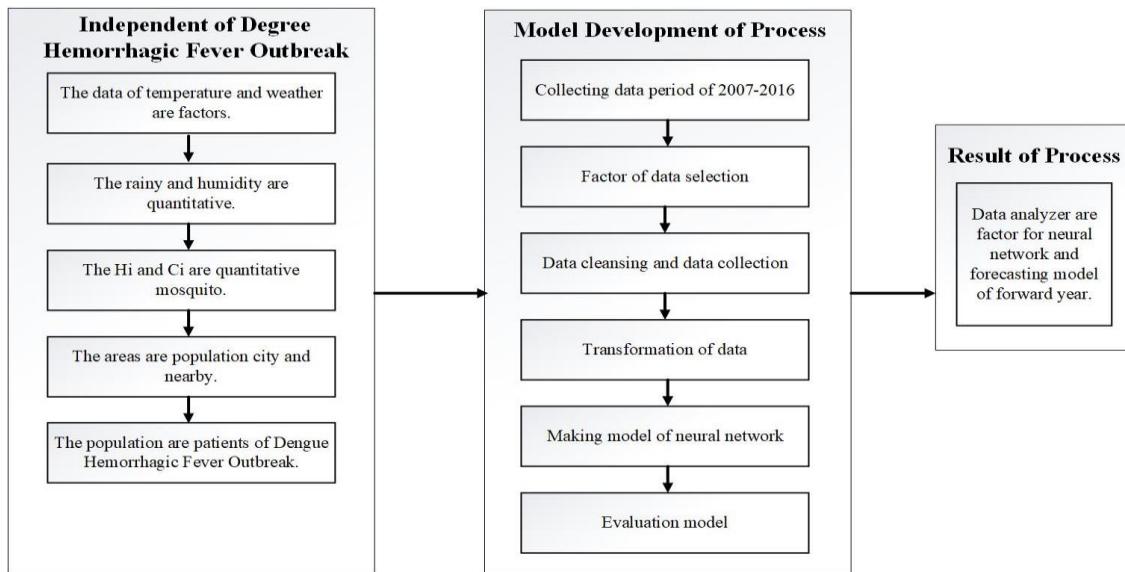


Fig. 1. Framework of research for neural network

From Fig 1. This framework is DHF outbreak of factor using ANN prediction in northeast of Thailand for model process and method eight steps including of step1 to step 8.

Step 1. Data collection can used of dependent to effect of DHF outbreak (e.g, temperature, weather, rainy, humidity, Hi (House Index), Ci (Container Index), areas of address, patient of dengue hemorrhagic fever outbreak). The study areas were thirty-two province in the past of northeast of Thailand. In province were selected because of there high incidence of DHF cases and high morbidity mortality rates during the five year period 2007-2016.

Step 2. Data selection can used of input system and the result evaluation from process. In addition, data selection goal result were presented to predictive effectiveness of climate change to DHF outbreak by ANN.

Step 3. Data cleansing can used of collection reliability and many of data optimization to analysis. There are data to filter information (i.e., deleting to data of duplicate and editing data of error, outlier information from the other individuals or groups).

Step 4. Data transformation can used of prepare data in type were described algorithm to analysis data mining technique (i.e., data, number, picture).

Step 5. Data analysis can used of analyze data mining technique (i.e., classification, clustering and association rules. This research were presented neural network of technique for prediction data.

Step 6. To study method were process of data (i.e., grouping data, sorting data and calculating data).

Step 7. To evaluate method were measure performance model and analysis data in step 5.

Step 8. Final of model can used of analyze in work.

We compared the accuracy performance of the classification results of DHF outbreak in northeast of Thailand with the traditional model the prediction model (Linear regression, Artificial neural network). The dataset use in experiment physical years 2007-2016. The dataset are 14 factors, 14269 samples. Therefore, the results of the process are analyzed by ANN algorithm definition in 2.1.

2.1 Artificial Neural Network (ANN)

An artificial neural network is a “Brain” computational system. A linear neuron with R inputs is shown below in Fig 2.

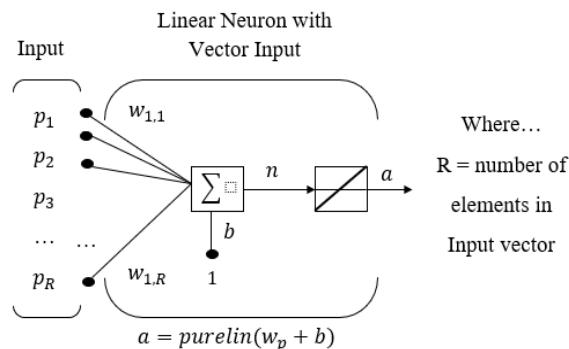
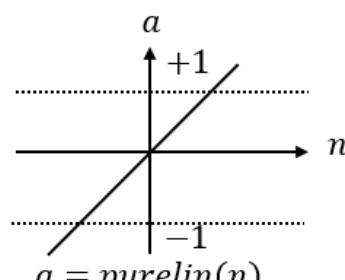


Fig. 2. Neuron Model

This network has the same basic structures as the perceptron. The only difference is that the linear neuron uses a linear transfer function *purelin*. [9].



Linear Transfer Function

Fig. 3. Linear Transfer Function

The linear transfer function calculates the neuron's output by simply returning the value passed to it.

This neuron can be trained to learn an affine function of its inputs, or to find a linear approximation to a nonlinear function. A linear network cannot, of course, be made to perform a nonlinear computation. [9].

3. Proposed work

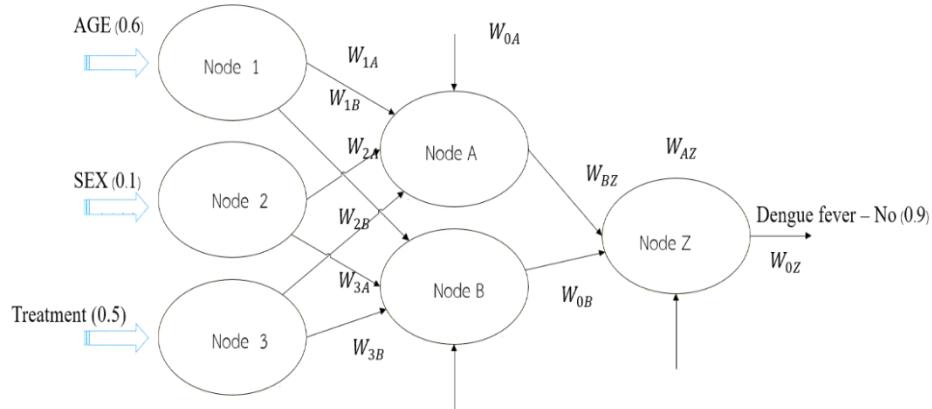


Fig. 4. Calculate the perceptron

From Fig 4. We have presented to techniques for perceptron algorithm. Therefore, the method is calculated and is detailed variables including of number 1 to 10.

1. For every input data can used be multiply that input by its weight each of node.
2. Calculated sum all of has results of the weighted inputs.
3. Compute data outputs used of the perceptron based on that sum passed through an activation function such as the sign of the sum as equation (1).
4. To learning has feed-forward networks belongs to of supervised learning, in which pairs of input and output values has into the network for many cycles, so that the network to learns the relationship between input and output.
5. We have provided the network with a number of training samples, which consists of an input vector i and its desired output j . For instance, in the classification suppose. We have points $(1, 1)$ and $(1, 2)$ belonging to group 0, points $(2, 1)$ and $(2, 2)$ belonging to group 1, $(3, 1)$ and $(3, 2)$ belonging to group 2, then for a feed-forward network with 3 input nodes and 1 output nodes, the training set would be:
 $\{i = (0,6), j=(0,0) i = (0,1), j=(0,1) i = (0,5), j=(0,2) i = (1,1), j=(0,3) i = (1,2), j=(0,1) i = (1,3), j=(0,2)\}$
6. The basic rule for choosing the number of output nodes depends on the number of different factors. It has represented to the different factors, i.e. for each output only one node can have value 1. Then, the number of output nodes equal to number of different between -1 to 1.
7. The backpropagation learning has every time input vector of data training sample presented to the output vector node z has compared to the desired value Err .
8. The comparison has done by calculating the squared difference of the equation (1).
9. This equation has calculated different between input and output data an including of as (1).

$$Err = (d - o)^2 \quad (1)$$

10. The goal of backpropagation has to minimize the sum of error for all the training samples, so that the network behaves in the most way.

We have checked for measurement hidden node and output node used of data factors total 14. First step function sum has equation defined (Σ). When, input node has calculated sum linear and connected weight has defined equation as (2).

$$net_1 = \sum_i w_{iA} x_{ij} = w_{0A}x_{0j} + w_{1A}x_{1j} + \dots + w_{iA}x_{ij} \quad (2)$$

Where x_{ij} is input data of i to node j.

w_{ij} is input connected weight of data i to node j and input number i+1 to node j.

Example 1. Hidden node has calculated learning rate equal to 0.35, momentum equal to 0.25. The define has equational as (3).

$$net_1 = \sum_i w_{iA} x_{iA} = w_{0A}x_{0A} + w_{1A}x_{1A} + w_{2A}x_{2A} + \dots + w_{31j}x_{31j} \quad (3)$$

$$net_1 = (1*0.30) + (1*0.067) + (1*-0.30) + (1*0.07) + (1*-0.08) + (1*0.09) + (1*-0.17) + (1*0.86) + (1*0.02) + (1*-0.06) + (1*0.01) + (1*-0.03) + (1*-0.07) + (1*0.03) + (1*-0.029) + (1*-0.08) + (1*-0.064) + (1*0.124) + (1*-0.123) + (1*2.581) + (1*-0.067) + (1*-0.074) + (1*-0.058) + (1*0.11) + (1*0.00) + (1*0.30) + (1*0.00) + (1*0.05) + (1*0.058) + (1*-0.034) + (1*0.068) + -0.42$$

$$net_1 = 3.07$$

From first node has calculated function sum of net_1 equal to 3.07 and input data sigmoid function by S-shape. The defined has equational as (4).

$$(f(net))_1 = \frac{1}{1 + e^{-3.07}} = 0.04 \quad (4)$$

The results is connected to input node or output node z. When, output node equal to 0.04. Method of ANN are process factors of dengue fever including of supervised learning and feed forward, if can input data are process and result of output. There are define detail number 1 to 3.

1. Supervised Learning meaning of learning of neuron of human. In particular, the process of thinking are complexity and result of knowledge data interested (e.g., occurs of disease). There are check disease result yes or no. Then, the physical used of feed forward process. Factors are input including of values independent and output DHF outbreak.

2. The interpretation neuron network are calculated model of number such as the number is 0.90 you can describe number by criterion.

3. The Structure neuron network are including of input layer and input factors between -1,1. For example, data of 100 people have to types of standardize (\bar{x} , S. D.) transform formulas and conversion.

In the case of the perceptron, the output has only two possible values +1 or -1. This means there are only three possible errors. If the correct answer is -1 and we have guessed -1, then the error is -2. If the correct answer is +1 and we have guessed -1, then the error is +2. The hidden layers have prepared properties of management reduce noise and regression non-linear. However, output layers have to every once display. Can used data discrete or continuous.

Transfer function has called sigmoid function and shape properties of nonlinear behavior for reduce noise. Then, the combination function refers to transfer function use in equations defined (4). If variables x equals to age then, hidden layer can be reduced noise and if, many occurs of noise overfitting. From the methodology calculate the perceptron are implementing to calculate sigmoid function of ANN and foundation learning rate of error and momentum of total 14 factors in section fourth.

3.1 Implementation

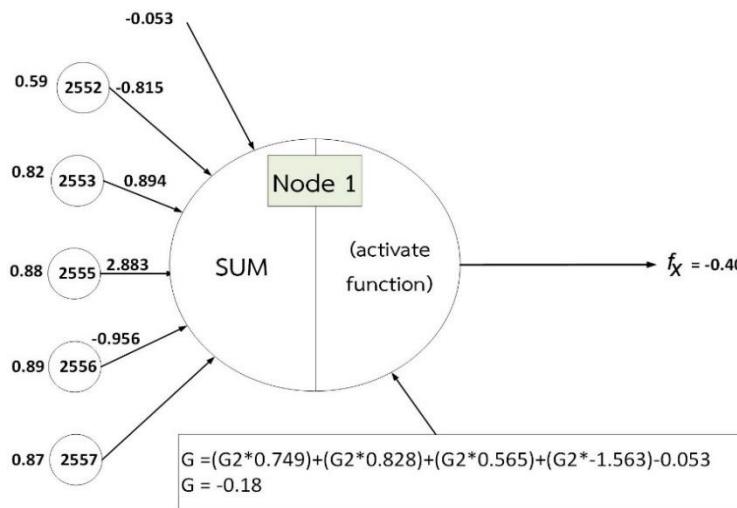


Fig. 5. Calculate sigmoid function of neural network.

From Fig 5. We have presented techniques for calculating sigmoid function and network of neurons. This sigmoid function are logical areas calculate of sum weight and transfer function result. Define the equation and method neural network propose some error and MSE. The sigmoid function are factors related to participation in dengue control and prevention motivation.

1. The hidden layer have to overfit hidden layer. ($n=1,2,3$) and has accuracy number of input layer hidden output complexity input variables independent. The hidden has complexity one variables and output of results.
2. The number has complexity of input layer /hidden layer and output layer. Then, the data must input variables hidden and output.
3. Algorithm feed forward and combination function have to factor input value and connected hidden layer. Weight into line use in combination function and several weights mathematical by equation (5) to (7).
4. Back-Propagation meaning of error final node and hidden layer. The error weight output has looper cycle. For each hidden unit h , calculate its error term e_h

$$e_h \leftarrow o_h(1 - o_h) \sum_{k \in outputs} w_{kh} e_k \quad (5)$$

Update each network weight w_{ji}

$$w_{ji} \leftarrow w_{ji} + \Delta w_{ji} \quad (6)$$

here

$$\Delta w_{ji} = + n e_j x_{ji} \quad (7)$$

Definition weight e equal to error from line forward hidden layer.

5. Learning rate meaning of loop least final forward called SSE by algorithm Global SSE. It was fixed requirement of speed minimum or medium. Then, SSE are minimum final weight. In addition, the input node is more than of one node and hidden layer is less than input layer.

Table 1. Learning rate of error for neural network ($n = 0.35, 0.1, 0.2, 0.3, 0.4, 0.5$), ($\alpha = 0.25, 0.5, 0.6, 0.7, 0.8, 0.9$)

Neural	$\alpha (0.25)$	$\alpha (0.5)$	$\alpha (0.6)$	$\alpha (0.7)$	$\alpha (0.8)$	$\alpha (0.9)$
Node 1	-1.29	0.79	-2.00	-2.39	1.01	264.55
Node 2	1.19	0.81	1.43	1.60	-1.97	1.28
Node 3	1.27	0.69	1.41	1.59	-1.86	6.30
Node 4	1.18	0.57	1.44	-3.07	-0.03	1.47
Node 5	1.24	0.58	1.43	1.60	-2.11	-1.06
Node 6	1.18	0.61	1.31	-2.41	-0.97	3.96
Node 7	1.28	0.73	1.44	1.60	0.60	19.41
Node 8	1.03	0.36	2.70	-2.40	-0.66	-65.82
Node 9	-1.77	-1.38	-1.57	-1.54	3.77	3.72
Node 10	1.20	0.77	1.63	1.59	-0.78	6.65
Node 11	1.21	0.85	1.44	-0.78	-2.26	677.11
Node 12	0.51	0.67	1.38	-2.43	0.48	5.48
Node 13	1.20	0.62	1.44	-2.41	-0.96	12.15
Node 14	1.20	0.79	1.44	1.61	4.32	5.31
Node 15	0.83	0.57	1.43	1.60	0.54	-0.79
Node 16	1.21	0.79	1.44	1.60	-2.21	7.66
Node 17	1.20	0.70	1.44	1.60	1.03	7.43
Node 18	1.17	0.77	1.43	-2.46	3.02	0.03
Node 19	1.26	-1.07	1.44	-2.41	-1.81	-16.26
Node 20	1.07	0.82	-1.63	-2.41	-0.26	-48.34
Node 21	1.20	0.94	1.44	1.60	1.20	1.14
Node 22	1.24	0.57	1.41	-2.41	-1.06	19.24
Node 23	1.20	0.75	1.44	-2.41	-2.76	-0.67
Node 24	1.18	0.64	1.40	1.60	0.28	-0.52
Node 25	1.20	-1.92	1.44	1.61	-0.35	14.32
Node 26	1.13	0.78	1.41	1.59	-3.51	-2430.55
Node 27	1.19	0.80	-1.67	1.60	-0.27	11.33
Node 28	1.18	0.71	1.44	1.45	-0.39	6.92
Node 29	1.19	0.64	1.44	-2.41	-3.03	0.47
Node 30	1.21	0.73	1.43	-2.41	0.52	16.54
Node 31	1.18	0.71	1.43	-2.41	-3.56	-14.92

Form table 1 has shown the learning rate of error for neural network ($n = 0.35, 0.1, 0.2, 0.3, 0.4, 0.5$) and ($\alpha = 0.25, 0.5, 0.6, 0.7, 0.8, 0.9$). Then, data have divided method detail of optimization weight equations for learning rate and momentum have usages. Whereas the learning rate between $0 < n < 1$ meaning of fixed choice rate for weight movement neural network of minimum. By n value have to appropriate level of data. When, the learning rate n of minimum can be adjusted weight to minimum them.

The momentum used of find algorithm effective increase momentum (α) are defined as (8).

$$\Delta w_{current} = -n \left(\frac{\partial SSE}{\partial w_{current}} \right) + \alpha \Delta w_{previous} \quad (8)$$

Where $\Delta w_{previous}$ is equation adjust weight in the part and between of values $0 \leq \alpha < 1$. Then, $\alpha \Delta w_{previous}$ is adjust weight in the part for fixed weight by set.

The momentum is inertia of maximum and adjust weight in the present $\Delta w_{current}$ for adjust movement direction in the past. This momentum is backpropagation by average exponential of adjust total in the past shows equation as (9).

$$\Delta w_{current} = \sum_{k=0}^n a^k \left(\frac{\partial SSE}{(\partial w_{current}) - k} \right) \quad (9)$$

Where a^k is adjust weight maximum and α is reduced. By adjust weight final $\alpha=0$. Then, composition disappear. However, the mean square error (MSE) values can be used to model performance in period with that of a validation period as well as to compare model performance to that of the other predictive models. Define as (10).

$$MSE = \frac{1}{2} \sum_{p \in P} \sum_{k \in outputs} (d_{p,k} - o_{p,k})^2 \quad (10)$$

From table 1. When, we have used to learning rate equal to 0.35 and momentum equal to 0.25. Then, neural network has found mean square error (MSE) equal to -1.77 and neural network of the node ninth. Learning rate has equal to 0.10, momentum equal to 0.50. Then, MSE equal to -1.92 and neural network has found number twenty-five of learning rate equal to 0.20 and momentum equal to 0.60. Then, MSE has calculated equal to -2.00. Next, step of neural network number one used learning rate equal to 0.30 and momentum has calculated equal to 0.70. It's found MSE equal to -3.07. The neural network has calculated the fourth and the fifth used learning rate equal to 0.40 and momentum equal to 0.80 by MSE equal to -3.56 from results of neural network number thirty-one. Finally, learning rate equal to 0.50 and momentum equal to 0.90. The results of neural network of number twenty-six and MSE equal to -2430.55.

The definition has criteria conditional of DHF outbreak of factor using ANN prediction in northeast of Thailand has defined as follows four conditions.

This is condition 1, if $0 \leq MSE < 0.25$ classified as outbreak level at the initial stage, step 1

Condition 2, if $0.25 \leq MSE < 0.50$ is classified as outbreak level at the initial stage, step 2

Condition 3, if $0.50 \leq MSE < 0.75$ is classified as outbreak level at the initial stage, step 3

Condition 4, if $MSE \geq 0.75$ is classified as outbreak level at the initial stage., step 4

Finally, we have presented conclusions and future work including of learning rate of error for neural network.

4. Conclusion

An artificial neural network for DHF outbreak has prediction of error by calculate use algorithm neural network. We found method of neural network are process factors of dengue fever including of supervised learning and feed forward, if can input data are process and result of output. Then, this model has calculated function which momentum has backpropagation by average exponential of adjust total. Which has used of numbers of learning rate and momentum including of ($n = 0.35, 0.1, 0.2, 0.3, 0.4, 0.5$), ($\alpha = 0.25, 0.5, 0.6, 0.7, 0.8, 0.9$). The result of ANN finds mean square error (MSE) equal to -1.77 uses of $n=0.35$ and $\alpha = 0.25$, can be define has results of DHF outbreak of factor using ANN prediction can define as If $0 \leq results < 0.25$ classified as outbreak level at the initial stage, step 1 because of, data factors are described for result analysis of period 2007-2016. This conclusion is result of node 9 to optimize more than node 1 and the other node. Therefore, $n=0.5$ and $\alpha = 0.9$ can be calculate of MSE equal to -2430.55 of node 26. With comparison is MSE between node 9 and node 26 can be describe model cannot is effect of DHF outbreak in northeast of Thailand. This model is accurate to more than 80%. In the future, we have presented deep learning of ANN algorithm.

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The Factors are Using Correlation and Regression Relationship Analysis for Dengue Hemorrhagic Fever Outbreak in Northeast of Thailand

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Abstract

The factors are correlation and regression relationship for dengue hemorrhagic fever (DHF) outbreak in Northeast of Thailand. Which factors can use of analysis for climate change by using data in past of between 2007-2016 total of ten years. Data analysis objective were (1) to factor analyzed climate change for DHF outbreak in Northeast of Thailand and (2) to created model optimization for predictors by correlation statistic is called a correlation coefficient and regression analysis. Furthermore, the factor is complex six variables include of type of dengue, sex, area, rainfall, temperature and humidity for DHF. This correlation input of data for analysis can use data correlation between factor relationship (such as sex with area, sex with rainfall or area with rainfall). The regression analyze is used to calculate linear function for prediction of factors. Program are working in process and analyze using SPSS, R Studio and Excel. Therefore, data after for analyze with are compared different between actual and prediction value. This model correlation and regression results is accurate to 91.3 percent.

Keywords: Dengue Hemorrhagic Fever (DHF); Correlation; Regression; Relationship; Factor Analysis.

1. Introduction

Dengue fever occurs from RNA virus which can divide group four serotypes including of DEN-1, DEN-2, DEN-3 and DEN-4. The four serotypes found Antigen integrate cross reaction and cross protection of period short time [1]. In DHF and DSS, there is an acute increase in vascular permeability that leads to leakage of plasma into the extravascular compartments, resulting in haemoconcentration and hypotension. [2]. Dengue is one of the main problems of public health in the world. It is estimated that about 2.5 billion people are now at risk of dengue. [3]. In recent years, dengue fever are six diseases of Thailand and other physical countries as they are both transmitted by Aedes mosquitoes, which are in area Thailand [4]. Therefore, we have used to factors analysis of DHF outbreak in Northeast of Thailand and can use statistic the correlation and regression analysis. The correlation addresses the relationship between two different factors variables. The statistic is called a correlation coefficient. A correlation coefficient can be calculated when there are two or more sets of scores for the same individuals or matched groups.

This research is collection data of secondary data and DHF outbreak in northeast of Thailand, which of the data include of climate change rainfall, air temperature humidity, sex, area, type of dengue fever, time of period in the part of year 2007-2016. Therefore, we have studied factors analysis which epidemiologic of social science for find tool of predictors DHF in northeast of Thailand. Moreover, this study is contribution for surveillance DHF system development and reduce occurs crucial outbreak. The calculate of statistical using frequency percentage and correlation coefficient of Pearson and is analyzed by multiple regression analysis. This is a study of the relationship between dependent variable with independent variable (i.e. sex with age, sex with area, sex with type of dengue fever, sex with year, sex with rainfall, sex with air temperature, sex with humidity) and predictors of disease outbreaks, which will be useful in planning, controlling and preventing future outbreaks.

2. Related Works

The correlation coefficient is a measure that determines the degree to which two variables movements are associated. The range of values for the correlation coefficient is -1.0 to 1.0. If a calculated correlation is greater than 1.0 or less than -1.0, a mistake has been made. A correlation of -1.0 indicates a perfect negative correlation, while a correlation of 1.0 indicates a perfect positive correlation. Show equation as (1).

$$p_{xy} = \frac{cov(r_x, r_y)}{\sigma_x \sigma_y} \quad (1)$$

While the correlation coefficient measures a degree to which two variables are related, it only measures the linear relationship between the variables. Nonlinear relationships between two variables cannot be captured or expressed by the correlation coefficient. A value of exactly 1.0 means there is a perfect positive relationship between the two variables. For a positive increase in one variables, there is also positive increase in the second variable. A value of exactly -1.0 means there is a perfect negative relationship between the two variables. This shows the variables move in opposite directions; for a positive increase in one variable, there is a decrease in the second variable. If the correlation is 0, this simply means there is no relationship between the two variables. The strength of the relationship varies in degree based on the value of the correlation coefficient. For example, a value of 0.2 indicates there is a positive relationship between the two variables, but it is weak.

Standard deviation is a measure of the dispersion of data from its average. Covariance is a measure of how two variables change together, but its magnitude is unbounded so it is difficult to interpret. By dividing covariance by the product of the two standard deviations, a normalized version of the statistic is calculated. This is the correlation coefficient. [5].

Then, for the regression model can used the residues from the adjusted model for each series in a study in which the dependent variable was the residue of dengue cases and variables waste were independent of the models adjusted for maximum, mean and minimum temperature, humidity. For statistical analysis of data the program Gretl 1.9.2 was used. Gretl (Gnu Regression acronym, Econometrics and Time-series Library) is a free software that collects and interprets econometric data, this software enables you to do a full analysis of temporal series, from graphical analysis of the data to forecasts. [3].

Dengue prevalence data (/1,000,000 population) for 2004 in a central region of Thailand were derived from the reported registry data on dengue of Ministry of Public Health (epid.moph.go.th). Rainfall data (average inches) in the studied area were derived from the Royal Irrigation Department, Thailand. The correlation between the rainfall and the prevalence of dengue was assessed by regression analysis. The least square equation plot prevalence (Y) versus rainfall (X) and the correlation coefficient (r) was calculated. All statistical analysis was performed using SPSS 10.0 for Windows. The detail of dengue prevalence in 22 provinces of a central region of Thailand and the average rainfall in each province is presented the least square equation plot prevalence (Y) versus rainfall (X) is $Y = 17.5X + 24.2$ ($r = 0.88$, $p < 0.05$). The main aim of this retrospective study was to investigate the correlation between the rainfall and the prevalence of dengue. The work described the effect of rainfall on dengue prevalence, which is important because of the need to develop tools to forecast variations in disease incidence and the risk related to the impact of change in climate [6].

The rainfall data (2002-03) collected from Ministry of Public Health were utilised for transformation of the infection and the rainfall data were derived from Royal Irrigation Department, Thailand. The correlation between the rainfall and the prevalence of dengue was assessed by regression analysis. The least square equation plot prevalence (y) versus rainfall(x) is $y = 3.0x + 4.6$ ($r=0.78$, $p<0.05$) ($r = 0.68$, $p<0.05$). The study indicated that the prevalence of dengue infection in Thailand may depend on rainfall. Therefore, the surveillance and control of mosquito should be intensified during the period with high rainfall is recommended. However, the other confounding factors like ambient temperature and humidity which also determine the transmission of dengue should be looked into, before concluding that the increased prevalence is a result of rainfall alone. Further, similar studies to access the correlation between the rainfall and prevalence of infection in the other countries are required to confirm these observations [7].

Patient with DHF is a probable case of DF, having hemorrhagic tendency along with thrombocytopenia (platelets 100,000/cu. mm or less) and evidence of plasma leakage. Fifty normal

healthy age and sex matched individuals, having no history of febrile or other illness in the last three months were included as negative controls. The statistical analysis was performed with Epi Info version 3.3.2 (updated 2005, Center for Disease Control and Prevention, USA). Proportions of patients with abnormal clinical, hematological and biochemical findings between the two groups were compared using Chi (χ^2)/Fischer exact test. Mean values between four serotype groups were compared using analysis of variance (ANOVA). The results of correlation of dengue serotypes with clinical and hemorrhagic manifestations. Among the wide spectrum of mild and severe clinical and hemorrhagic manifestations analyzed, the incidence of only two severe manifestations, namely, abdominal pain ($p<0.05$) and hepatomegaly ($p<0.05$), was significantly different between four serotype groups. While frequency of clinical manifestations was most predominant in Den-2 infected cases, severe hemorrhagic manifestations were predominant in Den-4 infected group. Individual analysis of each serotype group demonstrated hepatomegaly to be significantly higher in Den-2 as well as Den-3 infected patients [8].

The clinical data were collected on predesigned questionnaire which include gender, clinical findings, complications and laboratory test done. Statistical analysis was done using statistical package for social science (SPSS) programme. Chi square test was used to compare categorical variables and Fischer exact test were applicable. The results of 633 confirmed dengue patients were included in this study. 248 were male and 319 were female (male to female ratio was approximately 3:4). In this study, 13.2% of the patients had no increase in the transaminases level (grade 0), 63.8 % presented mild alterations in the liver enzymes levels (grade 1), 17.9% presented grade 2 liver involvement, 3.9 % of the patients had progressed to acute hepatitis (grade 3) and 1.1 % had severe liver damage with fulminant hepatic failure. In 86% of the patients there was elevation of the liver enzymes. All of them (549 patients) had increase in the AST level. The change in the ALT was seen in 82 % of the patients [9].

Dengue cases have been diagnosed in Florida. The purpose of this study was to find an association between potential risk factors and the expansion of dengue fever in the United States. Guided by the eco-bio-social framework, which offers a broad assessment of risk factors for the illness, a retrospective design was used with archival data to correlate changes in climatic variables and imported dengue cases with autochthonous dengue cases in Southeast Florida from 1980 to 2013. A spearman correlation indicated weak correlations between temperature and autochthonous dengue cases ($r_s = .099, p = 000$) and imported dengue cases with autochthonous dengue cases ($r_s = .162, p = 000$). A negative binomial multivariate regression was used to analyze the expansion of dengue to each monthly unit of temperature, rainfall and imported dengue cases over 34 years. The results indicated that temperature (IRR = 2.198; 95% CI[1.903,2.538]) and precipitation (IRR = .991; 95% CI[.988,.994]) were predictors for the geographic expansion of dengue fever in Southeast Florida [10].

The total number of 258 patients was obtained from Siriraj Hospital, Bangkok, Thailand. The data set consists of 128 DF, 65 DHF I, 52 DHF II and 13 DHF III. The set of attributes consists of clinical attributes and hematological attributes. There are totally 48 attributes (26 numerical attributes, 21 categorical attributes and one class attribute. During the treatment period, nurses and physicians followed the symptoms. The decision tree algorithm is applied for the feature selection process and it is found that the plasma leakage, the shock occurrence, the bleeding, the number of platelet, the level of ALT, the number of white blood cell, lymphadenopathy are the potential feature sets that can categorize the dengue patients. After the feature selection, the fuzzy logic approach is tried to see the classification performances the experimental result shows that Fuzzy logic outperforms Decision tree with the 97.94% of accuracy [11].

From 2007 to 2012. Ae. Aegypti mosquitoes were collected from three provinces in the central region of Thailand, including Nakhon Pathom, Ratchaburi and Samut Sakhon. These areas were selected primarily for three reasons: high mosquito density, minor differences in climatic factors, and a high DHF morbidity rate as reported in Thailand health information system. The forecasted cases were compared with the actual dengue cases reported by NTCAESI. The dataset in this experiment includes all variables from the three provinces. The best model (yielding the lowest MAPE, AIC and BIC) was selected in subsequent experiments. Four MPR models were constructed, To account for climate effect on dengue cases, the categorical variable of season was included into the model fitting. The first model (Model-1) deployed all four main predictors, whereas the second model (Model-2) and third model (Model-3) excluded insignificant terms. AgeRate and Mosquito were highly correlated with Mosquito ($r=0.61, p<0.001$; and $r = 0.57, p < 0.001$), implying that each conveyed a similar

relationship to dengue cases as that of Mosquito; both variables were thus removed from Model-3. Subsequently, the interaction of two newly identified main factors (Season and Mosquito) was added into the fourth model (Model-4), according to the model selection process [12].

From details related work of above. This is conclusion research for correlation all of total in table 1.

Table 1 Conclusion and Comparation methods of research for DHF

Author/Year	Study data of dengue patient	Regression and Multiple Analysis	Test Hypothesis (P value)	ANOVA	Data Mining and Fuzzy Logic	Correlation Coefficient
Viroj Wiwanitkit. (2005).	✓	✓	-	-	-	✓
Viroj Wiwanitkit. (2006).	✓	✓	-	-	-	✓
Rajni Kumaria. (2009).	✓	-	-	✓	-	✓
Ali K. Ageep and Abu elgasim S. (2012).	✓	-	✓	-	-	✓
Lugo Brunilda (2015).	✓	-	✓	-	-	✓
Nuanwan Soonthornphisaj. (2016).	✓	-	-	-	✓	-
Siriyasatien et al. (2016).	✓	-	✓	-	-	✓
Benjapuk Jongmuenwai, Sudajai Lowanichchai, and Saisunee Jabjone (2016).	✓	✓	✓	-	✓	✓

3. Proposed work

Pearson's use signal r or r_{xy} . The dataset has to interval two groups and more than. This is dataset and analyze by as SPSS or R studio program show in table 2.

Table 2. Pearson Correlation of DHF

Interval	Type	Sex	Area	Rainfall	Temperature	Humidity
Type	1.000	0.000	-0.220	-0.022	0.104	0.014
Sex	0.000	1.000	-0.013	-0.011	-0.006	-0.008
Area	-0.220	-0.013	1.000	0.049	0.003	-0.033
Rainfall	-0.022	-0.011	0.049	1.000	-0.041	-0.027
Temperature	0.104	-0.006	0.003	-0.041	1.000	0.019
Humidity	0.014	-0.008	-0.033	-0.027	0.019	1.000

From table 2 show values of test for association between paired samples, using one of Pearson's product moment correlation coefficient for dengue hemorrhagic fever are total six factors. The correlation coefficient for predictors (R^2) equal to 91.3 percent. This is a study of the relationship between dependent variable with independent variable (i.e. sex with area, sex with type of dengue fever, sex with rainfall, sex with air temperature, sex with humidity) and predictors of disease outbreaks. Which is equation predictors dengue hemorrhagic fever as $y = 0.669 + -0.220\text{area} + -0.022\text{rainfall} + 0.104\text{temperature} + 0.014\text{humidity}$ When, we have conclusions effectiveness between correlation and regression include factor relationship of patient values of correlation coefficient equal to 0.955 and regression prediction equal to 91.3 percent and should produce regression estimates of 0.00 and 1.0 for α . Deviation from these values is evidence of bias and inefficiency in the predictors.

The F-test can be used to test the joint hypothesis that error regression equal to ± 0.699 . The correlation computes the variance of x and the correlation of x and y if these are vectors. If x and y are metrics then the correlations between the columns of x and the columns of y are computed. In additional, the correlation scales a covariance matrix into the corresponding correlation matrix efficiently.

The score or scale was found r value which include of smallest to r equal to .10 to .29 moderate equal to .30 to .49 and largest r equal to .50 to 1.0. Then, meaning of r value number 1 to 5 steps as:

(1). r value is minus show variable X and variable Y to relationship opposite direction, if variable X addition is effect to variable Y reduce but if variable X reduce is effect to addition.

(2). r value is plus show variable X and variable Y to relationship same way direction, if variable X addition is effect to increase but if variable X reduce is effect to reduce, too.

(3). If r value is imminent 1, meaning of variable X and variable Y to relationship same way direction and to much relationship.

(4). If r value is imminent -1, meaning of variable X and variable Y to relationship opposite direction and to much relationship.

(5). If r value equal to 0 is show variable X and variable Y none of relationship.

We have use of descriptive interpretation of the data generated by the correlation analysis. The details can be written as follows.

(1). sex with area equal to -0.220 is relationship least level and opposite direction, if number of area increase. Then, area to reduce but if sex to reduce can be area increase.

(2). sex with rainfall equal to -0.011 is relationship least level and opposite direction, if number of rainfall increase. Then, rainfall to reduce but if sex to reduce can be rainfall increase.

(3). sex with temperature equal to -0.006 is relationship least level and opposite direction, if number of temperature increase. Then, temperature to reduce but if sex to reduce can be temperature increase.

(4). sex with temperature equal to -0.006 is relationship least level and opposite direction, if number of temperature increase. Then, temperature to reduce but if sex to reduce can be temperature increase.

(5). sex with humidity equal to -0.008 is relationship least level and opposite direction, if number of humidity increase. Then, humidity to reduce but if sex to reduce can be humidity increase.

Therefore, we have presented the relationship between factor area with rainfall and temperature with type as follows.

(1). area with rainfall equal to 0.049 is relationship least level and same way direction, if number of rainfall to increase. Then, area to increase, too. but if area to reduce can be rainfall to reduce, too.

(2). temperature with type of dengue equal to 0.104 is relationship least level and same way direction, if number of temperature to increase. Then, type of dengue to increase, too. but if temperature to reduce can be type of dengue to reduce, too.

Moreover, we have described of regression analysis model to compute statistic by function linear and multiple regression used to found prediction values for DHF outbreak in Northeast of Thailand.

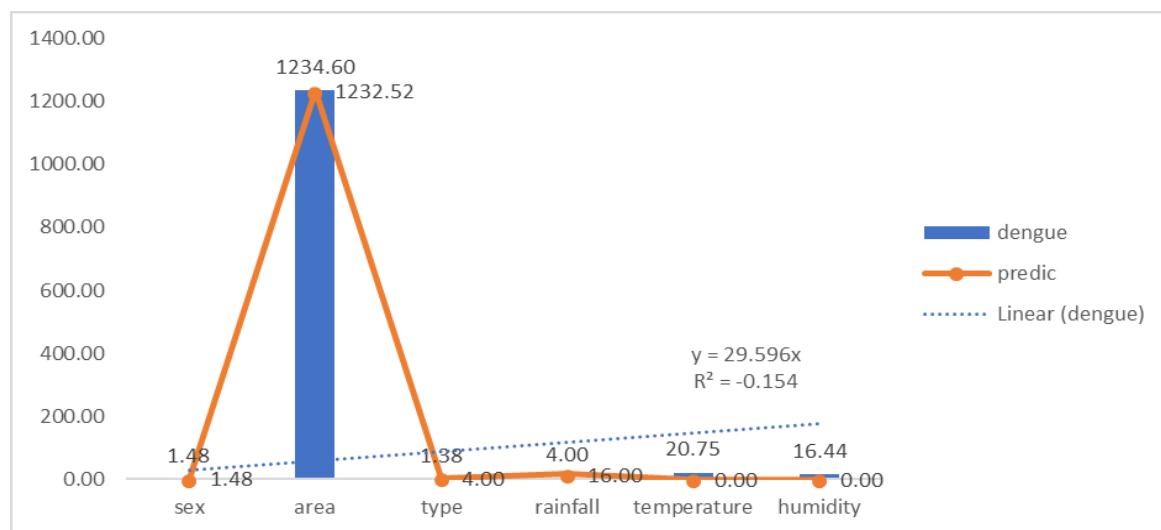


Figure 1. Shown in regression factor analysis period of data between 2007-2016 for DHF.

From figure 1. This graph is show regression factor analysis period of data between 2007-2016 for DHF outbreak of factor using function linear and multiple regression for prediction of model. We have compared actual and predictors value of analysis six factors. The dataset is a collection of data or a single statistical data where every factor of data represents variable and each factor has its own description. For prediction of dengue disease, we used dengue data set for prediction contains 15,000 records and detailed analysis of scoring using regression given by accuracy prediction for disease.

For experiment result showed that scoring accuracy of sex equal to 1.48 can describe trend is period data of 2017 the most is of female. The area equal to 1234.60 can told group the Mukdahan hospital Mukdahan district. The most people were Thai national and status being of treatment and to died. Moreover, age of patient between 23- 36 year and the epidemic is increasing every year. Forecasting is rainfall data between of period 26-30 every month. The humidity is level of 0.00.

4. Conclusion

This research is collection data of secondary data and DHF outbreak in northeast of Thailand, which of the data include of climate change rainfall, air temperature humidity, sex, area, type of dengue fever, time of period in the part of year 2007-2016. Therefore, we have presented data of DHF which of the regression analyze is used to calculate linear function for prediction of factors. Program are working in process and analyze using SPSS, R Studio and Excel. Therefore, they considered that calculate was compared different between actual and prediction value. This performance was found correlated and regression relationship analysis to results accurate 91.3 percent. The experiment results can have described trend was perioded data of 2017 the most is of female. The area equal to 1234.60 can told group the Mukdahan hospital Mukdahan district. The most people were found of data Thai national and being status of treatment until to died. Moreover, age of patient between 23- 36 year and the recent epidemic is increasing every year. In addition, rainfall is forecasting data for day between of period 26-30 every month and result is 16 millimeters. The temperature and humidity are forecasting data level of 0.00.

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