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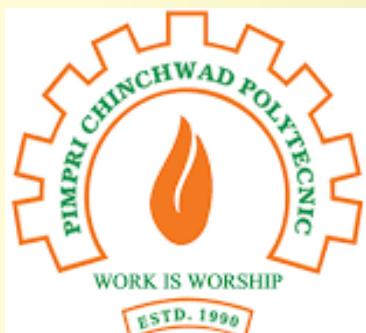
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(IJARSCT)**

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**Proceeding of International Conference (ONLINE)
On Emerging Trends in Engineering Science and Technology
(ICETEST-22)
5th and 6th May 2022**



Organized By
Pimpri Chinchwad Education Trust's
Pimpri Chinchwad Polytechnic,
Nigdi, Pune, Maharashtra

**Proceeding of International Conference
(ONLINE)**

On

**Emerging Trends in Engineering Science and
Technology**

(ICETEST-22)

5th and 6th May 2022

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**Proceeding of International Conference (ONLINE) On Emerging Trends in Engineering
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International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)



TABLE OF CONTENTS

Smart Signalling and Signal Breaking Identifier using RFID and GSM	1-5
<i>Archana S. Gaikwad, Sarojini V. Naik, Nivedita V. Hippalgaonkar, Ajay V. Raipure, Rohini K. Shinde</i>	
Innovations in Nanotechnology	6-7
<i>Ms. A. S. Sawalkar, Ms. T. R. Shinde, Ms. M. M. Mali, Mrs. M. A. Parlikar, Mrs. S. L. Mortale</i>	
Evaluation of Map-Based Control System for Application of Fertilizer	8-12
<i>Ajay V. Raipure, Mrs. N. V. Hippalgaonkar, Mrs. V. S. Kharote-Chavan, Mrs. S. V. Naik, Mrs. Archana Gaikwad</i>	
Fatigue Life Estimation Using Single Spot-Welded Joint Fracture Mechanics	13-18
<i>Bhimrao Pawal, Krishan Pandey, Chetan Chimote, Pushpaketan Deotale, Shanteshwar Dhanure</i>	
Applications of Artificial Intelligence in Machine Learning: Review	19-23
<i>Bhagyashali Vikram Jadhav, Gayatri Shrikant Mujumdar, Nilam Ajay Jadhav</i>	

Comparative Study of Green Rating Systems in India <i>Pratibha B. Patil, Alka Avasthi, Vijeta Kundlikar, Sampat Nanaware, Prasad Joshi</i>	24-29
Design and Implementation of an Automatic Irrigation System based on Monitoring Soil Moisture and Agriculture Thief Detection <i>Monika K. Kute, Supriya J. Patil, Poonam S. Chavan, Pooja S. Bhore</i>	30-32
Static Structural Analysis of Automobile Hood using Natural Hybrid Fiber Composite <i>Krishan Pandey, Chetan Chimote, Shanteshwar Dhanure, G. K. Raje, Y. D. Kale</i>	33-41
Review: Development of Industry 4.0 and the Role of Industrial Internet of Things in Manufacturing Industry <i>Ganesh Raje, Satish Birhade, Archana Gaikwad, Pushpaketan Deotale, Krishan Pandey</i>	42-48
Design of Hydraulic Floor Crane <i>Yogesh D Kale and Krishan Pandey</i>	49-54
Titanium Dioxide – A Boon to Contravene the Increasing Levels of Air Pollution in Indian Cities - A Review <i>Alka A. Avasthi, Sampat N. Nanaware, Prasad B. Joshi, Vijeta N. Kundlikar, Pratibha B. Patil</i>	55-57
Design and Analysis of FDM Gear Coupling <i>Mugdha Shinde, Pruthviraj D. Patil, Rutuja Bhangale, K. P. Pandey</i>	58-62
Acoustic Absorption Research on Woven Structure Fabrics <i>Himanshu Patil, Rutuja Bhangale, Krishan Pandey, G. K. Raje, Y. D. Kale</i>	63-70
Fatigue Analysis and Design Optimization of Excavator Bucket <i>Krishan Pandey, Pushpaketan Deotale, Yogesh Kale, Satish Birhade</i>	71-76

Tinkercad: A Blended Teaching and Learning Tool <i>Manisha Vibhute</i>	77-82
Heart Failure Prediction Technique using Complex Event Processing <i>Mrs. M. A. Parlikar, Ms. S. L. Mortale, Mrs. M. M. Mali, Ms. T. R. Shinde, Mrs. A. A. Sawlkar</i>	83-90
Web Personalization with Usage-Based Clustering <i>Mrs. M. M. Mali, Mrs. S. L. Mortale, Mrs. M. A. Parlikar, Mrs. T. H. Gavhane, Mrs. A. S. Sawalkar</i>	91-94
A Comparative Study on Internet of Things (IoT) and Its Applications in Smart Agriculture <i>Mangala S. Malkar, S. S. Jogdand, S. P. Chattar</i>	95-101
Enriching the English Language Skills of Students from Vernacular Mediums <i>M. V. Kadam, S. G. Aparanji, A. R. Kamthe, Teresa John</i>	102-103
A Review of Non-Premixed Combustion Models: Study and Comparison <i>Mohit Surwade, Krishan Pandey, Satish Birhade, Rutuja Bhangale, Shanteshwar Dhanure</i>	104-109
Contrast Enhancement of Gray Image Using Discrete Cosine Transform <i>Mrs. Nivedita V. Hippalgaonkar, Mr. Ajay V. Raipure, Mrs. Sarojini V. Naik, Ms. Archana S. Gaikwad, Mrs. V. S. Kharote-Chavan</i>	110-114
Bendable Concrete-A Concrete for Future <i>Prof. Popatrao P. Jadhav</i>	115-120
A Review on Experimental Study of Ferrocement Beams in Shear, Deflection and Bending <i>Prasad Joshi, Dipali Yerudkar, Minaxi Rai Sharma</i>	121-126

Healthcare IoT (HIoT)	127-133
------------------------------	----------------

Mrs. Pooja S Bhore, Mrs. Supriya J. Patil, Mrs. Poonam S. Chavan, Mrs. M. K. Kute

Survey on Various Image Compression Techniques Used in Image Processing to Improve the Quality of Image	134-138
--	----------------

Mrs. Poonam S. Chavan, Mrs. Pooja S. Bhore, Ms. Monika K. Kute, Mrs. Supriya J. Patil

Nano Technology	139-145
------------------------	----------------

Rohini Krishnagar Shinde, Mrs. Sarojini Vinay Naik, Ms. Archana Shatrughna Gaikwad

Safety in Construction a Management Perspective - A Review	146-148
---	----------------

Sampat N. Nanavare, Alka A. Avasthi, Prasad B. Joshi, Pratibha B. Patil, Vijeta N. Kundlikar

Heat Exchanger Design with Supercritical Fluid	149-157
---	----------------

Anurag Warghat, Shanteshwar Dhanure, Mohit Surwade, Krishan Pandey, Chetan Chimote

Review of Bacteria-Based Self-Healing Concrete	158-161
---	----------------

Vijeta Kundlikar, Alka A. Avasthi, Pratibha Patil, Prasad Joshi, Sampat Nanavare

A Study on IoT Based Real Time Flood Alert System for Dam	162-164
--	----------------

Mrs. Supriya J. Patil, Mrs. Poonam S. Chavan, Mrs. Pooja S. Bhore, Ms. Monika K. Kute

Clustering of Customer Transaction Data	165-169
--	----------------

Ms. S. L. Mortale, Mrs. M. A. Parlikar, Mrs. M. M. Mali, Ms. T. R. Shinde, Mrs. A. A. Sawlkar

Blockchain: Study, Application and Future	170-176
--	----------------

Ms. Shital Chattar, Prof. M. S. Malkar, Mrs. S. S. Jogdand

Bitcoin -Digital Currency Wallet	177-183
---	----------------

Mrs. Sonal Sanjay Jogdand, Prof. M. S. Malkar, Mrs. S. P. Chattar

Object Detection using Tensor Flow API **184-189**

Sarojini V. Naik, Archana S. Gaikwad, Ajay V. Raipure, N. V. Hippalgaonkar,

V. S. Kharote-Chavan

Change in Composite Material Behaviour Under Thermal Loading: An Investigation

190-196

Satish Birhade, Krishan Pandey, Bhimrao Pawal, Rutuja Bhangale, Shanteshwar Dhanure

Gesture Translator for Hard to Hearing and Tongue-Tied People **197- 201**

Mrs. T. H. Gavhane, Ms. S. L. Mortale, Mrs. M. M. Mali, Mrs. M. A. Parlikar, Mrs. A. S. Sawalkar

Battery Technology of An Electric Vehicles **202-205**

Mrs. V. S. Kharote Chavan, Mr. P. J. Deore, Mrs. N. V. Hippalgaonkar, Mr. Ajay V. Raipure, Mrs. Sarojini Vinay Naik

Predictive Algorithms for Equity Market **206-214**

Gayatri Shrikant Mujumdar, Bhagyashali Vikram Jadhav, Nilam Ajay Jadhav

Survey on IOT Security and Privacy **215-220**

Prof. Nilam Ajay Jadhav, Prof. Gayatri Shrikant Mujumdar, Prof. Bhagyashali Vikram Jadhav

Smart Signalling and Signal Breaking Identifier using RFID and GSM

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Abstract: In today's traffic signal system the lights (Red, Green, Yellow) have got fixed timings and so signals remain on for longer time when not needed and are not sufficiently on when density is more. To overcome this problem a system is to be designed that will vary the signal timings based on density at signal. Also, another major problem encountered is violation of traffic rules, signal breaking being one of them. So, system is designed to detect the vehicle which breaks the signal and it will send the code number of the vehicle to server unit for further processing through SMS using GSM techniques. The goal of our project is to make a wireless smart traffic signal and anti-signal breaking-system. After the successful completion of the project these features can be added to present traffic signal system to become a completely automatic. This report is description of smart signalling and signal breaking identifier system including information about GSM, RFID system and of the different modules being used for controlling.

Keywords: RFID, GSM, etc.

I. INTRODUCTION

Business in a megalopolis is veritably important affected by business light regulators. When staying for a business light, the motorist loses time and the auto uses energy. Hence, reducing staying times before business lights can save our society billions of rupees annually to make business light regulators more intelligent, we exploit the emergence of new technologies similar as communication networks. With the ever- adding business demand, traffic has come a serious problem in numerous major metropolises around the world. By regulating the business demand at each crossroad in the network, the thing is to avoid business conflicts and dock the line length at a stop line. Our end is to develop the system at signals. This system will have multifunctional operations. The system will originally measure the position of business viscosity at different signals and consequently change the time detainments for business lightship. the side at which the business is high the signal will remain green for further time. Secondly, it'll also descry the vehicle which breaks the signal. Eventually it'll shoot the law number of the vehicle to garcon unit for farther processing through SMS using GSM ways.

II. METHODOLOGY OF SYSTEM

DESCRIPTION OF BLOCK DIAGRAM AT SIGNAL UNIT:

1. IR Detectors:

IR detectors will descry the business viscosity position. This is a simple yet effective IR propinquity detector erected around the TSOP 1738 module. The TSOP module is generally plant at the entering end of an IR remote control system; e.g., in TVs, CD players etc. These modules bear the incoming data to be modulated at a particular frequency and would ignore any other IR signals. It's also vulnerable to ambient IR light, so one can fluently use these detectors outside or under heavily lit conditions. Similar modules are available for different carrier frequentness from 32 kHz to 42 kHz.

In this particular propinquity detector, we will be generating a constant sluice of square surge signal using IC555 centred at 38 kHz and would use it to drive an IR led. So, whenever this signal bounces off the obstacles,

the receiver would descry it and change its affair. Since the TSOP 1738 module works in the active-low configuration, its affair would typically remain high and would go downward when it detects the signal (the handicap).

2. Max 232

As the TTL sense of the computer and the microcontroller is not the same, there's a need to use the IC MAX232. This IC converts the TTL sense position to RS232 standard and makes the DTE (Data terminal outfit) and DCE (Data collector outfit) TTL compatible.

3. GSM Module

GSM is our favoured system of communication between the two units. We've used GSM for its high range and low cost compared to other communication norms.

4. LED Panel

The LED panel forms the visual part of the system which will direct the business inflow. The LEDs are controlled by the micro-controller and grounded on its control action.

5. RFID

RFID is used to read a Label information of the vehicle of stoner who have broken the signal. DESCRIPTION OF BLOCK DIAGRAM AT SERVER UNIT

6. TV Display

TV display is used to display dispatches to the public in case of extremities or suggestions for alternate routes. It can also be used to display the general business conditions of the coming signal so that the motorists can decide their routes wisely.

7. PC

PC is used for storing the information regarding the details of stoner (USER DATABASE).

III. SYSTEM BLOCK DIAGRAM

At Signal Unit:

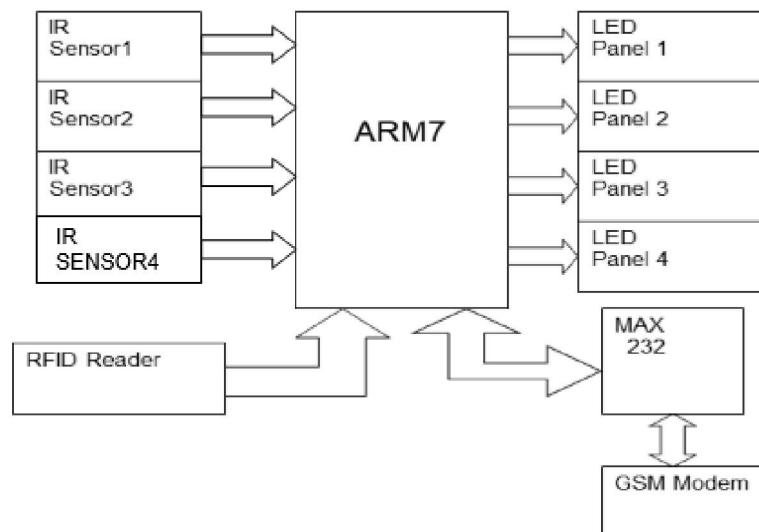


Figure 1: Description of Block Diagram at Signal Unit

At Server Unit:

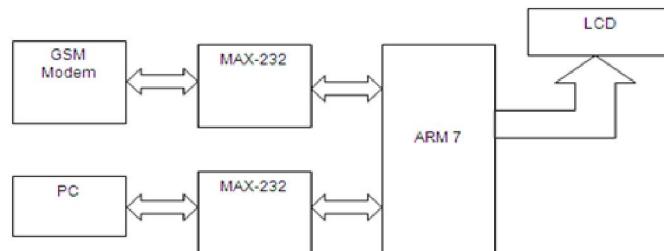


Figure 2: Description of Block Diagram at Server Unit

IV. CIRCUIT DESCRIPTION

The first step of our process is the traffic density measurement which will be done by the IR sensors. The IR sensors placed at different locations on each lane will send the signal to the microcontroller. This information regarding the density of each lane is further passed on to the microcontroller.

As the TTL logic of the Zigbee and the microcontroller isn't the same, there is a need to use the IC MAX232. This IC converts the TTL logic level to RS232 standard and makes the DTE (Data terminal equipment) and DCE (Data collector equipment) TTL compatible.

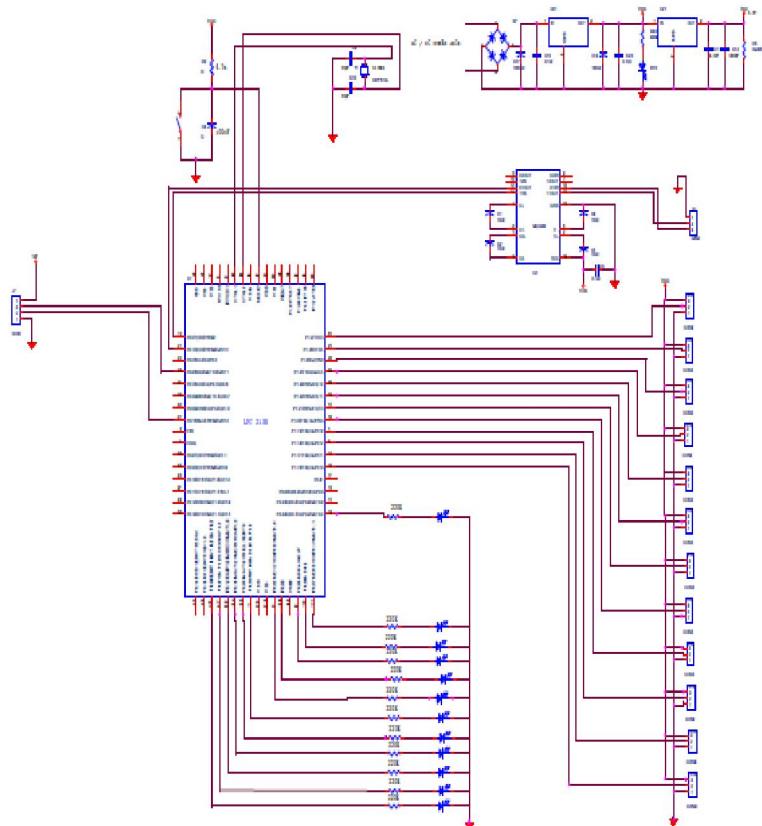


Figure 3: Circuit Diagram at Signal Unit

The microcontroller, after receiving the data from the IR, decides according to program, which of the lanes has the necessity to let the traffic flow faster and which lane can afford to be held for a longer duration of time. In accordance to this, the respective LEDs are made to glow, or are made off, and furthermore, a signal is also sent to the adjacent junction to either lessen or increase the flow of traffic in the particular lane.

RFID reader interfaced with the microcontroller will detect the signal breaking. Each vehicle will have a tag on it. Whenever the signal is red the RFID will activate and detect the vehicle passing. This signal is transmitted to the server via GSM module to the server.

On receiving this signal, the microcontroller transmits the signal to the PC in which the database is maintained of all the users. The microcontroller will give the Tag no i.e., user id and appropriate fine will be charged.

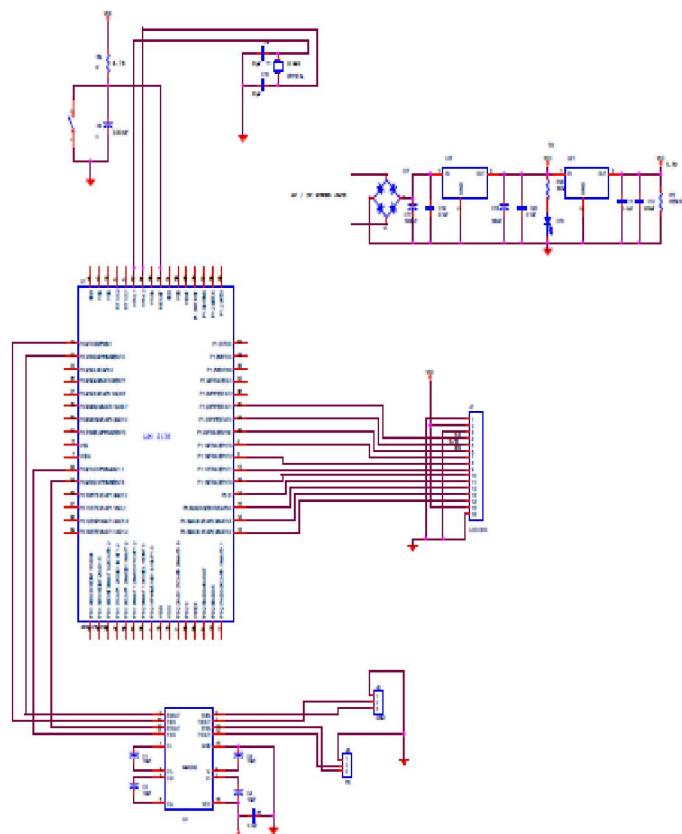


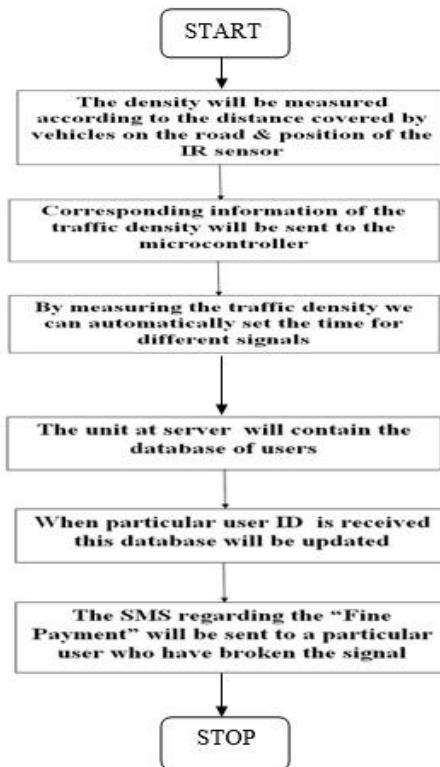
Figure 4: Circuit Diagram at Server Unit

V. HARDWARE TESTING

STEP BY STEP TESTING OF VARIOUS MODULES:

- First IR sensor circuit was tested, IR rays are continuously transmitted on detection of any obstacle, and these rays are reflected back and sensed by the TSOP sensor output of the sensor. Output of the sensor then goes high.
- Next working of RFID was checked when the reader is made on it continuously checks for any tag in its field when a tag enters the field reader accepts the tag number and sends it to the microcontroller interrupt pin. Microcontroller then displays this tag number on LCD to which it is interfaced.
- When GSM is interfaced to the controller LCD displays “GSM Connected”. The information is transmitted to the control room (RTO Office) modem via the GSM interfaced with the signal unit controller the transmitted information is displayed on the screen.
- On reception of tag number, computer in RTO office checks the database and the identity of the respective person is retrieved. Corresponding SMS is sent on the mobile number.

VI. SOFTWARE TESTING: FLOW CHART



VII. CONCLUSION

- The entire project helped us in understanding various concepts related to wireless communication, Embedded system design.
- Throughout, the project tried to touch every field the device can be related to, be its designing, Programming involved, circuitry, construction, working and application.
- In a nutshell, considering the current scenario, this technology is both very essential and necessary i.e., it certainly suffices to the demands of the modern-day world, by reducing one of the main problems we are faced with today, that of traffic congestion and signal violation.

REFERENCES

- [1] Engr. Salami. S. O, Engr. Akinyele. A. O, Engr. Sarumi A. J, Engr. Keshinro. K. K. Design & Construction of a Closed Loop Traffic Light Control System VOLUME 02, ISSUE 12 (DEC. 2013).
- [2] Jean J. Labrosse Embedded System Building Blocks 1995.
- [3] Marco Wiering Intelligent Traffic Light Control ERCIM News No. 53, April 2003.
- [4] Santwana Panda, Anjali M. Patki, Kedar Husing Traffic Management Using Swarm Intelligence and Route Selection Using Android Application (IJEIT) Volume 5, Issue 6, December 2015
- [5] Theodore Rappaport, Wireless Communications: Principles and Practice 1995
- [6] Jestin_Cubetech Reliable and Low-Cost IR Proximity Sensor <https://www.instructables.com/Reliable-and-low-cost-IR-Proximity-sensor/>
- [7] <https://www.jcbrolabs.org/tsop-obstacle>
- [8] <https://www.instructables.com/Reliable-and-low-cost-IR-Proximity-sensor/>
- [9] <https://www.engineersgarage.com/>

Innovations in Nanotechnology

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Abstract: "Nano' is something which is smaller than the atomic level of anything. Nanotechnology is the study of matter manipulating scales. It is the construction of any functional level or ways level. Very can say atomic. A Nano is one billionth of a meter. In nanotechnology, products are created with building blocks at length scale less than hundred nanometres. Nanoscience is the most fundamental aspect of phenomenological study at length scale less than hundred nano meter. Nanoelectronics is the most commercial manifestation of nano science and nanotechnology.

Keywords: Nanotechnology, Nano, Transistors, Electronics, etc.

I. INTRODUCTION

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Need of Nanotechnology in Electronics

Today microelectronics is used, and they solve our most of the problems. The two exceptional disadvantages of microelectronics are:

- Physical size
- Increasing cost of fabrication of integrated circuits.

To overcome these disadvantages nanotechnology can be used.

II.NANOTECHNOLOGY

Atoms are really small-more than a million times smaller than the tip of your finger and that means they are not easy to work with, but over the past few years, scientists and engineers have become increasingly good at designing and engineering materials down at the levels of atom, and because of this, new technology involves doing things at such a minute scale, called Nanotechnology.

Using their new skills, nanotechnologist is beginning to develop new stuffs like creating materials that are really good at turning sunlight into energy or using monoscopically small particles to deliver anti-cancer drugs.

III. INNOVATIONS IN NANOTECHNOLOGY

3.1 Ultra-Ever Dry

Ultra-ever dry is an amazing invention that completely repels almost any liquid. It uses proprietary nanotechnology to coat an object & create a secure wall of air on its surface. The Secure wall Repels water, refined oil, wet concrete & other liquids, unlike any other coating we can extend the life of work gloves, Electric motors, and coat nuts and bolts to protect corrosion.

3.2 Self-Energy Converting Sunglasses

We have already seen the solar chargers that convert sunlight into electricity to charge your mobile phones, mp3, ipad& more. These are the self-energy converting sunglasses. They come with dye solar cells & nanotechnology in the lenses that turn sun rays into "Electrical energy" It collects the sunlight & converts it into electricity to power up different gadgets.

3.3 Smartphone Screen Protector

Utilizing nano-coating tech. This glass screen protector is the thinnest screen protector in the market & perhaps one of the few products that have antibacterial properties.

3.4 A Fish Finder

So, here you don't have to spend hours of time looking for the night spot. The fish finding locator is a Helpful gadget it sends sound wave signals to the device giving exact location, structure details, composition as well as its depth below.

3.5 Smartphone Projector

Phones have been commonly used to record videos and photographs. Now you can enjoy all those viral moments without crowding around your tiny smartphone. This smartphone projector lets you display the footage on any surface. It has a magnifying lens ten times larger to increase the video size and to give a much better viewing experience.

IV. ADVANTAGES

Small tech size is the new trend. These new technology devices are as efficient as they don't occupy much space likewise, they reduced size they are more ecofriendly. Nanotechnology has been hailed as the next big thing for decades and will increase the efficiency of energy of energy consumption, help clean environment and solve major health problems. It is said that Nanotech inventions will be able to massively increase manufacturing productions and significantly reducing the cost.

Products of Nanotechnology will be smaller, cheaper and lighter, get more functional and require less energy and fewer raw material to manufacture.

Future Scope in Nanotechnology

- Nanotechnology for Flexible Electronics
- Nanotechnology for Wireless Technology
- Nanotechnology for Molecular Technology

V. CONCLUSION

So, whatever you see, it's because of different atoms that can be put together and if we arrange atoms in a smarter way, we could actually create a new material in an innovative way. This is really a powerful technology. It's helping us to do stuffs we couldn't even dream of just few years ago. But because, Nanotechnology is so powerful, we need to be very careful how to use it.

REFERENCES

- [1] https://www.researchgate.net/publication/339069917_Nanotechnology_An_innovation_in_scientific_research_and_technology.
- [2] https://www.researchgate.net/publication/315641209_Nanotechnology_innovations_industrial_applications_and_patents.
- [3] <https://www.sciencedirect.com/science/article/abs/pii/S0166497207000697>
- [4] M. Wegmuller, J. P. von der Weid, P. Oberster, and N. Gisin, "High resolution fiber distributed measurements with coherent OFDR," in Proc. ECOC'00, 2000, paper 11.3.4, p. 109.
- [5] <https://in-part.com/blog/new-nanotechnology-innovations-top-10/>

Evaluation of Map-Based Control System for Application of Fertilizer

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Abstract: Preserving environment in farming is now becoming main concern since use of inputs like fertilizers & pesticides has been widely employed. Site-specific application of agricultural chemicals is an effective way of resource saving and environmental protection. Precise farming implementation is now gaining popularity and widely accepted as one of smart solutions to sustain agriculture production without ignoring environment. This paper is based on results of map analysis, where map of soil can be developed based on (1) soil type (chemical composition of soil) (2) soil colour and texture (3) topography (high ground, low ground) (4) crop yield. As per results of chemical analysis, system is developed for controlling opening of outlet of valve for delivery of proper chemical composition (i.e., fertilizer) in same soil by controlling D.C. motor. Through this system, it is possible to improve agricultural production without ignoring environment, [1]

Keywords: Precision Farming, Map Based Technique, Variable Rate Applicator, etc.

I. INTRODUCTION

Main concern in developed countries is to preserve environment while focusing on high yielding with intensive use of inputs such as fertilizers and pesticides. Beside maintaining high yield performance, conscious efforts are made in preserving environment through concept of soil specific crop management or as precision farming.[2] Soil fertility varies from place to place, even it differs from foot to foot in the same field. Therefore, application of fertilizers should be done keeping this fact in mind. It is possible to develop the map-based design for application of particular fertilizer in a particular field as follows:

- Perform soil sampling (lab analysis) for the field, Laboratory test often check for plant nutrients in three categories:
 1. Major Nutrients: nitrogen(N), phosphorus (P), and potassium (K)
 2. Secondary Nutrients: sulfur, calcium, magnesium.
 3. Minor Nutrients: iron, manganese, copper, zinc, boron, chlorine.
- Generate site-specific map of soil nutrient properties.
- Algorithm to develop site specific fertilizers map.
- Use map to control fertilizers application.

II. MAP BASED TECHNIQUE

Site specific farming utilize the map-based method of sampling, map generation, and variable rate application. This method is more suitable sensors are difficult to rapidly monitor soil and crop conditions.

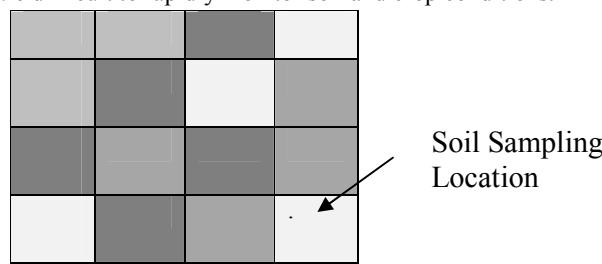


Figure 1: Grid map of Soil Sampling Data

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Maps are good for collecting and interpreting data for soil properties that do not fluctuate greatly from year to year. Properties such as organic matter content and soil texture tend to change slowly. Soil fertility may change more quickly.[4] Particular nutrients such as phosphorus and potassium may change from year to year, Concentration of nitrogen in the soil are greatly affected by temperature and moisture conditions and can fluctuate rapidly.Nitrogen is most important soil fertility factor.

III. PROPOSED SYSTEM

The application system mainly includes four parts: crop nutrition monitoring system based on interface module, variable fertilization controller and variable fertilizer applicator.Crop nutrition monitoring system installed in front of the tractor,foracquisition crop growth state and nutritional status, the sensors were connected to interface module, and the collected data transmission to interface module. The interface module has serial and power connections. The interface module connected with variable fertilization controller by serial. The variable fertilization controller combined with fertilization model to make the best use of fertilizers decision, this decision information can transmit fertilization information to variable applicator by the fertilization controller, the fertilizer applicator control system through the control hydraulic valve opening size which scatter the needed fertilization in the surface of the soil. Variable rate fertilization system is designed to achieve demand of fertilization application.

The paper is based on a variable input signal to output the electric signal to control hydraulic valve opening size.The flow rate of valve can be controlled by adjusting the opening position of hydraulic valve. And the flow rate can be controlled by changing hydraulic motor rotation speed as feedback-based tractor speed. The input signals of controller include crop nutrient information by optical sensor, per-axis fertilizer amount, fertilizer applicator parameters and pre-set fertilizer amount; the feedback of sensors; tractor speed; and GPS / GIS / PC input signals, etc. Output signal is mainly hydraulic valve opening size which used to control flow rate, the pulse-width modulation (PWM) used to control the hydraulic control valve and the serial data which output to the LCD screen. In addition, the controller has a serial data interface to allow for the extended application (to connect some testing equipment, such as bin level sensor etc.).[5]

The system structure shows in Figure 2.

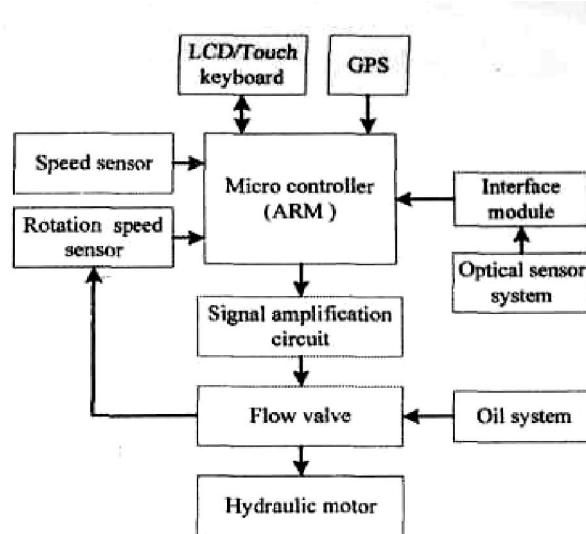
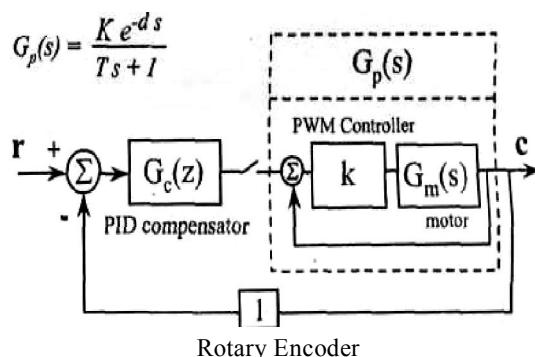


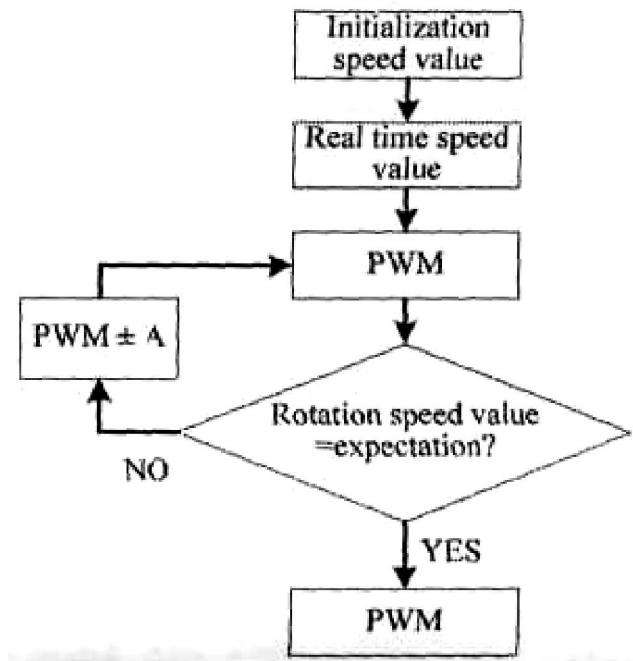
Figure 2: The System Structure

Digital PID Control: Digital control based on embedded system will be used in this research. A feedback control with a digital PID compensator, therefore, was adopted to improve the robustness of control. For this purpose, the rotor speed was monitored using an optical rotary encoder with resolution 30 pulses per rotation. A 16 bit counter was used to count the pulses every 20 ms.


Figure 3:Schematic Diagram of Digital Control

IV. FERTILIZATION AMOUNT FEEDBACK CONTROL

The chip can calculate the output PWM duty cycle according to the pre-set fertilizer amount after collected the speed of tractor. The feedback control is to regulate the PWM signal duty cycle according the real revolution speed of hydraulic motor by the microcontroller chip collect the rotary encoder output signal which fixed on the hydraulic motor. The new PWM signal controls the oil flow of the hydraulic flow control valve to control hydraulic motor which achieved to adjust the hydraulic motor revolution speed. Software design flow chart shows in Fig. 4


Figure 4:Feedback Control Design

V. SYSTEM TEST AND EXPERIMENT

In order to test the actual performance, carry out field trials and testing to the automatic controller of variable rate fertilizer applicator. Before the experiment, fix the controller, hydraulic motors, Hall switches and the other implementation units to these positions and connect the oil hydraulic circuit to the tractor.

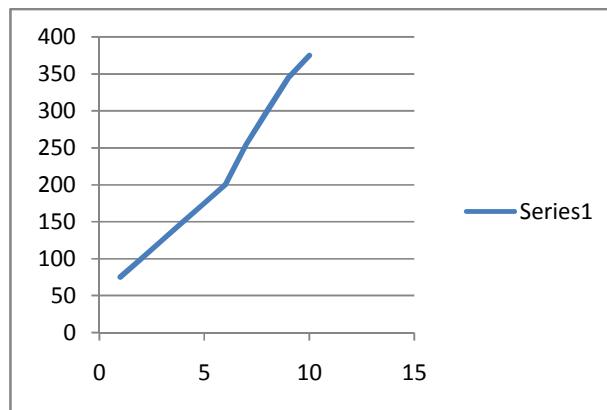
The DC power is controller, sensors and hydraulic need provided by tractor battery and its specifications is +12V/240 A hr. Fertilizer uses the better mobility of chemical fertilizers - urea in the experiment. Check the corrects of the system, then power up, after initialization, the operator through the keyboard input the preset data, after

controller calculate these collected signals output PWM signals to control the hydraulic motor, hydraulic motor driven gears through chains to achieve the precise variable rate fertilization. Table 1 showed the measured results of different preset fertilizer amount.

Table 1: Different Preset Fertilizer Amount Experiment

Number	Pre-set Amount (kg/hm²)	Actual amount kg/hm²	Relative Error (%)
1	75	75.50	0.50
2	100	103.1	3.1
3	125	128.7	3.7
4	150	154	4
5	175	173	2
6	200	204	4
7	255	252.42	1.01
8	300	302.44	0.81
9	345	341.20	1.10
10	375	365.17	2.62

In the actual measurement, the maximum relative error is 4 %, and it shows range is from 0.5 % to 4 %. So, it can well meet the purpose of variable rate fertilization and its standards. From Figure 5, we can see that the response is the rapid and timely in fertilization. The response time of fertilizer volume changes is less than 0.9s; this time is less than the desired time of the controller designed. The experiment has proved that fertilizer controller can meet the requirements of field fertilization.


Fig. 5.1: Preset Amount of Distribution

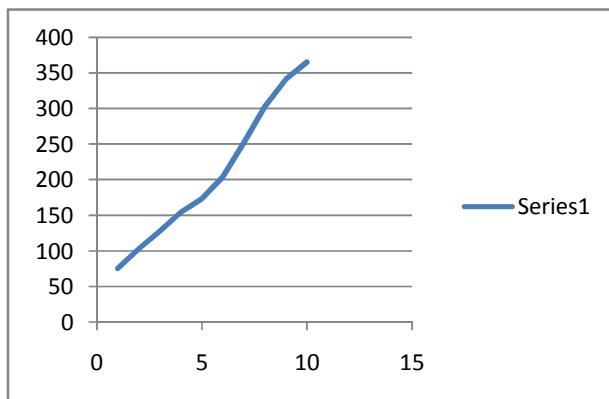


Figure 5.2: Actual Amount of Distribution

VI. CONCLUSIONS

Design of feedback control system for developing VR fertilizer applicator was successful. It was able to discharge fertilizer at target rate with acceptable delay and accuracy or, the paper analyzes the input and output conditions of control system, designed a hardware control system based on ARM chip, designed mainly software flow and designed a feedback control.

The system can automatically control flow amount by adjusting hydraulic valve size, and can change hydraulic motor rotation based on working speed at the same time. The system used the hydraulic motor as a drive mechanism is more reasonable than motor, which can overcome the small torque and start out-of-step phenomenon. And used control chip is faster, reliability well, and has a good real-time online display.

Carried out systematic laboratory testing, field testing and analyses experimental results of errors. Field experiment results show that fertilizer amount in fact is well to target fertilization amount, the maximum relative errors is 5.%, and it shown CV is from 0.35 % to 2. %. Experiment indicated that the variable rate fertilization control system to control fertilization, which achieves the aim of saving fertilizer and reasonable fertilization. The fertilizer response time of controller system is less than 0.9 s.

REFERENCES

- [1] Rui Zhang, XiuWng, Jianhua Guo, Liping Chen, Jianjum Zhou, "Development of variable rate fertilizer system based on optical sensor" sensor & Transducers, Vol.26, March 2014, pp1-6.
- [2] Kyle H. Holland, James. Schepers, use of virtual- reference concept to interpret active crop canopy sensor data, precision agriculture, 14-1-2013 pp 71-85.
- [3] Chunling Lang, "Design and developmentof control system for deep fertilization variable liquid fertilizer applicator", ICDMA 2011 second international conference pp 369-372.
- [4] Zidong Yang, "The Research on adaptive control modeling of a liquid fertilizer spreader" published online February 2010 (<http://www.scrip.org/journaleng>).
- [5] Rui Zhang, Chunjiang Zhao. "Variable rate fertilizer control system for disc fertilizer spreaders" Intelligent automation and soft computing, Vol.18 No.5, pp.461-467, 2012.
- [6] WengianHuanog, Zhijien Meng, "Ddesgn of CAN- based variable rate fertilizer control system" pp 1330-32.
- [7] P.A.S. Radite, WawanHermawn "Development of variable rate fertilizer applicator module based on 8-bit embedded system."AFITA 2010 international conference pp-93-98.
- [8] A.M. Mouazen, M.R. Maleki, "On-line measurement of some selected soil properties using a VIS-NIR sensor". Soil and Tillage research 2007, pp13-27.
- [9] EhteshamForouzanmehr, Mohammad Loghavi, "Design, development and field evaluation of a map - based variable rate granular fertilizer control system", CIGR journal dec. 2012 Vol.14, No. 4 pp 255-261.

Fatigue Life Estimation Using Single Spot-Welded Joint Fracture Mechanics

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Abstract: The influence of a spot-welded joint on the overlap section of the specimen, which is critical for spot welded joints subjected to uniaxial in plane loads, on fatigue life is explored in this study. This study was carried out using the ANSYS finite element program. The fatigue life properties of spot-welded specimens with various gap values are numerically calculated using a created computer program and several fatigue-life techniques to see how the gap affects the fatigue life of the spot-welded specimens. With rising gap values, it is noticed that maximum stress and strain values increase, resulting in a loss in fatigue life. Maximum stresses and strains, and hence fatigue-life values, are shown to be relatively constant for gap values less than 0.0025mm.

Keywords: Fatigue Life, Resistance Spot Welding, Finite Element Analysis, etc.

I. INTRODUCTION

Despite the trend toward other joining methods such as laser-beam welding, adhesive bonding, bolted and riveted joints, resistance spot welding (RSW) remains the primary joining method for joining or fastening panels and bodies that contain hundreds, if not thousands, of spot welds, especially in the automotive, railroad, and aero plane industries. The welding procedure is used in industrial applications because it provides excellent operating efficiency at a lower cost of production than other welding processes like laser and friction stir welding. Resistance spot welding, on the other hand, entails cutting a sharp slit into the welded joint, which increases stress concentration and causes the joint to shatter. In order to analyze the long-term strength reliability of spot-welded structures, it is necessary to first understand their fatigue properties. Spot welds in real cars are subjected to a variety of loads, including shear, peel, and cross tension. As a result, some articles have published spot-welded joint strength evaluation results under these stress conditions. Because the strength of spot-welded joints is known to be dependent on the type of metal used. The objective of this paper is to find stress-strain values of the specimen using finite element analysis and Fatigue life estimation of the specimen using different approaches.

II. LITERATUREREVIEW

A. H. Eertas, Y. Yilmaz, C. Baykara, the influence of the space or gap value between the overlap portions of components on fatigue life is explored in this study for two different types of geometry, MTS and TS, and for five different gap values. Fatigue lifetimes for five different gap values of MTS and TS specimens are computed using a computer software created by the authors utilising monotonic test data combined with empirical relationships found in the literature. They demonstrate that stress distributions generated under varied loading circumstances are realistic and exhibit a variety of characteristics. Because all stress and strain data at crucial places are available, they provide numerical capacity for fatigue analysis. The gap value between the overlap sections of the specimens is discovered to be significant and has an impact on the specimen's fatigue life.

Xiangbo Liu, Yanhong Wei, Haijiang Wu, Tao Zhang, to obtain the total residual deformation in continuous simulation, a 3-D comparison between the original geometry and the final deformed geometry is necessary, which can highlight the deformation interaction between the continuous welding processes. The virtual and actual welded rear side panels show good agreement in terms of deformation, demonstrating the direct

reliability of direct finite element analysis while modelling the resistance spot welding process. It also shows how parameter optimization through reverse engineering and direct finite element analysis is sensible. The reverse stamping pieces that make up the BSP are shown to have considerable clearances after assembly. The apparent deformation in the reverse BSP is caused by clamp pressure, electrode pressures, and residual tensile stresses.

Ryota Tanegashima, Hiroyuki Akebono, Atsushi Sugeta, the empirically obtained fatigue fracture initiation angles in this work deviated substantially from the conclusions of traditional theories on mixed-mode cracks in the locations most impacted by stress. Because the experimental and numerical results were so close, the theories' relevance to the fatigue properties of real joints appears to be dubious. Numerical methods, on the other hand, may be able to precisely predict the fatigue crack start angles of spot-welded joints. The fatigue properties of shear- and peel-type single spot-welded joints were examined experimentally and analytically to evaluate the accuracy of joint fatigue life calculations produced using traditional theories. The observed fracture starts angles deviated from expectations based on traditional theories, implying that the theories cannot be used to assess the fatigue properties of the joints.

Sajjad Seifoori, Ahmad MahdianParrany, MojtabaKhodayari, Fatigue fracture is one of the most common causes of failure in many rotating machinery components. In this paper, the fatigue behaviour of a typical shaft, which is widely used in the turbocharger of BELAZ 75131 mining dump trucks, is studied both theoretically and experimentally. There is one diameter change along the shaft and investigations show that the dominant cause of failure is fatigue caused by cyclic loadings. Finite element based numerical simulations are also performed by MSC Fatigue software to demonstrate the accuracy of the experimental results. In addition, a fatigue testing machine is developed to obtain the fatigue life of the shaft experimentally and validate the theoretical results.

SendongRen, Yunwu Ma, Shuhei Saeki, Yoshiaki Iwamoto, Chuantong Chen, NinshuMa, Coaxial one-side resistance spot welding was used to fuse carbon fibre reinforced polymers (CFRP) and Al5052 sheets. During the SLS test, the joints with low welding current showed interfacial fracture with low strength and little displacement, whereas the joints with high welding current showed a staged failure process with CFRP tearing, resulting in higher strength and bigger displacement. In welded junctions, molten CFRP produces a thin layer. It is always partially attached to the metal sheet. Micro gaps on the interface can be removed using a higher welding current. Excessive heat input, on the other hand, will cause ablation of the CFRP resin matrix.

III. IMPLEMENTATION

In the literature, there are stress-based and strain-based approaches to fatigue life estimation models. Because of the very confined plastic deformation around the spot weld nuggets, stress-based techniques were found to be more conservative for spot-weld joints. Only strain-based models with the best correlation with experimental results are used to evaluate fatigue life of spot-welded joints in this study.

$$\begin{aligned} \frac{\Delta\epsilon}{2} = \epsilon_a &= \epsilon_e + \epsilon_p = \frac{\Delta\epsilon_e}{2} + \frac{\Delta\epsilon_p}{2} \\ &= \frac{\sigma'_f}{E} (2N_f)^b + \epsilon'_f (2N_f)^c \end{aligned}$$

Where ϵ_e is the elastic component of the cyclic strain amplitude, ϵ_p the plastic component of the cyclic strain amplitude, ϵ'_f the regression intercept called 'the fatigue ductility coefficient', c the regression slope called 'the fatigue ductility exponent', σ'_f the regression intercept called 'the fatigue strength coefficient', N_f the number of cycles to failure, and b the regression slope called 'the fatigue strength exponent'

Experimentation is used to establish the most trustworthy results of fatigue behavior of structures, components, or elements. Empirical relations, developed by numerous researchers, are employed in the absence of experimentally determined values. Muralidharan and Manson relation, given by, is one of the most important empirical relations

$$\frac{\Delta\epsilon}{2} = \epsilon_a = 0.623 \left(\frac{s_{ut}}{E} \right)^{0.832} (2N_f)^{-0.09} + 0.0196 (\epsilon_t)^{0.155} \left(\frac{s_{ut}}{E} \right)^{-0.53} (2N_f)^{-0.56}$$

IV. NUMERICAL ANALYSIS

In numerical analysis, for the modelling of the MTS and TS specimens, following true stress versus strain curve, shown in Figure, is used

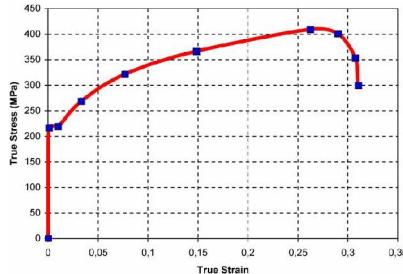


Figure 1: True stress versus strain curve

Initially, the space or gap value between the overlap portions of pieces is assumed as 0.02mm. Then the gap values (that is 0.01, 0.005, 0.0025, and 0.00125 in mm) the analysis are repeated.

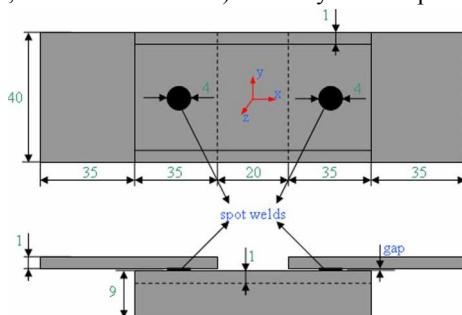


Figure 2: Geometry of MTS specimen (top and side views)

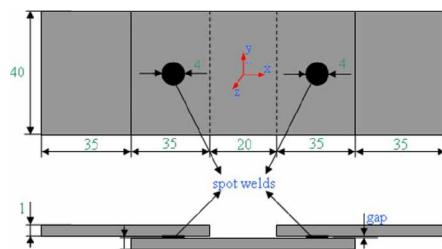


Figure 3: Geometry of TS specimen (top and side views)

A linear (two node) beam element in three-dimensional, BEAM188, is chosen for the description of the spot weld. When defining the mesh sizes, the influence of the mesh size on the resulting forces is analysed and the final elements sizes are defined after convergence.

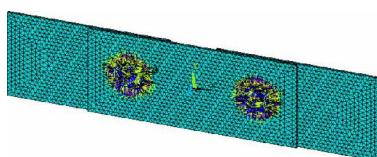


Figure 4: Finite-element model for TS specimen

The results of the convergence are shown In Tables 1 and 2 in terms of both material element size and sub steps versus first principal stress value for the load range of 150–2700N as an example.

Tables 1: Sub steps versus First principal stress value

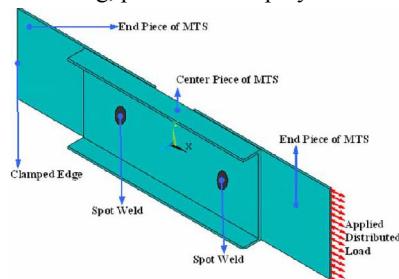
Number of sub steps	First principal stress value(MPa)
10	486.34
20	443.6
40	420.72
80	415.47
120	414.5
160	412.94
200	412.6
240	412.2
320	415.72
640	418.22
1280	418.68
2560	418.69

Tables 2: Element size versus First principal stress value

Element size	First principal stress value(MPa)
0.012	248.59
0.007	278.42
0.005	312.21
0.004	355.55
0.003	380.67
0.0025	409.24
0.002	412.94
0.0015	413

V. BOUNDARY CONDITIONS

On the surface of the left end of the MTS and TS, all displacements and rotations of the associated nodes are fixed. Aside from that, all displacements and rotations of the associated nodes on the surface of the right end of the MTS and TS specimens are limited, with the exception of the 'x' (applied load) direction. The loading, on the other hand, is mimicked by applying negative pressure to a set of nodes on the areas of the right end's surfaces of MTS and TS specimens in cycles (to generate a tension effect). Because the distributions of nodes on surfaces are not uniform due to the specimen modelling, pressure is employed instead of load directly in the cycles.


Figure 5: Boundary Conditions

VI. ANALYSIS AND FATIGUE LIFE CALCULATION

For proper design, stress concentration values must be as lower as possible in order to increase fatigue life values. Because the stress distributions of the TS and MTS specimens under loading conditions are similar the effect of solution type on stress concentration have been examined only for MTS specimen.

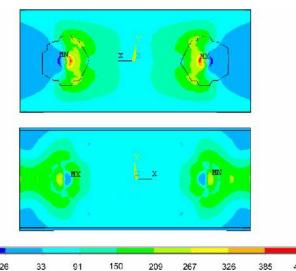


Figure 6: Distribution of principal true stress (in MPa) on the inner and outer surfaces of the central piece of the MTS specimen developed due to the maximum load (nodal type solution)

The minimum (150N) and maximum (3000N) loads are used to create these stresses. The fatigue life was calculated using a nodal solution in this study. A non-linear finite-element analysis is used to calculate the stress and strain values of the crucial nodes of spot-welded MTS and TS specimens. Under linearly elastic circumstances, a detailed analysis of the three-dimensional mechanical behavior of spot-welded joints was carried out for MTS and TS specimens. For MTS and TS specimens, finite-element solutions of the stress fields in the base metal and nugget have been derived.

VII. RESULT AND DISCUSSION

Figures show typical spot-weld fatigue results for two distinct types of geometry and five different gap values, according to various fatigue life prediction methodologies. Using a non-linear finite-element analysis, the stress and strain values of the critical nodes of spot-welded MTS and TS specimens for various gap values, namely 0.02, 0.01, 0.005, 0.0025, and 0.00125 in mm, are estimated first. The fatigue life (number of cycles to failure) versus load range relations are then generated utilizing several types of fatigue life prediction algorithms.

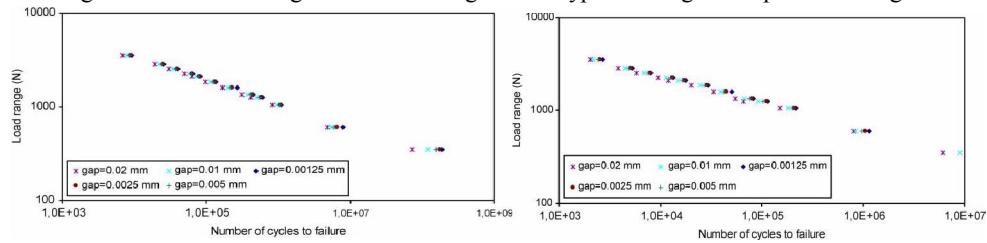


Figure 7: Results of fatigue analysis for different gap values of spot-welded MTS & TS specimen using the Coffin–Manson’s approach

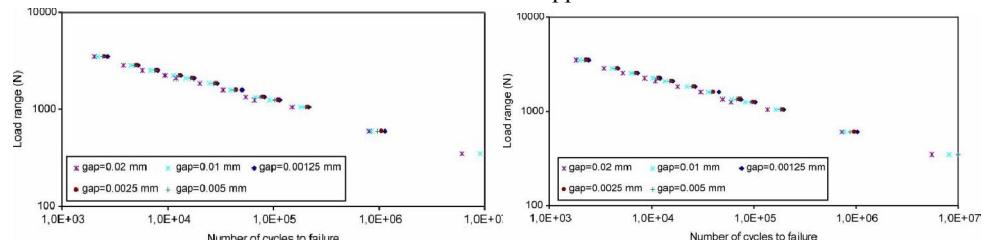


Figure 8: Results of fatigue analysis for different gap values of spot-welded MTS & TS specimen using the Muralidharan and Manson’s Universal slopes approach

Variation of the number of cycles to failure versus gap value for the MTS specimen is obtained using fatigue lives calculated previously for the load range of 150–2700 N, as an example, and shown in Table 3 to clearly see the effect of the gap value between the overlap portions of the spot-welded specimens on fatigue life.

Gap value (mm)	Number of cycles to failure
0.02	30431
0.01	35128

0.005	38000
0.0025	39231
0.00125	40099

Table 3: Variation of the fatigue lives with respect to gap values for the spot-welded MTS specimen and load range of 150–2700 N

VIII. CONCLUSION

The influence of the spacing or gap value between the overlap portions of pieces on fatigue life is explored in this study for two different types of geometry, MTS and TS, as well as five various gap values. The created computer programme calculates fatigue lifetimes for five distinct gap values of MTS and TS specimens. The stress distributions obtained for various loading circumstances are realistic and exhibit a variety of distinguishing characteristics. Because all stress and strain data at crucial places are available, they provide numerical capacity for fatigue analysis. The gap value between the overlap sections of the specimens is discovered to be significant and has an impact on the specimen's fatigue life. The maximum stresses and strains decrease as the gap value decreases, resulting in an increase in fatigue life. Maximum stress and strains, and hence fatigue life values, do not change substantially for gap values less than 0.0025mm, especially for spot welded MTS specimens.

REFERENCES

- [1] AHErtas, YYilmaz, and C Baykara, “Aninvestigation of the effect of the gap values betweenthe overlap portions of the spot-welded pieces onfatigue life”, Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science(2008).
- [2] XiangboLiua, YanhongWeia, Haijiang Wub, Tao Zhangb, “Factor analysis of deformation in resistance spot welding of complex steelsheets based on reverse engineering technology and direct finite elementanalysis”, Journal of Manufacturing Processes 57 (2020) 72–90.
- [3] RyotaTanegashima, Hiroyuki Akebono, Atsushi Sugeta, “Fatigue Life Estimationbased on Fracture Mechanics of Single Spot-WeldedJoints under Different Loading Modes”, Engineering Fracture Mechanics(2017).
- [4] Sendong Ren, Yunwu Maa, Shuhei Saeki, Yoshiaki Iwamoto, Chuantong Chen, Ninshu Maa’ “Fracture mechanism and strength evaluation of Al5052/CFRP joint producedby coaxial one-side resistance spot welding”, Composite Structures 252 (2020) 112766.
- [5] S. Aslanlar, A. Ogur, U. Ozsarac, E. IlanWelding time effect on mechanical properties of automotive sheets in electrical resistance spot weldingMater Des, 29 (2008), pp. 1427-1431.
- [6] X. Kong, Q. Yang, B. Li, G. Rothwell, R. English, X.J. Ren Numerical study of strengths of spot-welded joints of steel Mater Des, 29 (2008), pp. 1554-1561.
- [7] H. Moshayedi, I. Sattari-Far Resistance spot welding and the effects of welding time and current on residual stresses J Mater Process Technol, 214 (2014), pp. 2545-2552.
- [8] J. Pakkanen, R. Vallant, M. Kicin Experimental investigation and numerical simulation of resistance spot welding for residual stress evaluation of DP1000 steel Weld World, 60 (2016), pp. 393-402.

Applications of Artificial Intelligence in Machine Learning: Review

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Abstract: Artificial Intelligence has been growing in all the technologically relevant fields but it's also spreading within the areas where nobody had imagined it to be. This may sound sort of a progress but it is often equally disruptive in future. It is believed that AI may be a very sensitive issue and if not handled with care, it could find itself imparting 'Superintelligence' to machines which might make them even more intelligent than humans. Machine learning is one among the foremost exciting recent technologies in AI. Learning algorithms in many applications that we make use of daily. Every time a web search engine like Google or Bing is used to search the internet, one of the reasons that works so well is because a learning algorithm, one implemented by Google or Microsoft, has learned how to rank web pages. Every time Facebook is employed and it recognizes friends' photos, that's also machine learning. Spam filters in email saves the user from having to go through plenty of spam emails, that's also a learning algorithm. In this paper, a quick review and future prospect of the vast applications of machine learning has been made.

Keywords: Artificial Intelligence, Machine Learning, Supervised Learning, Unsupervised Learning, Semi-Supervised Learning Applications, etc.

I. INTRODUCTION

Since the invention of computers or machines, their capability to perform various tasks went on growing exponentially. Humans have developed the facility of computer systems in terms of their diverse working domains, their increasing speed, and reducing size with reference to time. A branch of computing named AI pursues creating computers or machines as intelligent as citizenry.

What is Artificial Intelligence?

According to the daddy of AI, John McCarthy, it's "The science and engineering of creating intelligent machines, especially intelligent computer programs". AI may be a way of creating a computer, a computer-controlled robot, or a software that thinks intelligently, within the similar manner the intelligent humans think. AI is accomplished by studying how the human brain thinks and the way humans learn, decide, and work while trying to unravel a drag, then using the outcomes of this study as a basis of developing intelligent software and systems.

While exploiting the facility of the pc systems, the curiosity of humans led him to wonder, "Can a machine think and behave like humans do?" Thus, the event of AI started with the intention of making similar intelligence in machines that we discover and regard highly in humans. AI may be a science and technology supported disciplines like computing, Biology, Psychology, Linguistics, Mathematics, and Engineering. A serious thrust of AI is within the development of computer functions related to human intelligence, like reasoning, learning, and problem solving. Out of the subsequent areas, one or multiple areas can contribute to create an intelligent system.

Goals of AI:

To Create Expert Systems— The systems which exhibit intelligent behavior, learn, demonstrate, explain, and advice its users. To Implement Human Intelligence in Machines— Creating systems that understand, think, learn, and behave like humans.

II. APPLICATIONS OF ARTIFICIAL INTELLIGENCE

AI has been dominant in various fields like –

1. Gaming- AI plays a crucial role in strategic games like chess, poker, tic-tac-toe, etc., where machines can consider a sizable number of possible positions that support heuristic knowledge.
2. Tongue Processing- it's possible to interact with a pc that understands the tongue spoken by humans.
3. Expert Systems- There are some applications which integrate machine, software, and special information to impart reasoning and advising. They supply explanations and advice to the users.
4. Vision Systems- These systems understand, interpret, and comprehend visual input on the pc. For instance, A spying airplane takes photographs, which are wont to find out spatial information or map of the areas. Doctors use a clinical expert system to diagnose the patient. Police use computer software which will recognize the face of the criminal with the stored portrait made by a forensic artist.
5. Speech Recognition- Some intelligent systems are capable of hearing and comprehending the language in terms of sentences and their meanings while a person's talks thereto. It can handle different accents, slang words, noise within the background, change in human's noise thanks to the cold, etc.
6. Handwriting Recognition- The handwriting recognition software reads the text written on paper by a pen or on screen by a stylus. It can recognize the shapes of the letters and convert it into editable text.
7. Intelligent Robots- Robots are ready to perform the tasks given by a person. They need sensors to detect physical data from the important world like light, heat, temperature, movement, sound, bump, and pressure. They need efficient processors, multiple sensors and large memory, to exhibit intelligence. Additionally, they're capable of learning from their mistakes and that they can adapt to the new environment.

Artificial Intelligence(AI), once a notion confined to Sci-Fi novels, movies and research papers, is now making an incredible impact on society. Today, there are numerous applications of AI within the consumer and business spaces, from Apple's Siri to Google's DeepMind. Siri, for instance, uses tongue processing (NLP) to interpret voice commands and respond accordingly. Google's DeepMind, on the opposite hand, uses deep learning. it's capable of creating connections and reaching meanings without counting on predefined behavioral algorithms, instead learning from experience and using data as its inputs. In fact, by applying findings from DeepMind, Google was ready to improve the efficiency of its own power centers, reducing the energy used for cooling by 40%.

In the business world, AI is enabling businesses to figure smarter and faster, doing more with significantly less. As technology and society still advance, more organizations are trying to find powerful, sophisticated solutions which will improve and streamline operations. But it's important to understand that AI is an umbrella under which a variety of various technologies reside. Machine learning, deep learning, robotics, computer vision, cognitive computing, artificial general intelligence, tongue processing and knowledge reasoning are just a few of the best branches of AI. However, many of the applications of AI we see today are considered to be 'weak AI' because we've yet to release their true potential. Weak AI, also referred to as 'narrow AI', is non-sentient AI, which focuses on one task alone.

Strong AI, on the other hand, refers to AI applications which will readily formulate their own decisions without human input, apply intelligence to multiple problems, and perform and behave more sort of a human. We are quite sure how strong AI is. Yet despite current AI solutions not being 'true' AI, the advantages and capabilities they supply are extraordinary – and lots of industries have already incorporated some sort of AI into their day-to-day processes. In some industries, AI is capable of automating business intelligence and analytics processes, providing a holistic end-to-end solution. In others, computer vision is being deployed to map and navigate terrain, contributing to the development of smart, self-driving cars that are learning to drive as humans do.

Below are just a couple of samples of how AI is getting used to enhance efficiency:

1. Banking and Finance – fraud detection:

Many banks use the varied applications of AI to detect fraudulent activity. The AI software is given a really large sample of knowledge that has fraudulent and non-fraudulent purchases and is trained to work out whether a transaction is valid supported data. Over time, the software becomes incredibly adept at spotting fraudulent transactions supporting what it's learned previously.

2. Retail – online customer support

Many websites now offer some sort of 'chat' functionality where you'll ask a customer support representative or sales representative. In most instances, it's some sort of automated AI that begins these conversations. As these AI chat bots are capable of understanding tongue, i.e., human conversation, they will readily assist customers find out what they have to understand, extracting information from the web site, and directing them to the acceptable website or person for further support.

3. Security

As cyber-attacks increase in frequency and more sophisticated tools are wont to breach cyber defences, human operators are not any longer enough. Top firms across the planet are investing heavily in cybersecurity to make sure their data is protected. Real-time threat detection, mitigation, and ideally, prevention, are what's needed for businesses – and AI can deliver. Using machine learning algorithms and feeding those algorithms great quantities of knowledge, IT and security experts can teach the AI solution to watch behavior, detect anomalies, adapt and answer threats and issue alerts. AI has quickly become a key component during a business' cybersecurity infrastructure, providing a multi-layered security strategy that's robust and complicated.

Organizations that respond rapidly to opportunities in AI application will have the advantage within the landscape of the longer term. But, because AI is evolving rapidly, the challenge is to make sure that the business has the required strategies and plans to support AI capabilities as they become available, and therefore the right technical infrastructure to support AI implementation. For several businesses, it's not an issue of if but rather when to adopt AI. On the basis, monitoring the event of AI technology and planning far beforehand is important to adopt AI successfully.

The optimum strategy is to watch, learn and experiment with current AI. Investing an excessive amount of into AI which seems to be ineffective are going to be damaging for the business' adoption and utilization of future AI-based solutions. Instead, attempt to determine how your business can enjoy AI – and the way it are often built into core processes to drive efficiency. Start with the outcomes you would like to realize to modernize your IT environment. Remember, AI won't necessarily replace human operators any time soon, but it'll empower organizations to try too much, much more.

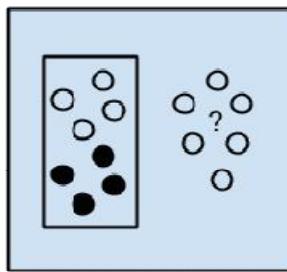
III. ALGORITHMS IN ARTIFICIAL INTELLIGENCE

Basically, there are alternative ways an algorithm can model a drag. Also, because it relates to the interaction with the experience. Although, it doesn't matter whatever we would like to call the input file. That's to first consider the training styles that an algorithm can adapt.

Generally, there are only a couple of main learning styles that a Machine Learning algorithm can have. And, also, we'll undergo them. Also, we've few samples of algorithms and problem types that they suit.

Basically, this manner of organizing machine learning algorithms is extremely useful. As because it forces you to believe the roles of the input file and therefore the model preparation process. Also, to pick one that's the foremost appropriate for your problem to urge the simplest result. Let's take a glance at three different learning styles in machine learning algorithms:

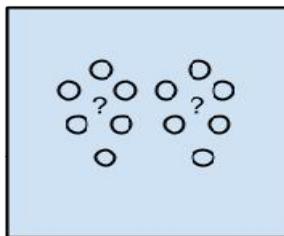
i) Supervised Learning



Supervised Learning
Algorithms

Basically, during this Supervised Machine Learning, input file is named training data and features a known label or result like spam/not-spam or a stock price at a time. In this, a model is ready through a training process. Also, during this required to form predictions. And is corrected when those predictions are wrong. The training process continues until the model achieves the specified level. Example problems are classification and regression. Example algorithms include logistic regression and back propagation Neural Network.

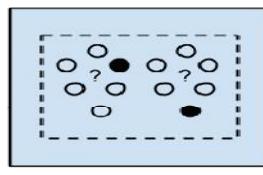
ii) Unsupervised Learning



Unsupervised Learning
Algorithms

In this Unsupervised Machine Learning, input file isn't labelled and doesn't have a known result. we've to organize the model by deducing structures present within the input file. This might be to extract general rules. it's going to be through a mathematical operation to scale back redundancy. Example problems are clustering, dimensionality reduction, and association rule learning. Example algorithms include the Apriori algorithm and k-Means.

iii) Semi-Supervised Learning



Semi-supervised
Learning Algorithms

Input data may be a mixture of labeled and unlabeled examples. there's a desired prediction problem. But the model must learn the structures to arrange the info and also to make predictions. Example problems are classification and regression. Example algorithms are extensions to other flexible methods. That makes assumptions about the way to model the unlabeled data.

IV. CONCLUSION

Humans have always sought to create a cushy life, the proof of this lies within the incontrovertible fact that we've always trusted machines to urge our work to be done more easily, in a faster and more efficient manner. Within the past, machines were wont to reduce the manual labor required to get employment done, but at the present, with the arrival of machine learning humans seek to create machines which aren't only strong but also intelligent and hence machine learning has emerged to become a neighbourhood of study that's ever within the bloom. Machine learning has not just made the machines autonomous, bringing forward the concept of autonomous computing, but it's also reduced the constant vigilance users are required to stay upon the applications.

This paper discusses the four categories of machine learning i.e., supervised learning, unsupervised learning, and reinforcement learning and recommender system and also presents the various applications under them. Aside from those two proposed applications namely information machines and virtual doctor are suggested. The main purpose of machine learning is to develop algorithms that assist within the creation of intelligent machines thus reducing the roles of the programmers because the machine learns in due course of your time to enhance its performance. Although tons of advancements are made during this field still then there exists glaring limitations within the data set from which machine learns. It is often rectified by constantly keeping the info sets up-to-date as learning may be a continuous process. Aside from this issue, an excellent number of publications on machine learning evaluate new algorithms on a couple of isolated benchmark data sets. In spite of these shortcomings, machine learning has solved varying problems of worldwide impact.

Machine learning has proven to be vastly useful in a variety of fields like data processing, AI, OCR, statistics, computer vision, mathematical optimization, etc and its importance tends to stay ever on the rise. Machine learning theories and algorithms are inspired from the biological learning systems where the performance depends on factors just like the amount of obtainable data, the training history and knowledge, etc, and thus help explain human learning. The applications of machine learning are therefore never ending and it still remains a lively field of research with immense development options and a promising future. Future challenge is to develop an automated prescription at critical condition using machine learning concept, which may minimize the error in diagnosis.

REFERENCES

- [1] Tzanis, George, et al. "Modern Applications of Machine Learning." Proceedings of the 1st Annual SEERC Doctoral Student Conference–DSC. 2006.
- [2] Horvitz, Eric. "Machine learning, reasoning, and intelligence in daily life: Directions and challenges." Proceedings of. Vol. 360. 2006.
- [3] Mitchell, Tom Michael. The discipline of machine learning. Carnegie Mellon University, School of Computer Science, Machine Learning Department, 2006.
- [4] Ball, Gregory R., and Sargur N. Srihari. "Semi-supervised learning for handwriting recognition." Document Analysis and Recognition, 2009. ICDAR'09. 10th International Conference on. IEEE, 2009.
- [5] R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.(2002) The IEEE website. [Online]. Available: <http://www.ieee.org/>
- [6] M. Shell. (2002) IEEtran homepage on CTAN. [Online]. Available: <http://www.ctan.org/tex-archive/macros/latex/contrib/./supported/IEEtran/>
- [7] FLEXChip Signal Processor (MC68175/D), Motorola, 1996.
- [8] "PDCA12-70 data sheet," Opto Speed SA, Mezzovico, Switzerland.
- [9] A. Karnik, "Performance of TCP congestion control with rate feedback: TCP/ABR and rate adaptive TCP/IP," M. Eng. thesis, Indian Institute of Science, Bangalore, India, Jan. 1999.
- [10] J. Padhye, V. Firoiu, and D. Towsley, "A stochastic model of TCP Reno congestion avoidance and control," Univ. of Massachusetts, Amherst, MA, CMPSCI Tech. Rep. 99-02, 1999.
- [11] Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification, IEEE Std. 802.11, 1997.

Comparative Study of Green Rating Systems in India

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Abstract: Indian construction industry is highest growth rate from last years, which is having a negative impact on the environment and natural resources available for construction. Following this problem of carbon imprint, concept of sustainable development in construction industry is the need of an hour. With increase in demand of sustainable buildings or green buildings demand of green rating and assessment tools is also increasing. Rating tools set benchmark for green building measurement, which are helpful in reducing negative impact on environment by promoting quality green building. India has two main building environment assessment tools i.e., Indian Green Building Council (IGBC) and Green Rating for Integrated Habitat Assessment (GRIHA). The former is benchmarked with global standards while later is indigenously developed. This paper aims to focus on comparative study of IGBC (LEED India) and GRIHA rating system and compare both with regards to their certification-cost, influence and popularity, performance criteria and benchmarks (rating score). Through this study, an attempt is made to make clear understanding of IGBC and GRIHA rating system assessment criteria that need to be considered before certification.

Keywords: Green Rating System, GRIHA, LEED, IGBC, etc.

I. INTRODUCTION

Due to rapid urbanization and increased population, there is a huge demand of residential and commercial buildings. Traditional materials and methods of construction are harmful for our environment and society because they emit greenhouse gases (GHGs), dust, consumes more energy and water. A green building is one which utilizes less water, improves vitality productivity, saves common assets, creates less waste and gives more advantageous spaces to tenants when contrasted with a regular building. Use of Innovative materials and non-renewable energy resources in green or sustainable building reduces environmental impact. A Green Building advances productive utilization of natural assets and reused or recyclable materials. Sustainable building has three fundamental measurements - ecological, cultural and economic sustainability [1]. It Depend upon the kind of nation, due to regional differences expectation of people also changes, likewise culture is also essential angle in accomplishing sustainability.

The traditional buildings satisfy the necessities of well-being, but utilize excess energy and other natural assets, but Green Buildings adopts variety of eco-friendly concepts and provide same comfort with healthy environment. The sustainable building demand has expanded quickly worldwide in recent decades. With increase in green building demand assessment and benchmarking tools were needed [2]. In view of the extent of green measures embraced, credits are granted to a project and, after applying required weightage; a final score is calculated to determine the certification Level of the building. This helps to know the range of utilization of green practices in building development. The BREEAM (Building Research Establishment's Environmental Assessment Method) was launched in UK in 1990 and first guide was published in 1996, after BREEAM every country started developing their own rating system, the Hong Kong Building Environmental Assessment Method (HK-BEAM) was introduced in the same year in Hong Kong in 1996. In the year 1998, the Leadership in Energy and Environmental Design green building rating system was introduced in US. In year 2002 Green building council of Australia introduced Green Star rating system.

In year 2003 the Indian Green Building Council was introduced BY CII. In year 2005, the Green Mark rating system was introduced by the building and Construction Authority of Singapore. In year 2005 TERI developed Green Rating for Integrated Habitat Assessment in India which was adopted as national rating system for green building in November 2007.

II. AN OVERVIEW OF GREEN BUILDING RATING SYSTEM

A. Building Research Establishment's Environmental Assessment Method (BREEAM)

BREEAM was founded almost three decades back in the United Kingdom in 1990 by the Building Research Establishment (BRE), and it stands for Building Research Establishment Environmental Assessment Method. It is one of the most popular and internationally recognized green building rating systems in the world that sets standards and measures the environmental performance of buildings – both new as well as existing. In other words, BREEAM is the world's leading sustainability assessment method for master-planning projects, infrastructure and buildings. It recognizes and reflects the value in higher performing assets across the built environment lifecycle, from new construction to in-use to renovation and refurbishment. BREEAM does this through third party certification of the assessment of an asset's environmental, social and economic sustainability performance, using standards developed by BRE. This means BREEAM-rated developments are more sustainable environments that enhance the well-being of the people who live and work in them, help protect natural resources and make for more attractive property investments. BREEAM rating system is divided in 10 categories, namely Energy, Health and wellbeing, Innovation, Transportation, Material, Waste, Land use and Ecology, Water, Pollution, Management [3].

B. Leadership in Energy and Environmental Design

LEED is an American green building rating system developed by the U.S. Green Building Council whereas BREEAM is English and was introduced by the UK-based Building Research Establishment (BRE). The first LEED building appeared in 1998 – only 8 years after the creation of the BREEAM system. Technically, these two systems are pretty similar (almost 70-80%). They are constantly improving and taking the best world practices in the design, construction and operation of buildings. But the approach to certification of buildings is very different.

In case of LEED, the project team (usually with the help of a LEED Accredited Professional) is engaged in the design and construction of the building. The team itself can register the project, take into account the requirements of LEED standards and prepare the necessary documentation. It forms a package of project documentation and sends it to the USGBC, where the examination is conducted in different sections. If everything is in order, it results in a certificate with a certain level. BREEAM has a different approach, and if there are similarities with the technical criteria with LEED, the processes vary considerably. In BREEAM there is the concept of an "appraiser", and when a project is developed (usually by involving a BREEAM consultant), it is checked by an appraiser – one person, not a group of experts. The evaluator acts very formally: he is provided with documents for checking compliance with the established criteria, and if everything is in order, he approves them. Appraiser appears twice – at the design stage and at the stage of putting the object into operation. Based on the results of the compliance check, he prepares a report, which is then sent to the UK for a selective audit. The evaluation results in a certificate.

C. Indian Green Building Council

It is an Indian version of USGBC LEED (Leadership of Energy and Environmental Design) started in 2003 by CII. Indian Green Building Council is a part of CII-Godrej Green Business Centre. The vision of the IGBC is to serve as main solution provider and be a key institution to facilitate all Green Building activities in India [7], the association spreading and promoting sustainability through sustainable construction. IGBC is most popular rating system in India with over 2000 building registered for rating. IGBC is a rating tool for surveying building performance according set criteria and standard norms. In the year 2000 the benchmarks for the IGBC (LEED

India) Green Building Rating System were created and final rating was released in 2003 and is as of now accessible for new and existing developments.

III. COMPARATIVE ANALYSIS

Cost: For non-members and 5000 m² or less built-up area.

Table 1: Total Cost of Certification

IGBC		GRIHA	
Membership fee	30000	Membership fee	N.A.
Precertification	185000	Precertification	-
Certification	160000	Certification	314000
Total	375000	Total	314000

IGBC charges membership fee results in increased cost, on the other hand GRIHA do not charge such membership cost.

Popularity and Influence: Popularity is measured in terms of number of projects registered under each rating system and their contribution towards green footprint.

Table 2: Influence

	IGBC	GRIHA
Inception Year	2001	2005
Number of projects Registered	4077	900
Green Footprint	4.53 Billion sq. ft.	387.501 million sq. ft. (approx.)

IGBC is more popular both in terms of numbers of project and green footprint. IGBC follow LEED rating system, which has higher publicity toward the West, making it more adequate to multinationals who are prime purchasers/investors of properties.

Assessment Criteria for New Construction

IGBC has divided its whole rating system into 7 basic criteria [6] and GRIHA has divided its rating system into 4 main groups which are further divided into 34 criteria [5]. To compare both the rating systems 34 criteria of GRIHA has been summarized in 9 group criteria.

Table 3: Assessment Criteria

IGBC		GRIHA	
Criteria	Points allotted	Grouped Criteria	Point allotted
Sustainable architecture and design	05	Site Planning	17
Site selection and Planning	14	Water Management	13
Water Conservation	18	Energy Optimization	35
Energy Efficiency	28	Sustainable Building Materials	14
Building material and resources	16	Waste Management	05
Indoor Environmental Quality	12	Health and Wellbeing	14
Innovation and development	07	Building Operation and Maintenance	02
Total	100	Total	100

LEED allot 10 extra points, 6 for Innovation in Design and 4 for Regional Priority respectively therefore there are 110 maximum numbers of points that can be achieved. Meanwhile GRIHA allots 4 points for Innovation in Design, so maximum 104 points can be achieved under GRIHA ratings.

No.	Category	IGBC	GRIHA
1	MANAGEMENT/SUSTAINABLE SITE		
A	Site selection/Land reuse/Reclaimed land/Sustainable construction	✓	✓
B	Safeguard and protect the landscape during construction / Preserve top soil/ Existing vegetation	✓	✓
C	Soil conservation/Top soil laying & stabilization/Hard landscaping & boundary protection	✗	✓
D	Brownfield redevelopment	✓	✗
E	Design to include existing site features	✓	✓
f	Building & site operation & maintenance	✗	✓
g	Project management	✗	✓
2	ENERGY/ENERGY EFFICIENCY/ENERGY USE		
a	Renewable energy utilization	✓	✓
b	Minimum energy performance/Optimize ozone depletion	✓	✗
c	Fundamental building commissioning/Measurement & verification/ Energy monitoring/metering & monitoring	✓	✓
d	Ozone depletion	✓	✓
e	Additional commissioning	✓	✗
f	Energy improvement/Green power	✓	✓
3	INDOOR ENVIRONMENTAL QUALITY		
a	Optimize building design to reduce the conventional energy demand/Naturally ventilated design/Localized ventilation	✓	✓
b	Day lighting & views / Visual comfort / Day lighting / External views / Artificial lighting minimization / Interior lighting normally specified.	✓	✓

No.	Category	IGBC	GRIHA
4	HEALTH & WELL BEING		
A	Minimum level of sanitation/Safety facilities for construction workers	✗	✓
B	Reduce air pollution during construction	✓	✓
5	RECYCLE, RECHARGE & REUSE OF WATER		
A	Water consumption/Water monitoring/Water meter/Water usage monitoring	✗	✓
B	Waste Water Treatment	✓	✓
C	Water recycle & reuse	✗	✓
D	Minimize waste generation/Waste segregation/ Storage & disposal/Recovery from waste	✗	✓
E	Innovative waste water technologies/ Storm water management / Water recycling effluent discharge to foul sever.	✓	✓
6	MATERIALS		
A	Building reuse/Reuse of façade/Reuse of structure	✓	✗
B	Conservation and efficient utilization of resources	✓	✓
C	Utilization of fly ash in the building structure	✗	✓
d	Storage and collection of recyclables/Construction water management / Resource reuse / Recycled content / Construction waste management / Recycled aggregates / Recycled content of concrete / Recycled content of steel / Recycled content of reused products& materials	✓	✓
e	Reduce volume, weight & time of construction by adopting an efficient technology	✗	✓
f	Use low energy materials in the interiors	✓	✓
g	Sustainable procurement/Recycling waste storage / Sustainable construction/Sustainable products / Adaptability & Deconstruction / Sustainable Forest products / Waste recycling facilities / Waste management	✓	✓
h	Local or regional materials	✓	✗

c	Reduced heat island effects/Thermal comfort/Thermal insulation/Thermal performance of building	✓	✗
d	Low emitting material/Indoor chemical and pollutant source control/CO2 monitoring and control / Hazardous material / Indoor air pollutants/ETS control	✓	✓
e	Minimize ozone depleting substance/HCFC & CFC free HVAC/Low & Zero carbon technology	✓	✓
f	Acceptable indoor & outdoor noise levels / Acoustic performance /Background noise	✗	✓

7	TRANSPORTATION		
a	Alternative transportation / Public transport accessibility / commuting mass transport / Green transport / Local transport / Vehicular access	✓	✓
b	Alternative transportation/Cyclist facilities	✓	✗
c	Alternative transportation / Travel plan / Fuel efficient transport	✓	✗
d	Pedestrian route/ Local transport	✓	✓
e	Proximity to amenities/ Neighborhood amenities/ amenities features	✓	✗
8	INNOVATION		
a	Innovation in design	✓	✓

GRIHA rating framework is more suited for Indian conditions and it is more elaborated rating system.

Benchmarking (Rating Score)

Benchmark is a set of norms, utilized as a perspective for assessing performance.

Benchmarks for both the rating systems are given below.

Table 5: Certification Level

IGBC		GRIHA	
Rating	Points	Rating	% Points Scored
Certified	40-49	One star	50-60
Silver	50-59	Two stars	61-70
Gold	60-79	Three stars	71-80
Platinum	80 and above	Four stars	81-90
		Five stars	91-100

IV. CONCLUSION

To rate the green building both the rating systems IGBC and GRIHA are prominently used in India, where former is according to international standards while later is indigenously developed.

IGBC is backed by Confederation of Indian Industry and uses global standards norms of LEED. Meanwhile GRIHA is especially developed according to Indian Condition and supported by Ministry of New and Renewable Energy.

GRIHA is easy but detailed rating system while IGBC uses per capita energy consumption which is not a reliable factor for rating as India's per capita energy consumption is very low.

Over all GRIHA suits and fits in Indian Conditions while good market strategy and international standard are helping IGBC in maintaining their position of most preferred rating systems in India.

REFERENCES

- [1] N. Kohler, "The relevance of Green Building Challenge: an observer's perspective." *Building Research and Information*, 1999, pp. 309 - 320.
- [2] Poveda, Cesar A., and Ryan Young, "Potential benefits of developing and implementing environmental

and sustainability rating systems: Making the case for the need of diversification." International Journal of Sustainable Built Environment 4.1, 2015, pp. 1-11.

- [3] BREEAM, BREEAM International New Construction 2014, Publisher: BRE Global Limited, 2014, p (401).
- [4] Council, US Green Building. "LEED v4 User Guide." Retrieved from <http://www.usgbc.org/leed> (2013).
- [5] Green Star Design and As Built v1.1, Publisher: Green Building Council of Australia, 2015, p (296).
- [6] Shuzo MURAKAMI, Kazuo IWAMURA & Raymond J. COLE, CASBEE A decade of Development and Application of an Environmental Assessment System for the Built Environment, Institute for Building Environment and Energy Conservation (IBEC), 2014.
- [7] Indian Green Building Councils Green New Building rating system version 03, Abridged Reference guide, August 2015.
- [8] Introduction to National Rating System, "GRIHA, an evaluation tool to help design, build, operate, and maintain a resource- efficient built environment", Ministry of New and Renewable Energy, Government of India and The Energy and Resources Institute New GRIHA Manual, Vol. 1,2010, pp 1-42.

Design and Implementation of an Automatic Irrigation System based on Monitoring Soil Moisture and Agriculture Thief Detection

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Abstract: This Project is proposed on precision agriculture system over the Internet of Things (IOT). Through analysing the present development of precision agriculture in outside world and considering its advantages and shortcomings, we decide an ecology farm as an example to conduct a replacement precision agriculture management system (PAMS). Designing a non-public Internet of Things (IOT) enabled platform for the research in precision agriculture and ecological monitoring domains. As water supplies become scarce thanks to climatically change, there's an urgent must irrigate more efficiently so as to optimize water use. During this context, farmers' use of a decision-support system is unavoidable. Indeed, the real-time supervision of microclimatic conditions are the sole thanks to know the water needs of a culture. Wireless sensor networks are playing a very important role with the arrival of the web of things within the community of the farmers. It'll be judicious to form supervision possible via Sensors.

Keywords: Water Harvesting, Moisture, Irrigation, ArduinoController, etc.

I. INTRODUCTION

The water harvesting is that the backbone of farming industry. as per India is censured a lot of water gets wasted due to many regions. So, the requirement of water for farm can't get fulfill. due to the improper maintenance and wrong water harvesting plan the irrigation of water is additionally the foremost problem. Day by day the rain percentage is additionally becoming less than an extreme bit of water is obtainable for the farming. most of the water percentages also get wasted due to lack of proper attention by farmer. so, we are present a wise provision to deals with this problem that's nothing but "automatic irrigation control system". actually, we are sensing the moisture level of soil by using the sensor and accordingly control the motor. This is often the very cost-efficient unit because the value of sensor is extremely economical. The middle of the system is microcontroller atmega328.

A straightforward programming language program can perform all required operation. since nowadays, within the age of advanced electronics and technology, the lifetime of soul should be simpler and more convenient, there is a requirement for several automated systems that are capable of replacing or reducing human effort in their daily activities and jobs. Here we introduce one such system, named as automatic plant watering system, which is really a model of controlling irrigation facilities that uses sensor technology to sense soil moisture with a microcontroller so on create a wise switching device to help numerous people can we automatically water our home and garden plants without bothering our neighbours once we decide to last vacation or another place for an extended period? since irregular watering ends up in the mineral loss within the soil and will end up with rotting the plants, can we then somehow know if the soil really needs to be watered and if so, when exactly can we always water the plants?

We also propose Security could be an excessive amount of important thing to fret in our day-to-day life. Everyone wants to be secured the maximum amount as possible. Knowing our home or shop is secure provides us peace of mind. we all know now a day's theft has become a significant issue. during this project we design a sophisticated electronic security system by using small PIR and IR sensors built round the Arduino controller.

PIR sensor senses the presence of intruder & Controller reads the signal from sensors and if intruder is detected, it compares the detected signal with predefined signal within the database then it activates the buzzer yet as making a notification to predefined number

II. LITERATURE SURVEY

A. IOT in Precision Agriculture Applications Using Wireless Moisture Sensor Network.

- Wireless sensor network (WSN) and Wireless Moisture Sensor Network (WMSN) are components of IOT.
- Proper irrigation system could be achieved by using WSN technology.
- Monitoring and control applications have been tremendously improved by using WSN technology.
- It enabled efficient communication with many sensors. WMSN is a WSN with moisture sensors.

B. An Extensible Software Platform for Cloud-based Decision Support and Automation in Precision Agriculture.

- The precision agriculture may well be a decision support system (DSS) that acquires data from various sources, analyzes them, and recommends actions.
- DSS to manage various field devices through unified software defined interfaces.

C. Mobile Integrated Smart Irrigation Management and Monitoring System Using IOT

- The proposed automated irrigation and monitoring system consists of the raspberry pi, water pump, and moisture and temperature sensors. Smart phones module is employed for communication.
- Architecting an IoT-enabled Platform for Precision Farming.
- In the proposed work, crops or plants are considered together with their water requirement at different stages. The crops or plants are irrigated with respect.
- System has used an android application i.e., blue term. These applications work totally on Bluetooth. To interface the android application and also the master robot we require a Bluetooth module.
- The system features a custom sensor design for power efficiency, cost effectiveness, cheap components, yet as scalability and simple use.

D. Wireless sensor network for precision agriculture.

- The proposed irrigation management system is using intelligent humidity sensor and low power wireless Trans receiver to gather the info and record SWT for facilitating irrigation management. The display employed in this paper is laptop/computer or PDA. The processed SWT data make it possible to see soil moisture trends and to predict or modify irrigation schedule for better crop yield.

III. PROPOSED SYSTEM

The objectives of proposed system are to design and produce an automatic watering system thereby saving time & power for the farmer. "**Enhancing Agriculture System with water management and thief detection system**" is used to automatically provide water to the plants by using moisture sensor which helps in saving money and water. The entire system is controlled using AURDINO AT Mega 328microcontroller which is giving the interrupt signal to the motor. Moisture sensor is connected to internal ports of micro controller via connectors, whenever there is a fluctuation in moisture of the soil these sensors sense the change in moisture and gives an interrupt signal to the micro-controller and thus the motor is activated, along with this java application is used to provide user interface on computer screen.

A soil moisture sensor is used to monitor the moisture content in the soil and accordingly turn ON/OFF the pump & supply required water to the farmland/plants without any human interference. Java application consist of two modes that's are automatic and manual mode. In automatic mode system is completely depend on sensor. In manual mode system/motor is completely depend on user choice sensor is ignored in this mode. Automatic watering system is designed in such a way which gives required amount of water in a targeted area.

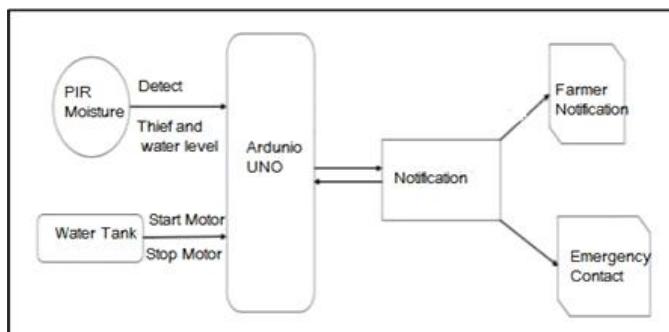


Figure 1: Architecture Diagram

IV. CONCLUSION

The Proposed system will help to automate the Motor in any electric system manually as well as automatically by sensing a moisture of the Soil. Our system will also help limit the water usage and saves money. Our system will also reduce the manual work by automating the process and also if any thief detected it will notify.

REFERENCES

- [1] KshitijShinghal, Dr. Arti Noor, Dr. Neelam Srivastava, Dr. Raghuvirsingh, wireless sensor networks in agriculture: for potato farming.
- [2] Prakash Gaud Patil, vidya h, Shreedevi Patil, Umakant Kulkarni, wireless sensor network for precision agriculture, 2011.
- [3] Jianfa Xia, Zhenzhou Tang, *Xiaoqiu Shi, Lei Fan, Huaizhong Li, an environment monitoring system for precise agriculture based on wireless sensor networks, 2011.
- [4] A Survey on Zigbee Based Wireless Sensor Networks in Agriculture T.Kalaivani, A. Allirani, P. Priya, 2011 IEEE.
- [5] Design and Implementation of a smart irrigation system for improved water-energy efficiency, kizitomasaba, AminiNtakirutimana, taha selimustan.
- [6] Mobile Integrated Smart Irrigation Management and Monitoring System Using IOT, Vaishali S, Suraj S, Vignesh G, Dhivya S and Udhayakumar S., International Conference on Communication and Signal Processing, April 6-8, 2017, India.

Static Structural Analysis of Automobile Hood using Natural Hybrid Fiber Composite

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Abstract: Natural fibres are a kind of renewable source and a replacement generation of reinforcements and supplements for polymer-based materials. The event of natural fibres composite materials or environmentally friendly composites has been a hot topic recently because of the increasing environmental awareness. Natural fibres are one such skilful material that replaces the artificial materials and its connected product for the less weight and energy conservation applications. the appliance of natural fibres bolstered compound composites and natural-based resins for replacement existing synthetic polymer or glass fibres reinforced materials in large. Automotive and aircrafts industries are actively developing different styles of natural fibres, primarily on hemp, flax and sisal and bio resins systems for their interior components. High specific properties with lower costs of natural fibres composites are making it attractive for various applications. within the gift study automobile hood is analysed for hybrid material. From the analysis it's evident that the material is maintaining its structural integrity for given loading condition.

Keywords: Natural Fibres, Composites, Hybrid, Automobile Hood, Static Analysis, etc.

I. INTRODUCTION

FRC is superior fiber composite achieved and created doable by cross-linking plastic fiber molecules with resins within the FRC material matrix through a proprietary molecular re-engineering method, yielding a product of remarkable structural properties. Through this effort of molecular re-engineering hand-picked physical and structural properties of wood are with success cloned and unconditional within the FRC product, additionally to different important attributes to yield performance properties superior to up-to-date wood. This material, not like different composites, will be recycled up to twenty times, permitting scrap FRC to be reused once more and once more. The failure mechanisms in FRC materials embody laminating, intralaminar matrix cracking, longitudinal matrix cacophonous, fiber/matrix debonding, fiber pull-out, and fiber fracture.

There are mainly 2 sorts in material one is natural fiber material and artificial material. Composites will be natural or artificial. Wood, a natural composite, may be a combination of polyacrylamide or wood fibers and a substance referred to as polymer. The fibers offer wood its strength; polymer is the matrix or natural glue that binds and stabilizes them. different composites are synthetic (man-made). laminate may be a man-made composite that mixes natural and artificial materials. skinny layers of wood veneer are warranted together with adhesive to create flat sheets of laminated wood that are stronger than natural wood.

Hybrid materials are accustomed to achieve optimum ratio between the performances and also the costs of the material. costs chemical compositions, completely different weights, and mechanical properties will be applied among identical materials. Therefore, a material will be designed in the needed specification with low value. As an example, a mixture of carbon fibers and aramid within the yarn and warp arrangement is feasible, leading to a composite with various elastic properties within the main directions of stress.

The main objective is to use hybrid composite for automobile hoods. The auto hood is mainly factory-made using steel and metal. The hood (North american English) or bonnet (Commonwealth English) is the hinged cowl over the engine of automobiles. Hoods will open to allow access to the engine compartment, or trunk (boot in Commonwealth English) on rear-engine and some mid-engine vehicles for maintenance and repair.

**Figure 1:** Existing Automobile Hood

So, we replace the car hood material with the natural composite hybrid material and perform FEA on both existing model and optimized hybrid composite model to check out stress distribution and maximum deformation generated on bonnet. The tool use for analysis is static structural tool and the software used for project is CATIA and ANSYS software.

II. LITERATURE REVIEW

Changduk Kong, Haseung Lee, Hyunbum Park [1]: This article essentially centers around regular composite use to foster the auto hood. There has been a developing interest in the utilization of normally sourced filaments for use in composites plan and assembling. In this work, an underlying model on vehicle hood utilizing regular flax fiber composite was performed. The foundational layout consequences of flax/vinyl ester composite hood were contrasted and the plan aftereffects of metal hood structure. In this work, an examination on mechanical properties of flax/vinyl ester regular fiber composite is performed for the plan of eco-accommodating design utilizing flax/vinyl ester composite. The Vacuum Assisted Resin Transfer Molding (VARTM) fabricating strategy is embraced for assembling the flax fiber composite construction.

The mechanical properties of flax/vinyl ester examples were tried. At last, the underlying model and assembling of the car hood was performed utilizing mechanical properties. Through the underlying examinations, it is affirmed that the planned model utilizing regular flax composite is satisfactory for primary security and strength. The full-scale static primary test was performed under the recreated streamlined burdens. From the test results, it is tracked down that the planned hood has the primary respectability. Moreover, the deliberate outcomes are very much concurred with the logical outcomes like avoidances, strains.

Sodisetty V N B Prasad, G. Akhil Kumar, K. V. PrudhviSai, B. Nagarjuna[2]: The regular fiber supported polymer (NFRP) composites are as a rule broadly utilized as trade for traditional materials in different car and aviation applications. Regular fiber has properties like high explicit strength, lighter weight, biodegradable, minimal expense and promptly accessible. The principal objective of utilizing NFRPs in this examination is to upgrade the strength and lessen the heaviness of auto parts. Curved guard in a bike is given to forestall mud, water and flotsam and jetsam to fall on the rider and vehicle from the turning tire. In this current examination, Mudguard was manufactured utilizing regular fiber built up epoxy composite. Regular filaments, for example, Sisal, Ramie and Pineapple were utilized as fortifications for the Epoxy grid.

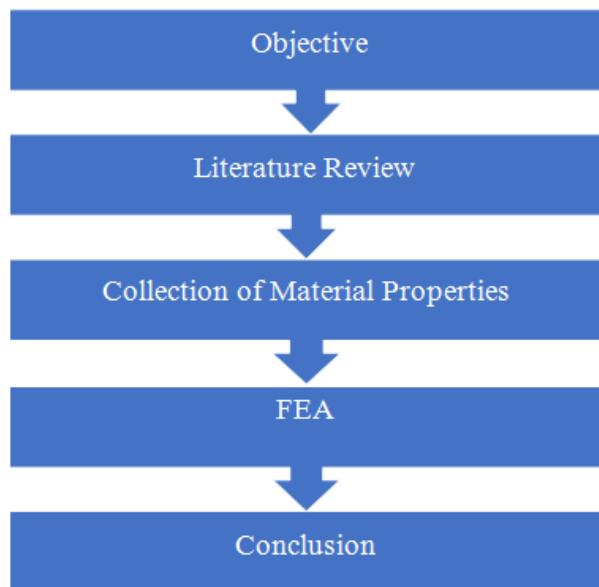
The current investigation manages the plan and improvement of normal fiber supported epoxy composites for the bike mud monitor segment. Regular strands like ramie, sisal and pineapple are chosen because of their properties like less weight, low thickness, minimal expense and high explicit strength. It likewise helps in diminishing ecological effects by utilizing regular filaments rather than glass strands as glass strands produce contamination while creating. Best blend of filaments isassessed from mechanical testing. PSRS composite example has the high rigidity of 24.43 MPa with pressure heap of 0.32 KN and effect heap of 6J. Trial investigation was completed to appraise the best boundaries for boring the PSRS example.

Taguchi strategy with L9 symmetrical exhibit was chosen by differing the shaft speed, boring tool measurement and feed rate. Feed rate was observed to be the principle affecting variables while boring this example. The

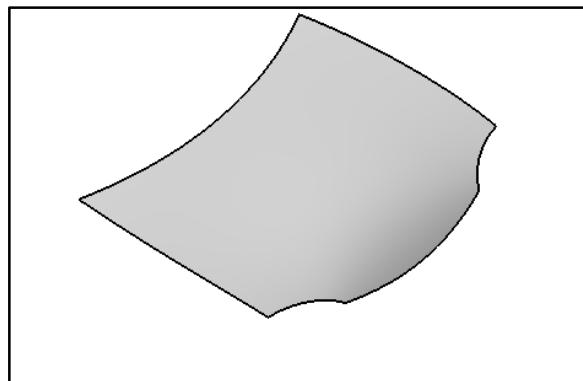
upsides of drill measurement of 5mm, feed pace of 50mm/min and speed of 3000 rpm were chosen as the best boundaries from relapse investigation.

Enrico Mangino, Joe Carruthers, Giuseppe Pitarresi[3]: In this writing, the writer clarifies about utilization of composite material in the car industry. The car business' utilization of underlying composite materials started during the 1950s. Since those early days, it has been shown that composites are lightweight, weariness safe and effectively formed to shape – at the end of the day, an apparently alluring option in contrast to metals. In any case, there has been no broad change from metals to composites in the auto area. This is on the grounds that there are various specialized issues identifying with the utilization of composite materials that actually should be settled including precise material characterisation, assembling and joining. This paper reports the discoveries of a new European drive that analyzed the future utilization of composite materials in the car area.

III. METHODOLOGY



IV. MODELING



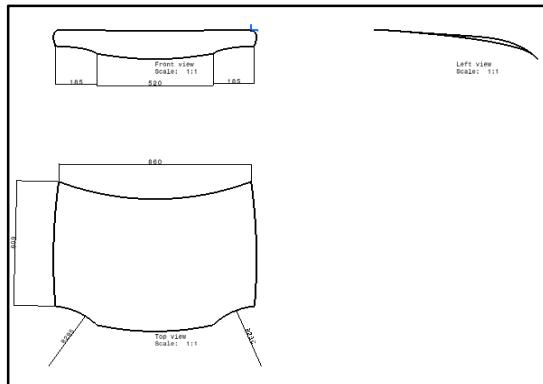


Figure 2:Automobile Hood Concept CAD Model

V. MESHING

ANSYS Meshing is a general-purpose, intelligent, automated high-performance product. It produces the most appropriate mesh for accurate, efficient multi-physics solutions. A mesh well suited for a specific analysis can be generated with a single mouse click for all parts in a model. Full controls over the options used to generate the mesh are available for the expert user who wants to fine-tune it. The power of parallel processing is automatically used to reduce the time you have to wait for mesh generation.

Creating the most appropriate mesh is the foundation of engineering simulations. ANSYS Meshing is aware of the type of solutions that will be used in the project and has the appropriate criteria to create the best suited mesh. ANSYS Meshing is automatically integrated with each solver within the ANSYS Workbench environment.

For a quick analysis or for the new and infrequent user, a usable mesh can be created with one click of the mouse. ANSYS Meshing chooses the most appropriate options based on the analysis type and the geometry of the model. Especially convenient is the ability of ANSYS Meshing to automatically take advantage of the available cores in the computer to use parallel processing and thus significantly reduce the time to create a mesh. Parallel meshing is available without any additional cost or license requirements.

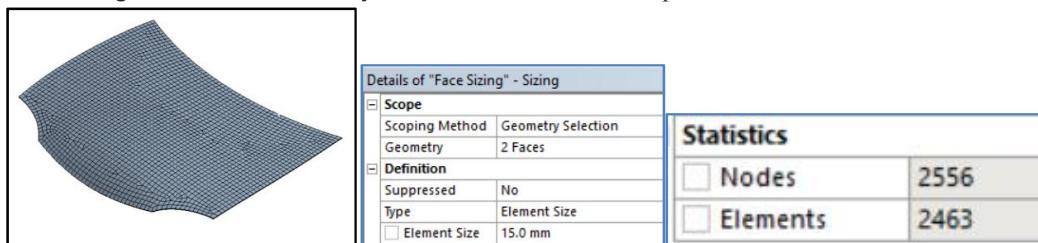


Figure 3:Meshing of Automobile hood

VI. BOUNDARY CONDITIONS

A boundary condition for the model is the setting of a known value for a displacement or an associated load. For a particular node you can set either the load or the displacement but not both. The main types of loading available in FEA include force, pressure and temperature. These can be applied to points, surfaces, edges, nodes and elements or remotely offset from a feature. The way that the model is constrained can significantly affect the results and requires special consideration. Over or under constrained models can give stress that is so inaccurate that it is worthless to the engineer. In an ideal world we could have massive assemblies of components all connected to each other with contact elements but this is beyond the budget and resource of most people. We can however, use the computing hardware we have available to its full potential and this means understanding how to apply realistic boundary conditions.

Boundary Condition for Conventional Material

Fixed support is applied on the three sides back side, left side and right side as shown in figure.

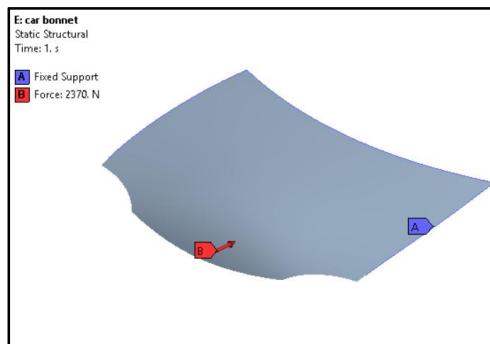


Figure 4: Boundary Condition for Conventional Material

Force acting on the body is from front side on the hood and the load value is considered from literature [3] which 2370 N. The force is uniformly distributed at whole front surface of hood as shown in figure

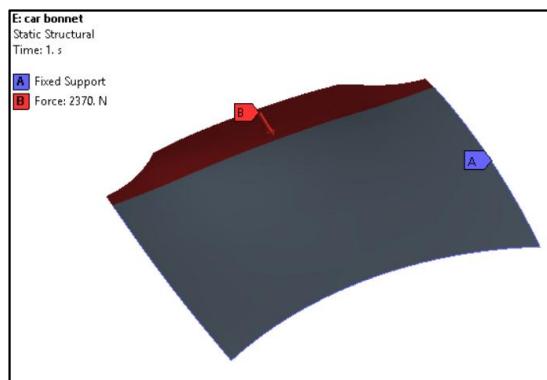


Figure 5: Loading Condition for Conventional Material

Boundary Condition for Hybrid Material

Fixed support is applied on the three sides back side, left side and right side as shown in figure.

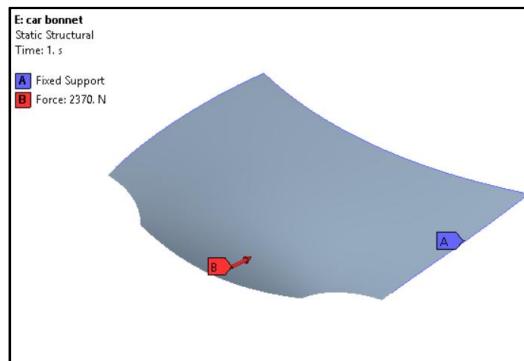


Figure 6: Boundary Condition for Hybrid Material

Force acting on the body is from front side on the hood and the load value is considered from literature [3] which 2370 N. The force is uniformly distributed at whole front surface of hood as shown in figure

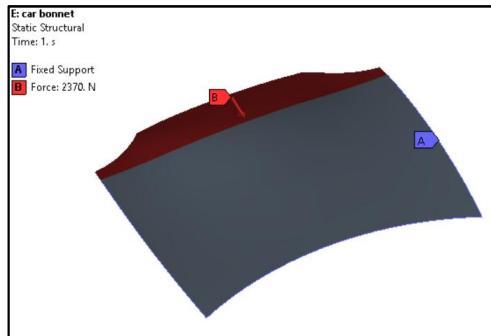


Figure 7: Boundary Conditions

VII. ANALYSIS OF AUTOMOBILE HOOD

Automobile hood is analysed under applied boundary condition and equivalent stress and deformation has been determined

For Aluminium

Deformation and stress analysis is done for automobile hood with aluminium

Total deformation- The total deformation & directional deformation are general terms in finite element methods irrespective of software being used. Directional deformation can be put as the displacement of the system in a particular axis or user defined direction. Total deformation is the vector sums all directional displacements of the systems.

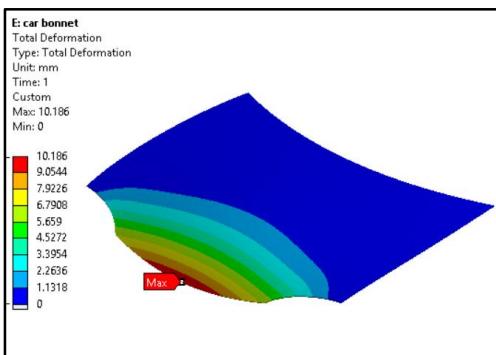


Figure 8: Total deformation of Aluminium

Equivalent Stress -

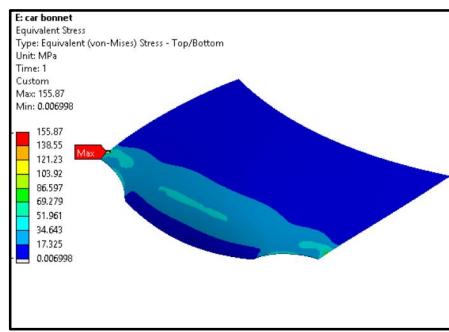


Figure 9: Equivalent Stress of Aluminium

For Hybrid Composite

For analysis of hybrid composite layer selection and lamina formation is done. The best possible combination and orientation has been selected for the composite laminate



Figure 10: Hybrid Composite

Laminate scheme and orientation is as follows:

Layer	Material	Thickness (mm)	Angle (°)
(+Z)			
4	BAMBOO FIBER COMPOSITE	0.5	0
3	JUTE FIBER COMPOSITE	0.5	0
2	BAMBOO FIBER COMPOSITE	1	0
1	JUTE FIBER COMPOSITE	1	0
(-Z)			

Total Deformation- The deformation results are as shown in the analysis result. It has been observed that the deformation is quite high in composite material as compared to conventional material

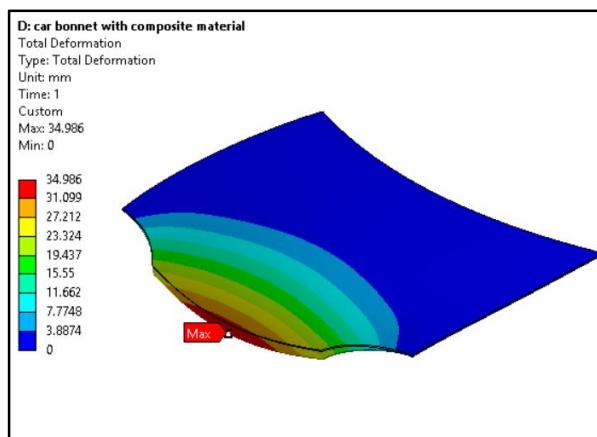


Figure 11: Total deformation of Hybrid Composite

Equivalent Stress – Equivalent stress for the composite is as shown in figure. It has been observed that the material is maintaining its structural integrity as the equivalent stress is less than allowable stress for the given material.

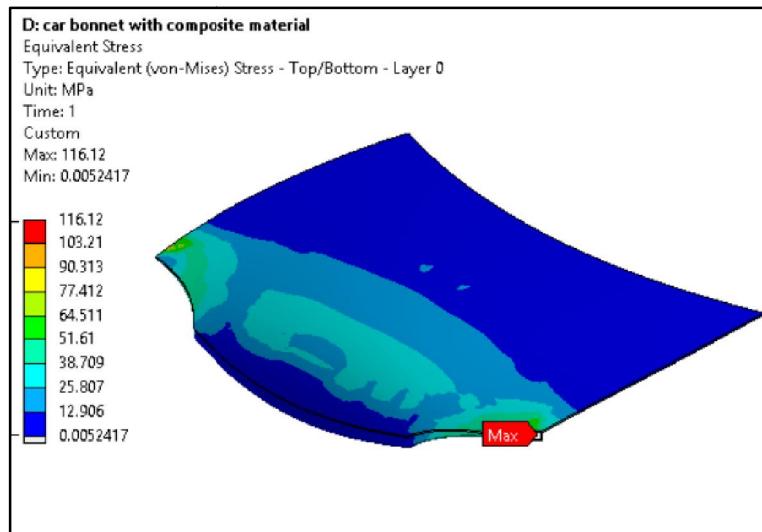


Figure 12: Equivalent Stress of Hybrid Composite

VIII. RESULT AND DISCUSSION

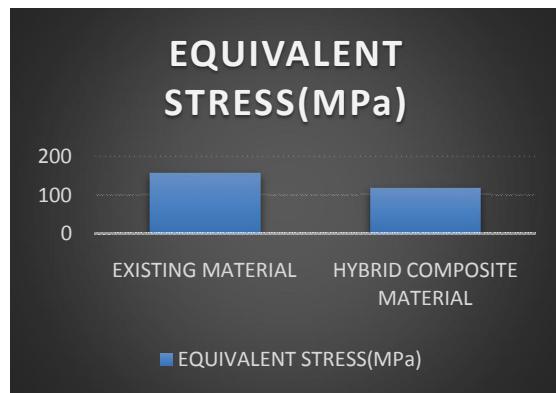
The static analysis performed on automobile hood with the help of ANSYS software. Perform Static structural analysis to find out total deformation and equivalent stress.

Table 1: Structural analysis of total deformation and equivalent stress

Sr No	Material	Total Deformation (Mm)	Equivalent Stress (Mpa)
1	Existing Material	10.18	155.87
2	Hybrid Composite Material	34.98	116.12

In existing material total deformation and equivalent stress is 10.18 mm and 155.87 MPa. In hybrid material total deformation and equivalent stress is 34.98 mm and 116.12 MPa. The graphical comparison of results is as below:





The stress observed on the optimized model is 116.2 MPa which is less than the material allowable stress. This shows that the material is maintaining its structural integrity for the given load condition.

IX. CONCLUSION

In this work the modelling of automobile hood is done. The automobile hood is then analyzed for conventional material which is aluminium, and hybrid composite of jute fiber and bamboo fiber. For given loading conditions the deformation and equivalent stress has been determined. As it was evident from the results that composite material was showing higher deformation than the conventional material. But as the equivalent stress of the composite material is less than the allowable stress for material hence it is maintaining its structural integrity.

REFERENCES

- [1] Changduk Kong, Haseung Lee, Hyunbum Park “Design and manufacturing of automobile hood using natural composite structure”. Composites Part B 91 (2016) 18e26 www.elsevier.com/locate/composites.
- [2] Sodisetty V N B Prasad, G. Akhil Kumar, K. V. PrudhviSai, B. Nagarjuna “Design and optimization of natural fibre reinforced epoxy composites for automobile application”. AIP Conference Proceedings 2128, 020016 (2019); <https://doi.org/10.1063/1.5117928>.
- [3] Enrico Mangino, Joe Carruthers, Giuseppe Pitarresi “The future use of structural composite materials in the automotive industry”. Int. J. Vehicle Design, Vol. 44, Nos. 3/4, 2007.
- [4] J. Schulz H. Kalay “Introducing composite material in car bonnet”. Department of Materials and Manufacturing Technology Chalmers University of Technology.
- [5] Gilsu Park and HyunbumPark“Structural Design and Test of Automobile Bonnet with Natural Flax Composite through Impact Damage Analysis”.S0263 8223(16)31879-7. DOI: <https://doi.org/10.1016/j.compstruct.2017.10.068>.

Review: Development of Industry 4.0 and the Role of Industrial Internet of Things in Manufacturing Industry

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Abstract: *Industry 4.0 and Industrial Internet of Things are the two most advanced implementations used in some of the modern manufacturing industries. Development in Industry 4.0 and IIoT is the most popular area of interest of researchers and industries. Both the concepts are parallel, coincide and sometimes Industry 4.0 even considered to be the implementation of IIoT in automation and manufacturing industries. The current developments in Industry 4.0 have been brought significant improvements in efficiency, flexibility, communication, adaptability, customization, modularity and productivity of the industry. Authors are focusing on need of continuous developments in Industry 4.0 by implementation of various tools and applications under the roof of IIoT which is possible due to recent research in many branches. This advancement is today's need of the manufacturing industries and hence this paper covers the developments and status of Industry 4.0 by implementing the IIoT one path ahead of automation in manufacturing industries.*

Keywords: Industry 4.0, IIoT, Modularity, Productivity, Communication, etc.

I. INTRODUCTION

Industry 4.0 is the need of today's manufacturing industry and in academia as far as the goal of achieving maximum productivity with optimum resources and time is concerned. This term has been introduced by German engineers which was accepted and got importance by the German Government. It works as a tool of communication between physical and digital world of industry. The main objective of Industry 4.0 is the digitalization of the industry and to digitally access the industry from any place all over the world. More-over Industry 4.0 concept often considered as an Industrial Revolution, due to which the lives of many people of different work skills will be benefitted. The industry 4.0 concept has very close relevance with the Industrial Internet of Things model because the heart of both Industry 4.0 and IIoT concepts is the excellent feedback system between different industrial resources and workstations. IIoT is a phenomenon derived from the Internet of Things concept and its applications areas are constantly increasing. IIoT is trying to connect computers, controllers, actuators and sensors to the Internet, thus enabling information exchange between all components involved.

This information exchange can form the basis for building future intelligent services with high potential of increasing the current levels of efficiency and flexibility that can be found in industry today. Many developments are targeting the mentioned domains and the researches are branching and extending continuously with various concepts, sometimes without an actual chance of materializing the studies, because of the lack of sustainability within the industry. This problem raises from losing the actual connection to the current IIoT/Industry4.0 ideas, and to the development directions set by the majority or the key successful research movements and industrial representatives in the domain. To overcome these issues, an organized and well-structured perspective over the state-of-the-art is necessary. The current paper provides an overview of the main development directions from Industry 4.0 in the IIoT context and also briefly presents a literature review of the state of the art from each of those development directions.

This can be very useful and time saving for academia researchers interested in this area, providing an easier way to develop an overview picture of the domain. The authors have guided the current research after the following ideas: relevant research papers for the state of the art were identified by mainly focusing on conferences and journals with a

high impact factor, the authors also favouring research papers with numerous citations. Several key words were used for searches, while the selecting and filtering process was based on both feasibility and sustainability of the researches. The research papers that were evaluated as either not sustainable or not having a significant impact by the authors were not used in the current paper. Also, the authors carefully considered the directions of interest in the industry, thus trying to narrow the gap between research and the real needs of the industry. The period of time considered of interest was between year 2016 and present, but a small number of relevant papers published before 2016 were also considered. The following section presents the most important concepts and characteristics of Industry 4.0. Section III introduces the Industrial Internet of Things with its most relevant concepts. In Section IV the main development directions of Industry 4.0 are presented, considering the Industrial Internet of Things context. Finally, Section V concludes this paper.

II. LITERATUREREVIEW

This section introduces the systematic literature review process that was conducted in order to determine the main characteristics of the different frameworks presented in various contexts in the literature. Herein, the main question this literature review intends to answer is: “What are the generic frameworks intended to guide Industry 4.0 implementation in companies for practitioners?”.

Structure of the Review

The field of Industry 4.0 technology implementation is vast. While a large bibliography is dedicated to actual implementation of technologies (at various technology readiness levels, TRL), publications have recently appeared that introduce implementation frameworks for a more or less large range of industries. The issue that was faced in this review is the genericity of the keywords, which can be used in many different ways by authors. Therefore, in order to identify those publications, a systematic literature review (SLR) was performed. The chosen methodology is presented in and consists of five steps:

1. Definition of the review scope: this step is used to define an appropriate perimeter of the scope and orientation of the review;
2. Conceptualization of the topic: this step intends to define the keywords that will be used in the next step, searching for articles;
3. Literature search: this step includes the choice of the source of information and the design of the queries in accordance with the previously defined topics;
4. Literature analysis and synthesis: this step shows the process of inclusion/exclusion of the results of the requests, and a categorization of the reasons that led to this result;
5. Research agenda: the last step consists in an analysis of the content of the included articles, showing the evidence retrieved from the review.

First Step: Definition of Review Scope

This first step is especially well suited for literature reviews on a large scope, where a horizontal search on a large range of topics is needed. It consists in defining the perimeter of the review and highlighting the main keywords. Here, the objective is rather oriented towards a vertical search, in order to identify the frameworks that are actually related to the work. The review scope here is directly connected to the previously defined problems. The objective is to detect the few articles that deal with a generic framework or methodology to implement Industry 4.0 technologies in companies from the whole set of articles dealing with only the implementation of one of those technologies.

Second Step: Conceptualization of Topic

The topic was decomposed into three necessary sub-topics: (i) the environment; (ii) the contribution; and (iii) the generalization. The environment is mainly built around the industry 4.0 paradigm; however, some authors might use the terms “smart factory”, “intelligent manufacturing”, or “smart manufacturing” to illustrate the same concept. The contribution is meant to address the implementation of new technologies, integration of those technologies in a manufacturing environment, or the transformation from a classical manufacturing system to an Industry 4.0-compliant one. These three terms were, therefore, addressed. The desired articles were meant to introduce a new framework or methodology, generalizing implementations. Therefore, those two terms were added to the topic.

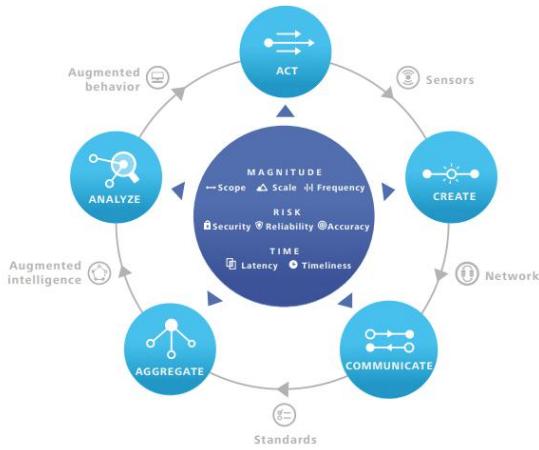
Third Step: Literature Search

In order to address a wide range of valuable contributions, the Scopus database was chosen. The topics mentioned above were searched in titles, abstracts, and keywords in the whole database, limiting the subject area to engineering, business, computer science, materials, energy, and the environment (which constitute the main pillars of Industry 4.0 technologies). Finally, only journal and proceeding papers in the English language were accepted in this search in order to consider only internationally recognized work

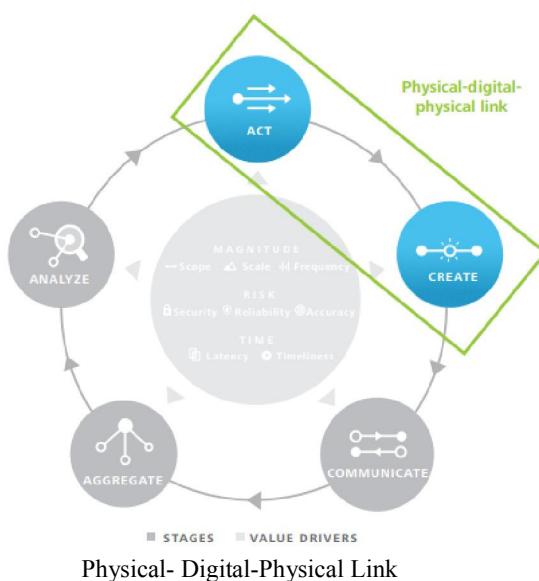
Fourth Step: Literature Analysis and Synthesis

The 1024 records obtained from Scopus were imported into Rayyan QCRI [29], a free online tool that can be used by researchers to assist in a systematic literature review. It allows to label each record with reasons to include or exclude articles from the final review. A first analysis, based on only the metadata of the records (title, abstract, keywords) was performed thanks to the filtering options in Rayyan. For records with ambiguous results, a manual check of the full text version was performed in order to guarantee accuracy of the analysis.

III. VALUE LOOP IMPLEMENTATION



Loop of Industry 4.0



Physical- Digital-Physical Link

IV. DIFFERENTIAL ANALYSIS

Table 1: Physical- Digital-Physical Link

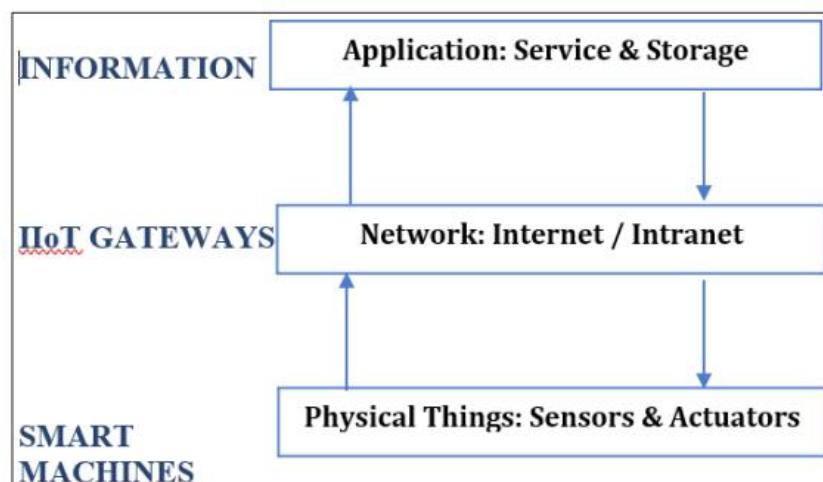
Product impact	Potential IT/OT applications
Physical —→ digital	<ul style="list-style-type: none"> • Sensors and controls • Wearables • Augmented reality
Digital	<ul style="list-style-type: none"> • Signal aggregation • Optimization and prediction • Visualization and POU delivery • Cognitive and high-performance computing
Digital —→ physical	<ul style="list-style-type: none"> • Additive manufacturing • Advanced materials • Autonomous robotics • Digital design and simulation

Table 2: Comparison on Internet of Things (IoT) and Industrial IoT (IIoT)

IOT	IIOT
IoT for Commercial Sector	IIoT for Industrial Sector
Human centred model	Machine centred Model
Volume of data is Medium	Volume of data is very High
Machine to Human communication.	Machine to Machine(M2M) communication.
Supports Infrastructure Less Mobile <i>Ad-hoc</i> connectivity	Structured Infrastructure based centralised connectivity is required.
Human and Things integrated Technology	Machine-to-Machine Integrated Digital Manufacturing and Operational Technology

V. THREE LAYER ARCHITECTURE

The structure of a IIoT architecture highlights scalability, modularity, and interoperability with various devices and platforms using different technologies.



A. Physical Things: Sensors & Actuators – Smart Machines

In the physical layer, some industry-specific devices like Sensors, Interpreters, Translators interfaces with ICS placed in the real-world environment. These devices enable the machines in industry environment as Smart Machines. Several heterogeneous physical things are deployed in the real-world environment like Sensors for monitoring environment, reading temperature, gauging pressure, proximity, location, smoke, humidity, chemical reaction, gas, and so on. Transient Data Stores, which stores the data temporarily to ensure durability during the system or network failure. Local Processors (data transformation, complex event processing, etc..) are also used to provide data to the application user end from the Physical things.

B. Network: Internet / Intranet – IIoTGateways

Network Channels act as a medium to connect and for data transfer between Physical Layer to the application end. The channel can be an Intranet if the smart environment has to be monitored within an industry closed monitoring system, known to be private IIoT channel. The smart environment can be built by connecting and monitoring the smart physical things at different locations of various industries on a production pipeline, there the channel supported through internet, known to be Public IIoT channel. The channels deploy different Network Protocols and API's for connectivity between machine to machine and machine to the application end. These channels interface with heterogeneous sensors and receive unstructured data, a sophisticated gateway is required, called to be IIoT Gateway. This gateway can be part of the middleware architecture – a cloud computing environment. Since the data would be huge, unstructured and with high velocity of retrieval, the IIoT can filter the captured data and send the structured data over the Internet to the service end.

C. Application: Service & storage –Information

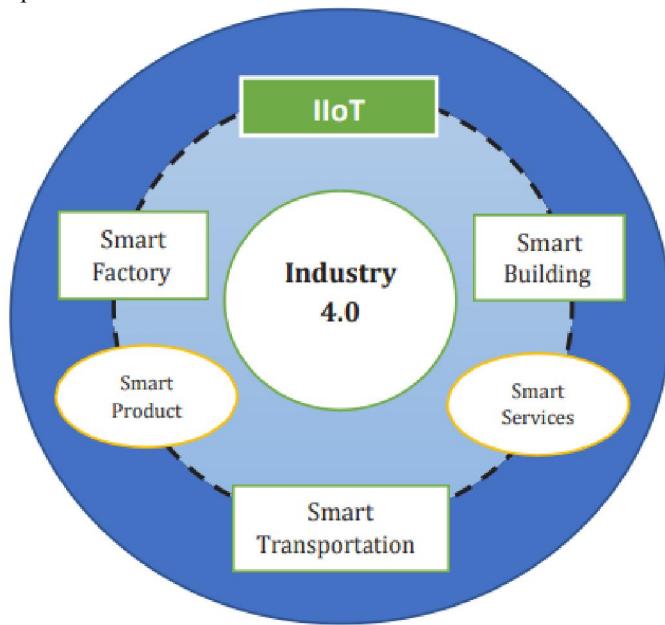
A collection of large amounts of context information from the Real-world IIoT environment to support different application domains are stored, processed and analysed in cloud computing environments. Some of the popular IoT based cloud environments like Thingworx[13], Xively[14], CISCO IoT cloud, AWS IoT Platform, etc.. supports for IIoT application development. Cantaloupesys supports remote stock tracking service in vending machines, HiKoB collects real-time measurements for the analysis parameters such as temperature gradients within the road, current outdoor temperatures, moisture, dew and frost points from sensors deployed in roads and provides traffic management, real-time information on traffic conditions, and services for freight and logistics. It is also evident that IoT based cloud platforms are allowed to build their own ecosystems with third party extension support for development and distribution through app store. The most user-end service support is extended through the Mobile Applications which allows users to interact and take or perform actuation tasks from any location at any point of the product development cycle in the industry environment, Mobile-based applications are also support the location-awareness service, i.e., service support based on the geo-graphic location specifically on Smart Enterprises – Transportation and Logistics, Energy and power production, Safety & Smart Infrastructure support. Wearable devices with gesture-based interactions also plays a significance role in IIoT applications also.

VI. RESULT and DISCUSSION

4.0 for an objective to attain a high level of productivity with effective operational and maintenance track. Digital optimization of production, Automation with industry environment adaption, Intelligent Data communication for remote action and effective and ease of Human-Machine interaction (HMI) are the major features of industry 4.0. Industry 4.0 makes a disruptive change in the traditional supply chain process and business models by integrating the IoT enabled services in the industry environment to build a smart industry ecosystem, for achieving the objective of the Industry 4.0 below figure shows the integrated IIoT applications for Industry 4.0, builds a smart productive environment, where different types and forms of massive amount of data is generated by the integration of sensor devices and communication technology for smart services and product development in manufacturing sectors.

Smart manufacturing is equipping machines with sensors, actuators, microchips and automatic recognition & detection in support with the computervision-based system. Agile software engineering technique is transferred to the

manufacturing domain describing an agile factory prototype. The developed smart product requires a smart logistics support for transportation by tracking the location and predicting the delivery-time with automated routing applications by sensing the roadway parameters like temperature, mist, humidity etc. Smart Building combines the Internet, Telecommunication networks, short distance networks (like Bluetooth, NFC etc..), Broadband networks and Sensor networks to build a smart living environment that ensures the quality of day-to-day life, connected with technology, safety & security of living place with recognition, detection and prediction systems and effective energy consumption with atmosphere sensed adaptive electric or electronic devices.



VII. CONCLUSION

The current work presented the main characteristics and notions involved into both Industry 4.0 and Industrial Internet of Things concepts, also highlighting the similarities between the two concepts. Both paradigms are currently representing very active fields of research and development, in the same time managing to draw significant attention from the industry as well. The high interest into those concepts is generated by the major improvement potential in the manufacturing and automation industries, which promises to positively impact the lives of many people. In order to provide a useful research overview of the industry 4.0 development directions in the Industrial Internet of Things context, the paper identified five primary research and development directions in this area. For each of the identified development direction a short literature review containing the state of the art in the domain has been presented, alongside different challenges and obstacles that are currently rising concerns.

REFERENCES

- [1] Zanella, N. Bui, A. Castellani, L. Vangelista and M. Zorzi, 2014. "Internet of Things for Smart Cities", IEEE Internet of Things Journal, 1(1).
- [2] Li Da XU, Wu He, Shancang L.I., 2014. "Internet of things in industries: a survey", IEEE Transactions on Industrial Informatics, 10(4).
- [3] J.D. Lin, A.M.K. Cheng and G. Gercek, 2016. "Partitioning Real-Time Tasks with Replications on Multiprocessor Embedded Systems". IEEE Embedded Systems Letters, 8(4).
- [4] H. Son, N. Kang, B. Gwak and D. Lee, 2017. "An adaptive IoT trust estimation scheme combining interaction history and stereotypical reputation", 14th IEEE Annual Consumer Communications & Networking Conference (CCNC), pp. 349-352, Year, 2017.

- [5] C. Zhu, J.J. Rodrigues, V.C. Leung, L. Shu and L.T. Yang, 2018. "Trust-based communication for the industrial internet of things," IEEE Communications Magazine, 56(2): 16–22.
- [6] X. Li, D. Li, J. Wan, C. Liu, and M. Imran, "Adaptive transmission optimization in SDN-based industrial internet of things with edge computing," IEEE Internet of Things Journal, 2018.
- [7] B.M. Lee and H. Yang, "Massive mimo for industrial internet of things in cyber-physical systems," IEEE Transactions on Industrial Informatics, 2017.
- [8] L. Lyu, C. Chen, Z. Shanying, and X. Guan, "5g enabled co-design of energy-efficient transmission and estimation for industrial IoT systems," IEEE Transactions on Industrial Informatics, 2018.
- [9] J. Akerberg, M. Gidlund, and M. Bjorkman, 2011. "Future research challenges in wireless sensor and actuator networks targeting industrial automation," in Proceedings of the 9th IEEE International Conference on Industrial Informatics, 2011, pp. 410–415.
- [10] C. Gong, 2009. "Human-Machine Interface: Design Principles of Visual Information in Human-Machine Interface Design", International Conference on Intelligent Human -Machine Systems and Cybernetics Year: 2009, Vol. 2.
- [11] "Industrial internet reference architecture," <http://www.iiconsortium.org/IIRA.htm>.
- [12] J. DeNatale, R. Borwick, P. Stupar, R. Anderson, K. Garrett, W. Morris and J.J. Yao, "MEMS high resolution 4-20 mA current sensors for industrial I/O applications", TRANSDUCERS '03, 12th International Conference on Solid-State Sensors, Actuators and Microsystems. Digest of Technical Papers, Volume: 2, Year 2003.
- [13] Thing Worx, "Thingworx: Smart systems innovator," Harbor Research, Tech. Rep., 2013, <http://www.thingworx.com/> [accessed on: 2013-0822].
- [14] LogMeIn Inc., "Xively," 2013, <https://xively.com/> [accessed on:201308-22].
- [15] Cantaloupe Systems, "Seed Platform," 2012, <http://www.cantaloupesys. com/> [accessed on:2013-08-22].
- [16] HiKoB, "Project Grizzly," 2013, <http://www.hikob.com/traficexploitation-routiere-its> [accessed on: 2013-08-13].
- [17] V Roblek, M Mesko, A Krapez "A complex view of industry 4.0", SAGE Open 6(2) (2016).
- [18] C. Scheuermann, S. Verclas, B. Bruegge, Agile factory – an example of an Industry 4.0 manufacturing process, In: 2015 IEEE 3rd International Conference on Cyber-Physical Systems, Networks and Applications (CPSNA), IEEE, 2015, pp. 43-47.

Design of Hydraulic Floor Crane

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Abstract: These hydraulic floor cranes provide an efficient, low-cost alternative to other material handling equipment. Strong, robust, sturdy and built to very standard, these cranes are maneuverable in loading, unloading and shifting of heavy loads. Crane structure consists of chassis, vertical column, horizontal arm, and the hydraulic pump with cylinder assembly. The box crane can take heavy loads effectively, avoids damage under rough and unskilled handling. The hydraulic crane was invented in Newcastle by William Armstrong in about 1845 to help load coal into barges at the Quayside. In this paper the design and analysis of a hydraulic floor crane having arm motion in the vertical.

Keywords: Hydraulic, Crane, Design, Analysis, etc.

I. INTRODUCTION

A crane mounted on a truck carrier provides the mobility for this type of crane. This crane has two parts the carrier, often referred to as the Lower, and the lifting component which includes the boom, referred to as the Upper. These are mated together through a turntable, allowing the upper to swing from side to side. These modern hydraulic truck cranes are usually single-engine machines, with the same engine powering the undercarriage and the crane. The upper is usually powered via hydraulics run through the turntable from the pump mounted on the lower. In older model designs of hydraulic truck cranes, there were two engines. One in the lower pulled the crane down the road and ran a hydraulic pump for the outriggers and jacks. The one in the upper ran the upper through a hydraulic pump of its own. Many older operators favor the two-engine system due to leaking seals in the turntable of aging newer design cranes. Generally, these cranes are able to travel on highways, eliminating the need for special equipment to transport the crane unless weight or other [Document title] JNEC AURANGABAD 8 size constrictions are in place such as local laws. If this is the case, most larger cranes are equipped with either special trailers to help spread the load over more axles or are able to disassemble to meet requirements. An example is counterweights. Often a crane will be followed by another truck hauling the counterweights that are removed for travel.

In addition, some cranes are able to remove the entire upper. However, this is usually only an issue in a large crane and mostly done with a conventional crane such as a Link-Belt HC -238. When working on the job site, outriggers are extended horizontally from the chassis then vertically to level and stabilize the crane while stationery and hoisting. Many truck cranes have slow-travelling capability (a few miles per hour) while suspending a load. Great care must be taken not to swing the load sideways from the direction of travel, as most anti-tipping stability then lies in the stiffness of the chassis suspension. Most cranes of this type also have moving counterweights for stabilization beyond that provided by the outriggers. Loads suspended directly aft are the most stable, since most of the weight of the crane acts as a counterweight. Factory-calculated charts (or electronic safeguards) are used by crane operators to determine the maximum safe loads for stationary (outrigged) work as well as (on rubber) loads and travelling speeds.

II. LITERATUREREVIEW

Material Handling is the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal [1].

It is mainly used for lifting heavy things and transporting them to other places. It uses one or more simple machines to create mechanical advantage and thus move loads beyond the normal capability of a man. Cranes are commonly employed in the transport industry for the loading and unloading of freight, in the construction

industry for the movement of materials and in the manufacturing industry for the assembling of heavy equipment [2].

The focus is on the methods, mechanical equipment, systems and related controls used to achieve these functions. Hydraulic cranes are an important part of the material handling equipment's. The hydraulic cranes that are being used work on electrical supply or manual power [3].

A crane is a type of machine, generally equipped with a hoist, wire ropes or chains, and sheaves, that can be used both to lift and lower materials and to move them horizontally [4]

III. CRITERIA AND CONDITIONS

3.1 Design Criteria

There are three major considerations in the design of cranes. 1. The crane must be able to lift the weight of the load; 2. The crane must not topple; 3. The crane must not rupture.

LIFTING CAPACITY, the lifting capacity of hydraulic crane mainly depends on following.

1. **The Lever:** A balance crane contains a horizontal beam (the lever) pivoted about a point called the fulcrum. The principle of the lever allows a heavy load attached to the shorter end of the beam to be lifted by a smaller force applied in the opposite direction to the longer end of the beam. The ratio of the load's weight to the applied force is equal to the ratio of the lengths of the longer arm and the shorter arm, and is called the mechanical advantage.
2. **The Pulley:** A jib crane contains a tilted strut (the jib) that supports a fixed pulley block. Cables are wrapped multiple times round the fixed block and round another block attached to the load. When the free end of the cable is pulled by hand or by a winding machine, the pulley system delivers a force to the load that is equal to the applied force multiplied by the number of lengths of cable passing between the two blocks. This number is the mechanical advantage.
3. **The Hydraulic:** This can be used directly to lift the load or indirectly to move the jib or beam that carries another lifting device. Cranes, like all machines, obey the principle of conservation of energy. This means that the energy delivered to the load cannot exceed the energy put into the machine. For example, if a pulley system multiplies the applied force by ten, then the load moves only one tenth as far as the applied force. Since energy is proportional to force multiplied by distance, the output energy is kept roughly equal to the input energy (in practice slightly less, because some energy is lost to friction and other inefficiencies). The same principle can operate in reverse. In case of some problem, the combination of heavy load and great height can accelerate small objects to tremendous speed. Such projectiles can result in severe damage to nearby structures and people. Cranes can also get in chain reactions; the rupture of one crane may in turn take out nearby cranes. Cranes need to be watched carefully.

3.2 Stability

For stability, the sum of all moments about any point such as the base of the crane must equate to zero. In practice, the magnitude of load that is permitted to be lifted (called the "rated load" in the US) is some value less than the load that will cause the crane to tip (providing a safety margin). Standards for cranes mounted on ships or offshore platforms are somewhat stricter because of the dynamic load on the crane due to vessel motion. Additionally, the stability of the vessel or platform must be considered.

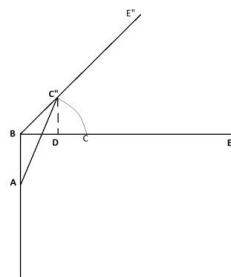
IV. CALCULATION

The angle subtended by the arm for maximum height at point B is calculated by basic construction and trigonometry $L(BC'') = 140 \text{ mm}$ $L(C''D) = 120 \text{ mm}$ $\angle C''BC = \sin^{-1}(120/140) = 58.99^\circ$ $\angle C''BC = 59^\circ 2$.

Hinge for cylinder to be attached = 140mm from point. 'B' along column Hinge for piston to be attached = 140 mm from point 'B' along arm

$$\therefore \angle BAC = \angle ABC = 45^\circ$$

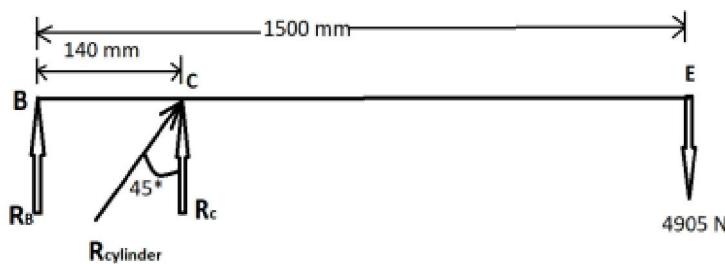
3 In fig. $L(AB) = 140 \text{ mm}$. $L(BC'') = 140 \text{ mm}$ $L(AC'') = 278 \text{ mm}$.



Applying Lami's Theorem $[l(AB)/\sin(C')] = [l(BC')/\sin(A)] = [l(AC')/\sin(B)] \therefore \sin(A) = 1 / \{l(AC')/\sin(B)\} \times l(BC') \sin(A) = [\sin(90+59)/278] \times 140 \sin(A) = 0.259 \angle A = \angle BAC' = 15.03^\circ$ i.e., Angle subtended by cylinder with vertical column when piston is fully extended i.e., maximum height [upper position]

Forces on cylinder:

Various forces are act on arm at different lifting positions. 1 At zeroth position Overhanging arm is perpendicular to the vertical column.



Reaction on horizontal arm

Taking moment @ point 'B' $M_B = 0 = 4905 \times (1500) - R_C \times (140)$ $R_C = 52.553 \text{ KN}$ Reaction indirection of cylinder will be given by $R_{Cylinder} = 52.553 \times (1/\sqrt{2}) = 37.272 \text{ KN}$

From Calculation we got,

$$R_B = 47.648 \text{ KN}, R_C = 52.553 \text{ KN}, \text{Cylinder} = R_C \cos(15.03^\circ) = 50.755 \text{ KN}$$

Calculation for Crane Stability

Forces on part one- Load applied to the arm at the hook is 500kg i.e., $=500 \times 9.81 = 4905 \text{ N}$ Volume of overhanging arm= $L \times B \times H = 900 \times 48 \times 48 - 900 \times 45 \times 45 = 251100 \text{ cu mm} = 251100 \times 10^{-9} \text{ cu m}$ Density of the material used is = 7850 kg/cu m Mass of the overhanging arm= $\text{Volume} \times \text{Density} = 251100 \times 10^{-9} \times 7850 = 1.971 \text{ kg}$ • Weight of the overhanging arm = $1.971 \times 9.81 = 19.335 \text{ N}$

Force on part two- Volume of remaining arm= $L \times B \times H = 600 \times 48 \times 48 - 600 \times 45 \times 45 = 167400 \text{ cu mm} = 167400 \times 10^{-9} \text{ cu m}$ Density of material used = 7850 kg/cu m • Mass of the remaining arm = $\text{Volume} \times \text{Density} = 167400 \times 10^{-9} \times 7850 = 1.314 \text{ kg}$ Weight of remaining arm = $1.314 \times 9.81 = 12.89 \text{ N}$

Force on part three- Volume of column = $L \times B \times H = 1500 \times 72 \times 72 - 1500 \times 69 \times 69 = 634500 \text{ cu mm} = 634500 \times 10^{-9} \text{ cu m}$ Density of material used= 7850 kg/cu m Mass of the column = $\text{volume} \times \text{Density} = 634500 \times 10^{-9} \times 7850 = 5 \text{ kg}$ Weight of the column = $5 \times 9.81 = 49.05 \text{ N}$

Force on part four- • Volume of base = $L \times B \times H = 400 \times 48 \times 48 - 400 \times 45 \times 45 = 111600 \text{ cu mm} = 111600 \times 10^{-9} \text{ cu m}$ Density of material used= 7850 kg/cu m Mass of the base= $\text{volume} \times \text{Density} = 111600 \times 10^{-9} \times 7850 = 0.876 \text{ kg}$ Weight of the base= $0.876 \times 9.81 = 8.594 \text{ N}$

Force on part five- Volume of base legs= $L \times B \times H = 1100 \times 48 \times 48 - 1100 \times 45 \times 45 = 306900 \text{ cu mm} = 306900 \times 10^{-9} \text{ cu m}$ Density of material used= 7850 kg/cu m • Mass of the base arm= $\text{volume} \times \text{Density} = 306900 \times 10^{-9} \times 7850 = 2.5 \text{ kg}$ Weight of the base arm= $2.5 \times 9.81 = 24.525 \text{ N}$

DESIGN OF CYLINDER

Assuming the internal pressure, (P_i) = 110 N/mm² Material used for cylinder is Mild steel = 226 Yield strength of mild steel = 250 N/mm² • Ultimate tensile strength of mild steel = 410 N/mm² Factor of safety = 1.5 (assumed) • $P_i = F/A$ $A = F/P_i = 35124/110$ $A = 319.30 \text{ mm}^2$ $d = 20.16\text{mm}$

Now, allowable tensile strength $\sigma_{all} = Syt/FOS = 250/1.5 = 166.66 \text{ N/mm}^2$, $Tall = 0.5Syt/FOS = 0.5*250/1.5 = 83.33 \text{ N/mm}^2$

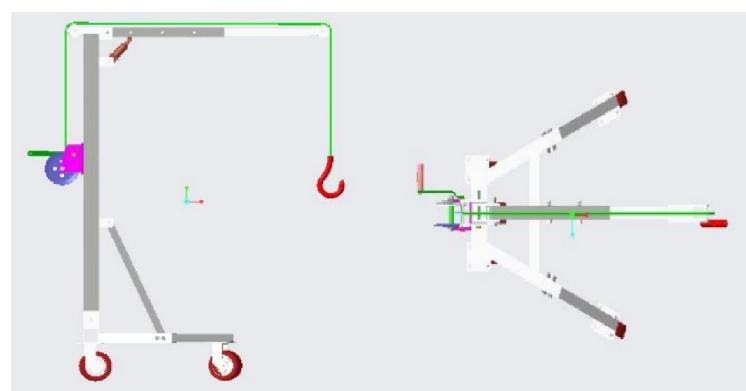


Figure: a) Front view b) Top view

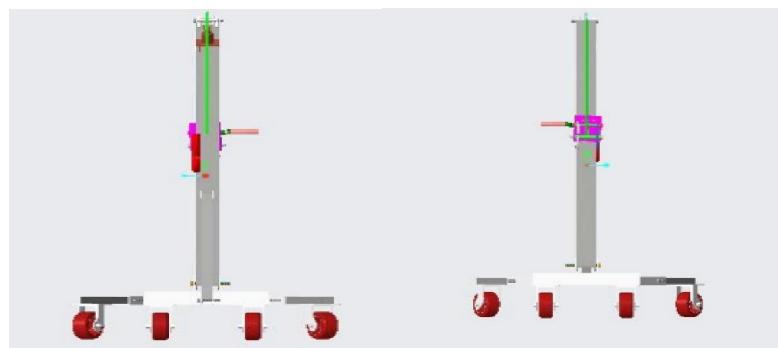


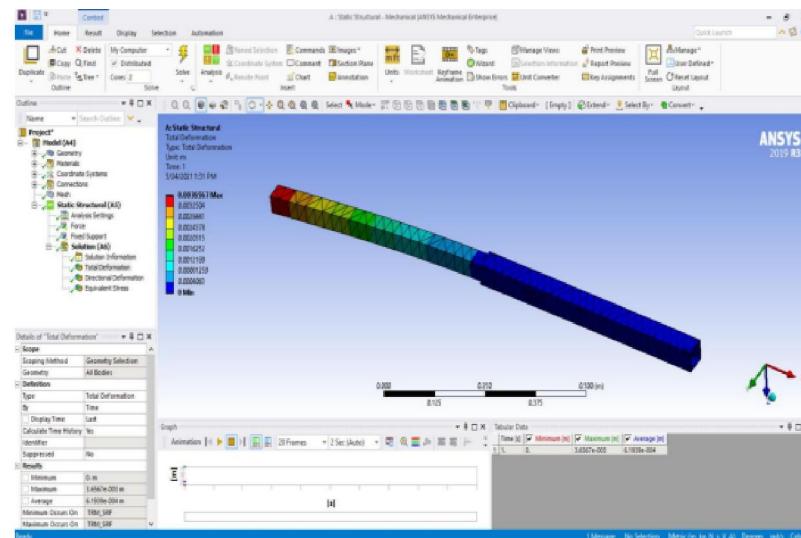
Figure: a) LHSV b) RHSV



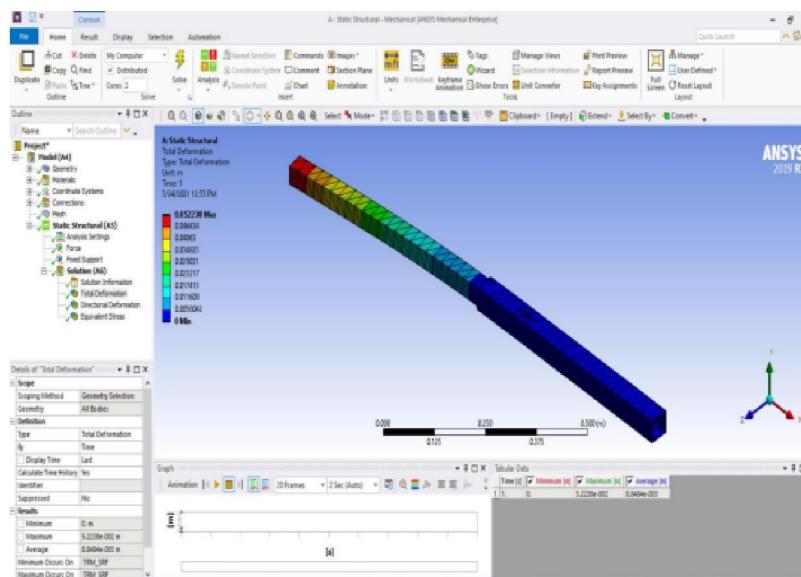
Figure: Isometric view

V. LOAD ANALYSIS

Force applied- 5000N Eq. \sim 500kg Total Deformation- 0.0036567m \sim 3mm



Force applied- 10000N Eq. \sim 1000kg Total Deformation- 0.0052238m \sim 5mm



VI. CONCLUSION

The aim of our project was to design a fully functional “HYDRAULIC FLOOR CRANE” mechanism which is capable of lifting load up to 500 kg. We accurately achieved our goal of lifting load from hook of vertical column with approximately 3mm of arm deflection and down movement of horizontal arm. We feel that our design and analysis is a great success both in terms of strength and stiffness. Our project is able to lift load up to 500 kg using hydraulic jack.

REFERENCES

- [1] "HYDRAULIC CRANE" Ashish Shejwal, Kishore Giri, Mahesh Solunke, Gaurav Rathod, Suraj Balkhande, Prof. M. D. Sirsat, Vol-3 Issue-3 2017 IJARIIE-ISSN(O)-2395-4396
- [2] Steel Work Design and Analysis of a Mobile Floor Crane, Okolie Paul Chukwulozie1, Obika Echezona Nnaemeka1, AzakaOnyemazuwa Andrew1 and Sinebe Jude Ebiedadoh1, British Journal of Applied Science & Technology 13(5): 1-9, 2016, Article no.BJAST.23079 ISSN: 2231-0843, NLM ID: 101664541
- [3] Design and Fabrication of a Single Acting Hydraulic Crane J.O. Oyejide1*, P.J. Eloho1, B.A, Mohammed2 IOSR Journal of Mechanical and Civil Engineering (IOSRJMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X, Volume 15, Issue 3 Ver. III (May. - June. 2018), PP 01-09
- [4] Fabrication of Hydro-Pneumatic Crane for Automobiles International Journal of Engineering& Technology,7(3.34) (2018)379-381J.
- [5] Pakkanen, R. Vallant, M. Kicin Experimental investigation and numerical simulation of resistance spot welding for residual stress evaluation of DP1000 steel Weld World, 60 (2016), pp. 393-402.

Titanium Dioxide – A Boon to Contravene the Increasing Levels of Air Pollution in Indian Cities - A Review

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Abstract: The Construction Industry has always been rightly blamed for working against the environment because of the concretization activity. So civil Engineers and architects around the world are continuously investigating and working on different construction materials for improving their properties and making them environmentally sustainable. Along with concretization the major cause of pollution are the petrol and diesel vehicles emitting NiO_2 in the environment. Hence a very important question is whether we have a solution to this problem? Scientists around the world are finding solutions to this everlasting question. One such material being used is Titanium dioxide which has the ability of absorbing nitrogen dioxide from the environment. As per the studies it is found that the effect of TiO_2 is more effective in the presence of sun. Already this technique is being used in the some of the countries like Mexico, China, Germany etc. It is used in different materials like tiles and paints. As a photo catalyst, titanium dioxide can be added to paints, cements, windows and tiles in order to decompose environmental pollutants. With a legacy of 100 years of safe commercial use, titanium dioxide is only going to become more vital as our environment faces greater challenges from a growing population. Smog also causes a lot of diseases which can be fatal [1]

Keywords: Smog, Pollution, Construction, Building, Sustainability, Nitrogen Dioxide, etc.

I. INTRODUCTION

Air pollution is a major cause of concern globally. Due to increasing population and less area many cities are becoming congested leading to concentrated air pollution zones. Scientists and researchers universally are continuously working towards finding a solution to this ever-increasing problem. Some of them have come up with a chemical photocatalytic titanium oxide. Photo catalytic Titanium dioxide is an effective chemical in smog abating in the presence of sunlight. When added in fixed proportions in cement it improves the mechanical properties of cement. Hence researchers worldwide have come up with different ways and means of using Titanium dioxide.

Some used it as a partial replacement to cement. Some used it in paint due to its reflective and refractive characteristics. It is also used in tiles to be fixed on pavements. This compound has been used worldwide in different forms. The air quality index of the countries using it for purifying the environment is better than India.

II. LITERATURE REVIEW

Pietrzak et al.(2016) investigated the properties of Titanium dioxide when added as an additive in cement it helped in improving the air quality by absorbing harmful substances present in the air and converting them into non-hazardous compounds in the presence of ultra violet rays. Due to the photo catalytic properties of Titanium dioxide the harmful nitric oxide presents in the atmosphere, which is due to fuel combustion by road vehicles and industries. This Nitric oxide (NO) is converted into the non-hazardous nitrogen dioxide. Hence keeping the

aesthetic value of the concrete buildings intact. The author concluded that the presence of photo catalytic Titanium dioxide in cement improves its early strength but did not comment on its later strength[2].

Joshaghani, Alireza(2018) also presented a study where they investigated the pore structure of concrete after partially replacing cement with Titanium dioxide and found out that there was improvement in the pore structure of concrete containing titanium dioxide as a partial replacement. The porosity of the concrete also reduced thus improving the mechanical and durability properties of concrete [3].

Diana-Maria Mircea(2019) proposed manufacturing concrete using titanium dioxide and called itself cleaning concrete as it cleaned the atmosphere around and hence preferred it for being used in Landscaping. She further provided evidence of such concrete maintaining its aesthetic value over the years to come[4].

George Diamantopoulos et.al (2020) investigated its use as an additive to cement and hence concluded that though Titanium dioxide improves the mechanical properties of concrete in terms of the early strength gain, it reverses the results later. hence though its early strength increases its hydration process in the later stages id hampered due to its property of not allowing water molecules to reach the un hydrated cement molecules[5].

III. METHODOLOGY

Titanium is one of the most common metals on the earth surface, but it does not occur naturally in its elemental form. Titanium dioxide – also known as titanium (IV) oxide or titania – is the naturally occurring compound created when titanium reacts with the oxygen in the air. As an oxide, titanium is found in minerals in the earth's crust. It also found with other elements, including calcium and iron. Its chemical formula is TiO_2 , which means it consists of one titanium atom and two oxygen atoms (hence dioxide). TiO_2 is typically thought of as being chemically inert, meaning it doesn't react with other chemicals and is, therefore, a stable substance that can be used in many different industries and for a variety of applications. Nano, or ultrafine TiO_2 comprises of primary particles sized less than 100nm. In this grade, titanium dioxide is transparent (colourless) provides improved UV scattering and absorbing properties compared with larger particle-size, pigment-grade TiO_2 . The smaller particle size also helps in improving the pore structure. it has a very high refractive index and hence it is able to scatter visible light and also provides a surface which is reflective. It can also be used as a coating for wind turbines and plastic window frames, providing both a suitable white colour and protection from UV degradation.

Different methods were proposed for the application of titanium dioxide to the structures and buildings. The most popular method was to use it in paint so that it could be applied evenly on the surface and due to its spreading characteristic, it could cover a larger area. Thus, being cost effective. Some researchers proposed using it as a partial replacement to cement so that along with pollution control it could also improve the mechanical and durability properties of concrete. The third method proposed was sprinkling titanium dioxide on the surface of wet concrete.

IV. RESULTS AND DISCUSSION

Earlier commercial paint manufacturers were using lead as a whitener. it is a very highly toxic material as it was very cost effective, realising little about the hazardous effect it would have on the health of the inhabitants. Despite all its disadvantages it also did not provide a reflective platform similar to that of titanium dioxide. Only being cost effective, would not solve the problem. hence researcher's world-wide came up with an alternative in terms of Titanium dioxide. It was already a known fact that titanium dioxide is a non-toxic, non-reactive substance that provides a brightening effect to the platform it is used in and also has reflective properties. It also spreads evenly on the surface it is applied and can also absorb harmful ultra violet rays.

This is a material which when mixed with paint, it provides a surface which absorbs pollutants from the atmosphere and provides a smog free environment. So, with congested cities dealing with air pollution have proposed buildings coated with photo-catalytic titanium dioxide to absorb smog and other pollutants in the air. in the presence of sunlight. The mass-produced tiles, created by Berlin-based company, are coated with titanium

dioxide, a pigment that can act as a catalyst for chemical reactions when it's activated by sunlight. When UV rays hit the tiles, a reaction occurs, converting mono-nitrogen oxides (the substances that make smog smoggy) into less harmful substances.

Countries like Italy are using titanium dioxide in preparing photo catalytic concrete which can break nitric oxide into nitrogen oxides in the presence of sunlight. These oxides breakdown in the presence of sunlight into non-toxic chemicals like water, carbon dioxide, calcium nitrate etc.

Out of the various methods proposed for using titanium dioxide the best method for removing hazardous compounds like nitric oxide from the atmosphere was using titanium dioxide as 5% replacement in cement. This method along with providing self-cleaning effect also resisted wear and tear of the surface and also lasted for a longer duration on the surface.

V. CONCLUSION

Titanium dioxide a nano material is being used in many countries in paint, tiles, pavements etc. Even India is battling with the ever-increasing problem of smog, which is mainly due to burning agricultural waste in the open. Resulting in high levels of pollution, leading to hazardous diseases and challenges to the health of the citizens. As India is a very highly populated country titanium dioxide can also be used which will provide a shield from pollution and reduce the pollution levels by absorbing the pollutants from the atmosphere. With a legacy of 100 years of safe commercial use, titanium dioxide is only going to become more vital as our environment faces greater challenges from a growing population.

As a widely used substance with multiple applications, research is being carried out to improve the production process to reduce the levels of chemicals used and waste produced, and to recycle any by-products. Titanium dioxide is also being considered as being used as a partial replacement to cement and some researchers have achieved positive results in terms of mechanical and durability properties. In its photo catalyst form titanium dioxide can also be used in manufacturing self-cleaning concrete which will clean the environment and be used in Landscaping and to improve aesthetic value of structures and Buildings. So, in countries like India which are overpopulated such solutions should be accepted and implemented with immediate effect. Earlier Titanium dioxide was itself considered as a hazardous compound itself, leading to cancer. But continuous investigations of the compound negated this myth. Lot of researchers put forth evidences proving the same. Hence misconceptions sometimes in the society pose a bigger challenge.

One of the major challenges faced by us in India is the deteriorating air quality Index, specifically in the northern states. Hence as per the present situation in India where Air Quality index is deteriorating by each passing day, it is proposed that such solutions should be paid heed and utilised for betterment of the ecosystem and for providing a sustainable environment.

REFERENCES

- [1] R. A. Silva et al., "Global premature mortality due to anthropogenic outdoor air pollution and the contribution of past climate change," *Environ. Res. Lett.*, vol. 8, no. 3, 2013.
- [2] A. Pietrzak, J. Adamus, and B. Langier, "Application of titanium dioxide in cement and concrete technology," *Key Eng. Mater.*, vol. 687, no. April 2016, pp. 243–249, 2016.
- [3] A. Josaghani, "Evaluating the effects of titanium dioxide (TiO₂) and carbon-nanofibers (CNF) as cement partial replacement on concrete properties," *MOJ Civ. Eng.*, vol. 4, no. 1, pp. 29–38, 2018.
- [4] D. M. Mircea, "Self-Cleaning Concrete for Landscaping Applications," *MATEC Web Conf.*, vol. 289, pp. 1–4, 2019.
- [5] G. Diamantopoulos et al., "The Role of Titanium Dioxide on the Hydration of Portland Cement: A Combined NMR and Ultrasonic Study," *Molecules*, vol. 25, no. 22, 2020.
- [6] URL: <http://worldcat.org/issn/19966814>

Design and Analysis of FDM Gear Coupling

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Abstract: In many transmissions mechanism and drives the couplings play a crucial role of providing the vibration free, safe transmission of power from input to output shaft of equipment. Although the conventional rigid couplings when properly designed, selected and maintained, can provide good service life. Gear couplings are standard, however in some cases customized couplings are needed which are not possible to produce because of very high molding costs. Project aims at design, modeling, analysis and comparison testing of the gear coupling that is 3-d printed. The modeling of the compact drive system has been done using Unigrafix Nx-8 whereas the analysis is done using Ansys Workbench-16.0.

Keywords: Gear Coupling, Customized, Modeling, Analysis, 3-D printing. etc.

I. INTRODUCTION

Gear couplings are commonly used industry, and majority of the plastic moulded couplings have gone from curiosity to industrial mainstay in the past 50 years. today they transfer torque and motion in products as diverse as cars, watches, sewing machines, building controls, and missiles. even with all the ground they've gained, their evolution is far from over as new and more demanding gear applications continue to emerge. plastic gear couplings are serious alternatives to traditional metal gear coupling in a wide variety of applications. the use of plastic gear coupling has expanded from low-power, precision motion transmission into more demanding power transmission applications. conventional method of manufacturing is the plastic molding, but this is only for a substantial batch quantity. in present day situation many at times it is required to produce small quantity of products for which plastic molding is not a economical solution.



Figure 1: Gear Coupling

In such cases the method of FDM (Fused deposition modeling) can be used. But though the method is extremely fast and economical for small batch quantity, the performance of parts produced by this method are yet to be proven for strength and durability. Gear couplings have been likened to a one-to-one gear box, that is, torque transfers from hub teeth to sleeve teeth and across the shaft gap with no change in RPM.

Gear couplings are standard, however in some cases customized couplings are needed which are not possible to produce because of very high molding costs.

II. LITERATURE REVIEW

Chen Feng et al (1): The authors developed a coupling using elastic gears and carried out the analysis of the same to verify the strength conditioning of the device and establish a 3-d model.

Mikhaylov Aleksandr et al (2): The paper deals with the gear coupling tooth development using a special forming spatial tool that uses kinematic method by application of thermo-mechanical treatment method.

M.M.Calistrat et al (3): The authors discuss the failure of the gear coupling hub, sleeve in the circumstance of block up of the coupling, and they found out that the lubrication plays a vital role in the service life of the coupling.

Stephen R. Locke et al (4): The authors discuss the credible failure modes of the gear coupling the authors bring forth the most common coupling failure modes and cite examples of deterioration and propose options for intervention in sufficient time to prevent catastrophic failure.

JonR. Mancuso et al (5): The authors discuss the modes of failure of the gear coupling sleeve and hub in the conditions of overload the coupling, and role that the lubrication plays in the service life of the coupling and how they can be replaced by flexible couplings to reduce chances of failure.

III. LITERATURE GAP

The conventional gear coupling systems do not provide overload safety. The non-standard gear couplings are difficult and costly to manufacture. Although the conventional rigid couplings when properly designed, selected and maintained, can provide good service life but they do-not provide the desired safety against the overloads. Conventional method of manufacturing is the plastic molding, but this is only for a substantial batch quantity. In present day situation many a times it is required to produce small quantity of products for which plastic molding is not an economical solution. In such cases the method of FDM (Fused deposition modeling) can be used.

IV. DESIGN OF PART ASSEMBLIES

4.1 Design of Input Coupling Gear

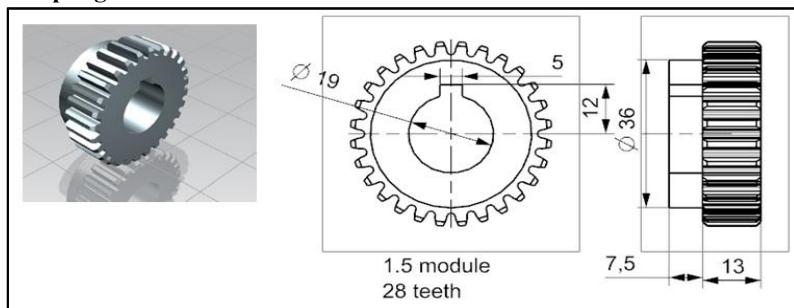


Figure 2: Input Coupling Gear

Table1: Material Selection for Input Coupling Gear

Designation	Ultimate Tensile Strength N/mm ²	Yield Strength N/mm ²
Abs Polymer	60	42

Check for torsional shear failure of shaft:

$$T_d = \Pi/16 \times f_{s_{act}} \times (D^4 - d^4) / D$$

$$\Rightarrow f_{s_{act}} = 0.075 \text{ N/mm}^2$$

As $f_{s_{act}} < f_{s_{all}}$

\Rightarrow Input coupling gear is safe under torsional load.

4.1.1 Analysis of Input Coupling Gear (Torsion):

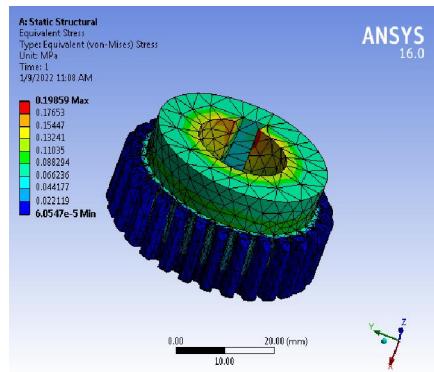


Figure 3: Von mises stress of Input Coupling Gear

The maximum theoretical stress in the input coupling gear under torsional load is 0.075MPa whereas the analytical stress is 0.199 MPa thereby suggesting that the design of the input coupling gear is safe under given system of forces.

4.1.2 Analysis of LH Gear Considering Tangential Tooth Load:

$$\text{Tangential tooth load} = T/R = 640 / ((28 \times 1.5)/2) = 30.5 \text{ N}$$

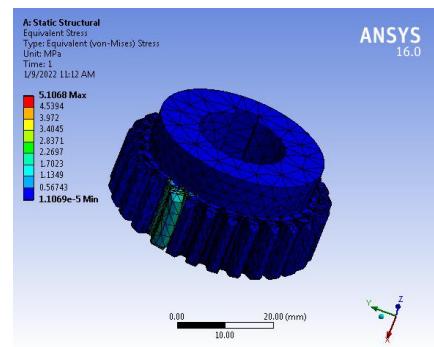


Figure 4: Von mises stress of Gear

The maximum stress induced in the part due to the tangential tooth load is 5.1058 MPa thereby suggesting that the design of the input coupling gear is safe under given system of forces.

4.2 Design of Gear Coupling Sleeve:

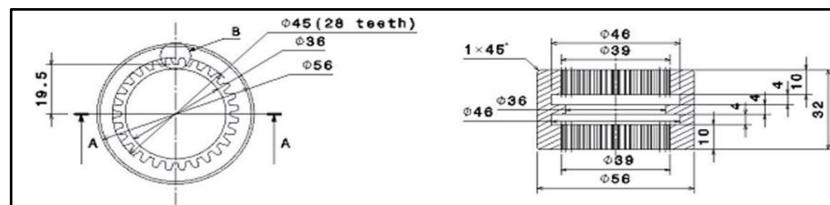


Figure 5: Gear Coupling Sleeve

Table2: Material Selection for Gear Coupling Sleeve

Designation	Ultimate Tensile Strength N/mm ²	Yield Strength N/mm ²
Abs Polymer	60	42

Check for torsional Shear Failure of Shaft:

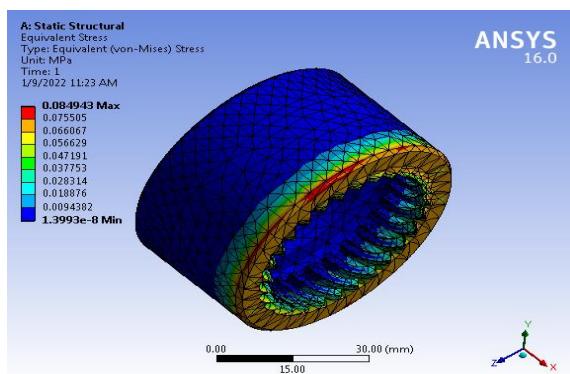
$$T_d = \frac{\pi}{16} \times f_{s_{act}} \times (D^4 - d^4) / D$$

$$\Rightarrow f_{s_{act}} = 0.07 \text{ N/mm}^2$$

As $f_{s_{act}} < f_{s_{all}}$

\Rightarrow Gear coupling sleeve is safe under torsional load.

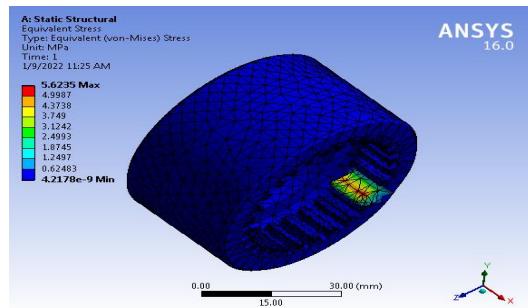
4.2.1 Analysis of Gear Coupling Sleeve (Torsion):


Figure 5: Von mises stress of Gear Coupling Sleeve

The maximum theoretical stress in the input coupling gear under torsional load is 0.07 MPa whereas the analytical stress is 0.0849 MPa thereby suggesting that the design of the input coupling sleeve is safe under given system of forces.

4.2.2 Analysis of Gear Coupling Sleeve Considering Tangential Tooth Load:

$$\text{Tangential tooth load} = T / R = 640 / ((28 \times 1.5/2)) = 30.5 \text{ N}$$


Figure 6: Von mises stress Gear coupling Sleeve with tangential tooth load

The maximum theoretical stress in the gear coupling sleeve under torsional load is 0.07 MPa whereas the analytical stress is 0.08 MPa. The maximum stress induced in the part due to the tangential tooth load is 5.6235 MPa thereby suggesting that the design of the gear coupling sleeve is safe under given system of forces.

V. RESULT DISCUSSION

1. Although the conventional rigid couplings when properly designed, selected and maintained, can provide good service life but they do-not provide the desired safety against the overloads. Conventional method of manufacturing is the plastic molding, but this is only for a substantial batch quantity. In present day situation many at times it is required to produce small quantity of products for which plastic molding is not a economical solution. In such cases the method of FDM (Fused deposition modeling) can be used.
2. The maximum theoretical stress in the input coupling gear under torsional load is 0.075 MPa whereas the analytical stress is 0.199 MPa. The maximum stress induced in the part due to the tangential tooth load is 5.1058 MPa thereby suggesting that the design of the input coupling gear is safe under given system of forces.
3. The maximum theoretical stress in the gear coupling sleeve under torsional load is 0.07MPa whereas the analytical stress is 0.08 MPa. The maximum stress induced in the part due to the tangential tooth load is 5.6235 MPa thereby suggesting that the design of the gear coupling sleeve is safe under given system of forces.

VI. CONCLUSION

Gear couplings are standard, however in some cases customized couplings are needed which are not possible to produce because of very high moulding costs. Project aims at design, modelling, analysis and comparison testing of the gear coupling that is 3-d printed. The modelling of the compact drive system has been done using Unigraphics Nx-8 whereas the analysis is done using Ansys Workbench-16.0 the parts are found to be safe by both methods. The developed gear coupling will integrate with overload coupling to develop a compact drive system.

REFERENCES

- [1] Chen Feng,Li Zheng-feng, Liu Yuan-xiang ' Design and calculation of a new type of elastic gear coupling and finite element analysis' Advanced Materials Research Vols. 989-994 (2014)
- [2] Mikhaylov Aleksandr,Grubka Roman,Lahin Aleksey, Nedashkovskiy Aleksandr, and Guitouni Ahmed Structural and Technology Support Quality Improvementof Gear Coupling Applied Mechanics and Materials Vol 371 (2013)
- [3] M. M. Calistrat ' Friction Between High-Speed Gear Coupling Teeth' *J. Mech. Des* 103(1), 54-58 (Jan 01, 1981)
- [4] Stephen R. Locke 'Coupling credible failure modes and owner options to intervene' Turbomachinery Symposium September 30 – October 3, 2013
- [5] JonR. Mancuso, C. B. (Barney) Gibbons Robert E. Munyon ' The application of flexible couplings for turbomachinery'
- [6] Adelaide Nespoli, Enrico Bassani, Elena Villa, and Francesca Passaretti ' Study of a Torque Limiter Based on NiTiPseudoelastic Tapes' *Adv. Eng. Mater.* 2021
- [7] Yi Guoa, Scott Lambert a, Robb Wallena, Robert Errichellob, Jonathan Keller ' Theoretical and experimental study on gear-coupling contact and loads considering misalignment, torque, and friction influences'Mechanism and machine theory 2016.
- [8] Jyun Rong Zhuang, HayatoNagayoshi, Hirotoshi Kondo, Hee-hyol Lee 'The Applicability of an Assistive Walking Device IntegratingOverload Protection Mechanism Using a Torque Limiter' 2018 IEEE/ASME International Conference on Advanced Intelligent Mechatronics
- [9] MarilenaGhi,tescu, Ion-Marius Ghi,tescu, Paul Nicolae Borza and Sorin Vlase ' A New Optimized Solution for a Flexible Coupling with Bolts Used in the Mechanical Transmissions' MDPI Journal Symmetry 2021, 13, 171
- [10] Xiang Gao, Cheng Lin ' Electromechanical Coupling Approach for Traction Control System of Distributed Drive Electric Vehicles E3S Web of Conferences 23 6, 01007 (2021) ICERSD 2020.

Acoustic Absorption Research on Woven Structure Fabrics

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Abstract: Noise has become one of the world's four major pollutant categories. Textiles have been employed as noise reduction materials in construction, automotive, and other industries because of their porous, light, and easy processing features, however there have been few investigations on woven fabrics' sound absorption properties. The effect of structural elements of woven fabrics on acoustic absorption was investigated in this research. Fabrics with plain, twill, and honeycomb weaves were woven with identical warp density and used as acoustic measuring samples, which were measured using an acoustical detecting platform based on an impedance tube. The experiment is carried out on a perforated panel to see how changes in thickness, porosity ratio, and cavity depth affect the sound absorption coefficient. The analysis is carried out using the MATLAB software. Although pore parameters have an impact on the acoustic properties of woven fabrics, the influence of pore features on textile acoustic absorption cannot be attributed solely to porosity. Sound absorption performance of woven fabrics may also be influenced by the number and shape of pores.

Keywords: Acoustic Absorption, Acoustical Property, etc.

I. INTRODUCTION

Noise has become one of the world's four major pollutant categories. constant noise exposure can lead to a variety of health issues, including hearing loss, cardiovascular illness, and sleep disturbances. Textiles are seen as a possible replacement to traditional porous materials due to their light weight, excellent machinability, and low costs among diverse sound absorption materials. because of its outstanding acoustic absorption properties in the high frequency band, the application range of textile sound absorbers is continuously expanding in noise reduction and vibration control. Porous absorbing materials have been characterised as cellular, fibrous, or granular based on their microscopic topologies. fibrous materials, in particular, are made up of a succession of tunnel-like apertures created by material fibre interstices. natural and artificial fibre materials are the two types of fibre materials. natural fibres can be vegetable (e.g., kenaf, hemp, and wood), animal (e.g., wool and fur felt), or mineral (asbestos), whereas synthetic fibres can be mineral (e.g., fibreglass, mineral wool, and glass wool), or polymer (e.g., nylon, polyester, and nylon) (polyester). nonwovens and felts have been the most studied sound-absorbing textile materials in recent years.

Due to their smaller thickness, woven textiles have poor sound absorption characteristics when compared to nonwovens and fiber-based felts. however, because of their superior structural design ability and dimensional stability, woven fabrics are commonly employed in domestic textiles and automotive decorations. versatility has become a noticeable trend in decorative fabrics in recent years. window curtains, for example, are intended to have not just traditional capabilities, such as shade and heat preservation, but also innovative capabilities, such as flame retardant, antimicrobial, and sound absorption.

II. OBJECTIVE

The effect of structural elements of woven fabrics on acoustic absorption was investigated in this research. Fabrics with plain, twill, and honeycomb weaves were woven with identical warp density and used as acoustic measuring samples, which were measured using an acoustical detecting platform based on an impedance tube. The experiment is carried out on a perforated panel to see how changes in thickness, porosity ratio, and cavity depth affect the sound absorption coefficient. The main objective of the study is:

- To determine acoustic absorption properties of woven materials.
- To check effects of thickness, incident frequency and porosity on absorption properties.

III. LITERATURE REVIEW

Umberto Berardi, Gino Iannace: Measurements on natural fibre samples revealed that these materials have good sound absorption coefficients, especially at medium and high frequencies, according to this paper. The inhomogeneity of natural fibres and the difficulty in developing models to anticipate their behaviour were validated by the high standard deviation values of the airflow resistance measurements. The considerable variability of the data indicated that direct methods for measuring material properties be limited, and that models capable of predicting material behaviour with the fewest available variables be considered. Using an inverse optimization technique, the coefficients that best represent the acoustic impedance and propagation constant for several natural fibres were computed.

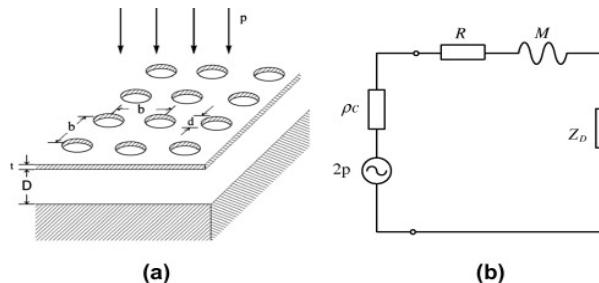
Dakai Chen, Jing Li, Jie Ren: The sound absorption property measurements in this study demonstrate that composites with short ramie fibre have superior sound absorption than ramie fabric reinforced PLLA composites. Furthermore, the addition of the flame retardant APP and the plasticizer PBAT improves the sound absorption properties of the ramie fabric/PLLA composites. The micro-phase separation in the PBAT/PLLA composites, the porosity of the single ramie fibre bundle, and the distribution of short ramie fibre and ramie fabric in the PLLA composites are also shown by SEM morphological studies. The fundamental cause for greater acoustical absorptivity is due to these unique features and their distribution.

Hsiao Mun Lee, Zhaomeng Wang, Kian Meng Lim, Heow Pueh Leea: Series of tests were conducted in a reverberation room on commercial P.E.B. noise barriers to investigate their absorption ability. During the testing, the effects of sample size on the noise barrier were also investigated. The sound absorptive and reflecting surfaces of two types of noise barriers (metal and plastic) were evaluated. Only for frequencies above 315 Hz and 630 Hz did the sound absorptive surfaces of the metal and plastic noise barriers outperform reflecting surfaces in terms of sound absorption. The results showed that sample size had no effect on noise barrier sound absorption ability, except when the sample size was too small (2 m²) at frequencies below 100 Hz and over 4000 Hz.

Mlando Basel Mvubu, Rajesh Anandjiwala, and Asis Patnaik: The univariate significance test revealed that all of the parameters, as well as two of the three two-way interactions, had significant effects on observed sound absorption coefficients in this investigation. Blend ratio and air gap were the only two-way interaction effect that failed to have a significant effect on sound absorption coefficient at the 95 percent confidence interval. The sound absorption coefficients increased as the air gap was extended from 0 to 25 mm, however they peaked at 15 mm air gap, after which they slightly reduced as the air gap was increased from 15 to 25 mm. From the literature survey we came to know that how we can control the efficient sound absorption coefficient by controlling the different parameters of materials.

IV. IMPLEMENTATION

The sound absorption capabilities of a material change when the parameters discussed above change. as a result, using MATLAB software, the study is carried out on perforated panels to check the influence of all parameters creating changes in the material's sound absorption characteristic. Noise control treatment methods such as perforated panels are excellent for absorbing noise, particularly noise in the lower frequency ranges. perforated panels work in a similar way to Helmholtz resonators in that they absorb sound. perforated panels are a collection of Helmholtz resonators.


Figure 1:Perforated panel set-up Figure 2:Electric circuit [11]

Effective panel absorption is formed by the exterior sheeting, an air space (perhaps filled with an absorptive liner), and an inside board. The important concern is to ensure that this absorption occurs at the desired frequency. The equation for perforated frequency is:

$$F_{pp} = \frac{C}{2 \times \Pi} \times \sqrt{\left(\frac{6}{t \times D}\right)}$$

Where, F_{pp} = Perforated frequency

C = Velocity of fluid

δ = Porosity ratio of panel

t = Thickness of panel

D = Depth of cavity in panel

This equation is used to create the programme, which is then analysed using MATLAB software. All of the figures are based on research. The dependent parameter is the perforated frequency, whereas the independent parameters are the porosity ratio, thickness, and cavity depth. The results are taken after some of the aforesaid parameters are analysed using MATLAB programme.

Sound Absorption Coefficient vs Frequency and Density:

To check the effect of porosity on sound absorption, different data were collected from literature. This data is curve fitting operation then analysed on MATLAB by performing

Table 1: Sound absorption coefficient as function of frequency and density for fabrics

	Density(Kg/m³)			
	199.50	207.60	249.54	257.54
Frequency(Hz)	Sound absorption co-efficient			
500	0.08	0.12	0.15	0.15
750	0.15	0.155	0.1	0.14
1050	0.155	0.155	0.16	0.22
1300	0.16	0.19	0.2	0.14
1600	0.175	0.14	0.22	0.16
2000	0.16	0.12	0.31	0.25
2500	0.17	0.23	0.28	0.32
3150	0.24	0.31	0.45	0.39
4000	0.34	0.42	0.58	0.56
5000	0.45	0.56	0.77	0.7
6250	0.47	0.83	0.92	0.75

Table 2: Sound absorption coefficient as function of frequency and density for wool boards

	Densities(g/cm3)						
	0.300	0.299	0.314	0.291	0.286	0.295	0.291
Frequency(Hz)	Sound absorption co-efficient						
1000	0.045	0.044	0.04	0.049	0.04	0.05	0.05
1250	0.055	0.056	0.045	0.065	0.06	0.065	0.075
1500	0.06	0.062	0.05	0.074	0.075	0.07	0.08
1800	0.073	0.072	0.07	0.08	0.08	0.08	0.095
2000	0.08	0.08	0.08	0.08	0.095	0.094	0.105
2300	0.12	0.11	0.12	0.14	0.12	0.11	0.138
2650	0.15	0.14	0.14	0.175	0.145	0.16	0.175
3200	0.16	0.15	0.148	0.18	0.155	0.175	0.195
4000	0.19	0.18	0.185	0.22	0.205	0.195	0.25
5000	0.265	0.26	0.28	0.34	0.275	0.28	0.365

The data shows the change of sound absorbtion coefficient with respect to change in density and frequency. this data to check the result in graphical form Small analysis is made on. The analysis is made on MATLAB software from this data and the graphs were obtained.

Results:

Effect of Thickness of material on perforated frequency

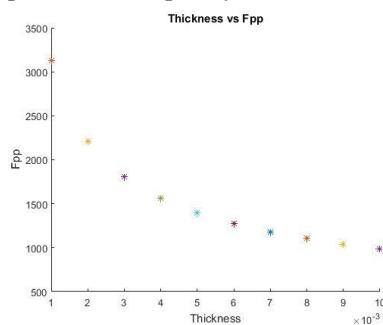

Figure 3: Graph of Thickness vs Perforated frequency

Table 3: Effect Thickness on perforated frequency

C(m/s)	D(m)	sigma	t(m)	Fpp(Hz)
340	0.15	0.5	0	inf
340	0.15	0.5	0.001	3124.2
340	0.15	0.5	0.002	2209.1
340	0.15	0.5	0.003	1803.8
340	0.15	0.5	0.004	1562.1
340	0.15	0.5	0.005	1397.2
340	0.15	0.5	0.006	1275.4
340	0.15	0.5	0.007	1180.8
340	0.15	0.5	0.008	1104.6
340	0.15	0.5	0.009	1041.4
340	0.15	0.5	0.010	987.95

When Fpp of the panel is calculated by varying thickness of the material in certain manner 0-10mm while keeping δ (Porosity ratio=0.5), D(Depth of cavity=0.15m), C(Speed of air=340m/s) constant then it is observed that the Fpp(Perforated frequency) of the system decreases as the thickness of the material increases in depth of cavity.

Effect Porosity Ratio on Perforated Frequency:

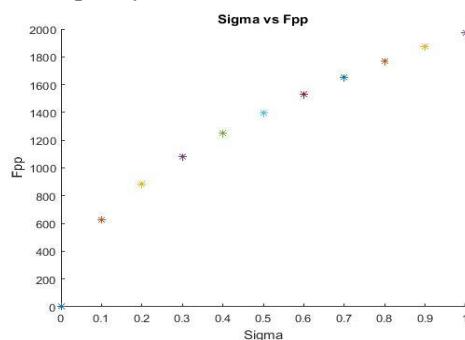


Figure 4: Graph of Porosity ratio vs Perforated frequency

Table 4: Effect of porosity ratio on perforated frequency

C(m/s)	t(m)	D(m)	sigma	Fpp(Hz)
340	0.005	0.15	0	0
340	0.005	0.15	0.1	624.8394
340	0.005	0.15	0.2	883.6564
340	0.005	0.15	0.3	1082.3
340	0.005	0.15	0.4	1249.7
340	0.005	0.15	0.5	1397.2
340	0.005	0.15	0.6	1530.5
340	0.005	0.15	0.7	1653.2
340	0.005	0.15	0.8	1767.3
340	0.005	0.15	0.9	1874.5
340	0.005	0.15	1.0	1975.9

When Fpp of the panel is calculated by varying Porosity ratio of the material from 0-1 while keeping t(Thickness =5mm), D(Depth of cavity=0.15m), C(Speed of air=340m/s) constant then it is observed that the Fpp(Perforated frequency) of the system increases with increase in porosity ratio.

Effect of depth of cavity on perforated fre:

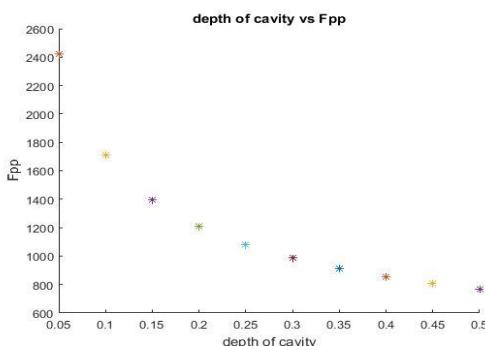


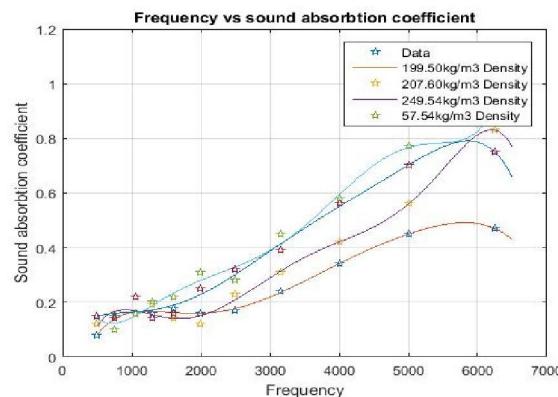
Figure 5: Graph of depth of cavity vs Perforated frequency

Table5: Effect of depth of cavity on perforated frequency

C(m/s)	t(m)	sigma	d(m)	Fpp
340	0.005	0.5	0.0	inf
340	0.005	0.5	0.05	2420.0
340	0.005	0.5	0.10	1711.2
340	0.005	0.5	0.15	1397.2
340	0.005	0.5	0.20	1210.0
340	0.005	0.5	0.25	1082.3
340	0.005	0.5	0.30	987.95
340	0.005	0.5	0.35	914.67
340	0.005	0.5	0.40	855.59
340	0.005	0.5	0.45	806.66
340	0.005	0.5	0.50	765.26

When Fpp of the panel is calculated by varying Depth of cavity of panel from 0-0.5m while keeping t(Thickness =5mm), δ (Porosity ratio=0.5), C(Speed of air=340m/s) constant then it is observed that the Fpp(Perforated frequency) of the system decreases with increase in depth of cavity.

on sound absorbtion coefficient uencyEffect of density and freq:


Figure 6: Sound absorption coefficients with different densities of wool boards

When the density of wool boards was raised, the sound absorption coefficients varied or marginally rose with increasing frequency in the low frequency region. The sound absorption coefficients also indicated a substantial increasing trend in the high frequency range (Figure 6). This is due to the fact that high density causes microscopic pores in the inside board. Low-frequency acoustic waves have a tough time entering the interior, and a considerable portion of these waves are reflected at the surface, resulting in the board's poor low-frequency sound absorption capabilities. Meanwhile, when the density of the board rises, the permeability of the board decreases, and flow resistance rises.

Given the absorbed high-frequency acoustic waves in the board surface, the larger the acoustic waves attenuate at the surface, the greater the degree of absorption, which leads to enhanced high-frequency acoustic wave sound absorption capabilities with increasing density. The effect of increasing density on the effect of high-frequency acoustic waves, on the other hand, is negligible. Thus, increasing density insignificantly enhanced the sound absorption coefficients at low frequencies.

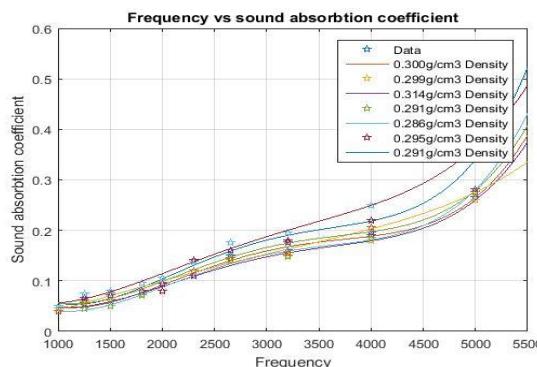


Figure 7: Sound absorption coefficient as a function of frequency for fabrics.

For all fabrics, the absorption coefficient rose as the sound frequency increased. When compared to the thick fabrics, the slopes of the curves were substantially steeper for the porous and medium fabrics, and they were much higher at mid-and high frequencies. Although density is a significant component in establishing a fabric's sound-absorption capacity, it also provides an estimate of the void/air spaces in the fabric.

V. CONCLUSION

Because of their porous, light, and easy processing properties, noise reduction materials such as cloth have been employed in building, automation, and other industries. The amount of sound that a material absorbs is determined by several factors. Incident frequency, material thickness, porosity ratio, and surface finish quality are the characteristics in question. The thickness of the material and the porosity ratio are the two characteristics that have the greatest influence on sound absorption. As a result, in order to control sound absorption, these parameters must be kept within reasonable bounds. With independent settings, sound absorption varies linearly. Analysis on a perforated panel using MATLAB software is used to check the influence of these settings on sound absorption.

The programme is written in MATLAB utilising a perforated frequency equation. We can clearly see from the graphs and corresponding values that increasing the thickness of the material or the depth of cavity in a perforated panel while keeping all other parameters constant reduces the perforated frequency, whereas increasing the porosity ratio while keeping all other parameters constant increases the perforated frequency. The other variables have a negligible impact on sound absorption. As a result, the thickness of the material, the porosity ratio, and the depth of the cavity in the panel must all be regulated in order to control sound absorption. In addition, data from the literature is used to investigate the influence of density on sound absorption. MATLAB software was used to conduct the analysis, and graphs were created. It shows that the density of material make huge impact on sound absorbtion properties.

REFERENCES

- [1] Xiaoning Tang, Xiong Yan, "Acoustic energy absorption properties of fibrous materials:A review", Composites: Part A (2017).
- [2] Umberto Berardi, Gino Iannace, "Predicting the sound absorption of natural materials: Best-fit inverse laws for the acoustic impedance and the propagation constant", Applied Acoustics 115 (2017) 131–138.
- [3] Dakai Chen, Jing Li, Jie Ren, "Study on sound absorption property of ramie fiber reinforced poly(L-lactic acid)composites: Morphology and properties", Composites: Part A 41 (2010) 1012–1018.
- [4] Hsiao Mun Lee, Zhaomeng Wang, Kian Meng Lim, HeowPueh Lee, "Investigation of the effects of sample size on sound absorption performance of noise barrier", Applied Acoustics 157 (2020) 106989.
- [5] Mlando Basel Mvubu, Rajesh Anandjiwala, and Asis Patnaik, "Effects of air gap, fibre type and blend ratio on soundabsorption performance of needle-punched nonwoven fabrics", Journal of Engineered Fibers and Fabrics (2019).

- [6] Xiaoning Tang, Xiansheng Zhang, XingminZhuang,Huiping Zhang and Xiong Yan, "Acoustical analysis of corduroy fabric for sound absorption: Experiments and simulations",Journal of industrial textiles(2017).
- [7] Hua Qui, Yang Enhui, "Effect of thickness, density and cavity depth on the sound absorption properties of wool boards", Autex Research Journal, Vol. 18, No 2, June 2018.
- [8] YoungA Kang, EunNyeong Lee, KwanChul Lee, SoonMo Choi &EunJoo Shin, "Acoustic properties of sound-absorbing polyester fabrics woven with thick staple and thin draw textured yarn for use in interior decoration", The Journal of The Textile Institute(2018).
- [9] Dakai Chen, Jing Li, Jie Ren, "Study on sound absorption property of ramie fiber reinforced poly(L-lactic acid)composites: Morphology and properties", Composites: Part A 41 (2010) 1012–1018.
- [10] P. Glé, E. Gourdon, L. Arnaud, "Acoustical properties of materials made of vegetable particles with several scales of porosity", Applied Acoustics 72 (2011),<https://nptel.ac.in/courses/112/107/112107290/>

Fatigue Analysis and Design Optimization of Excavator Bucket

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Abstract: Construction activity is continually rising, and the strong performance of construction equipment ensures rapid expansion in the earth moving machine sectors. This study focuses on the method for calculating the digging forces needed to dig the terrene for minor building work. This approach calculates the force and is also used to perform a fatigue analysis to determine the bucket's fatigue life and failure rate. Because the current excavator arm mechanism is subjected to deformation and bending forces during lifting and digging operations, failure at the bucket end of the arm happens frequently. The excavator arm is analysed using ANSYS workbench software at current digging force and lifting capacity. An analytical approach has also been provided for static force analysis of excavator bucket.

Keywords: Digging Forces, Fatigue Analysis, Excavator Bucket, Optimization, etc.

I. INTRODUCTION

For various earthmoving tasks, such as building, mining, agriculture, forestry, military applications, and notably for cleaning up dangerous areas, earth moving excavation provides a vast potential and a favourable technique. High-performance construction machineries with sophisticated mechanisms and automation of construction activities ensure a rapidly expanding rate of industry for earth moving machines. The machine is operated by a hydraulic system when digging or moving the material. Excavators are typically used to excavate beneath the natural surface of the land on which the machine sits and load the material onto trucks, tractor-drawn wagons, or convey or belt systems. "A ride-on dual purpose self-propelled wheeled machine for on and off-road operation," is the definition of a backhoe excavator. One end has loader arms that can support a full-width bucket or attachment, while the other has a boom and arm combination that can swing half-circle for digging or attachment manipulation. "Backhoe excavators are used as a utility machine on large building sites (such as highways and dams) and urban infrastructure projects in India, as well as for loading hoppers and trucks."

Excavator consists of various parts like bucket, rivet and tooth. Excavator buckets are typically built of solid steel and have teeth emerging from the cutting edge to disturb hard materials and reduce bucket wear.

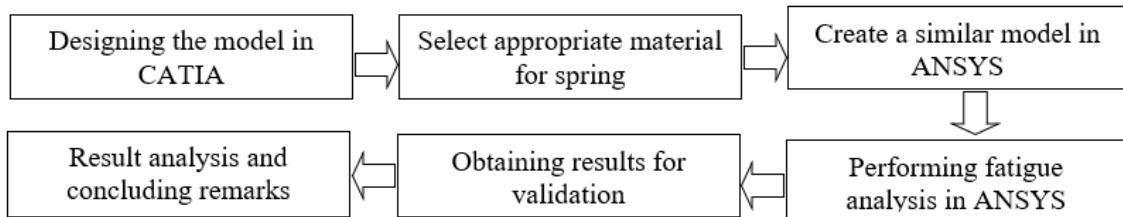


Figure: a) Excavator Bucket b) Tooth

A rivet is a mechanical fastener that is permanent. A rivet is made up of a smooth cylindrical shaft with a head attached to one end. The tail is the end opposite the head. The excavator bucket teeth must endure heavy loads of materials such as moist soil and rock, as well as abrasion wear caused by the abrasive nature of solid particles.

when breaking up material. Excavator bucket teeth are typically made of alloy steel, and hard facing of some wear resistant materials can be placed to the material of the bucket tooth to extend its life against abrasive wear.

II. METHODOLOGY



III. LITERATURE REVIEW

Darko Danicic, Stojan Sedmak (2015): Because time estimations based on the crack can provide a time period in which the cracks can be found and corrected to avoid a collapse of the structure, this technique is a direct contribution of new maintenance methods, particularly proactive maintenance. It resulted in a loss of more than ten million euros in this case. Furthermore, the inspection period may be prolonged, lowering maintenance expenditures. Set a time when key elements of the structure should be updated to avoid damage, using proper non-destructive assessment. It means that based on these predictions, a corrected time for steel structure inspection may be applied, resulting in more efficient inspection and maintenance

Ana Petrovic, TaskoManeski (2018): The following methods were taken in this study to solve the problem of a fracture appearing on the gusset plate of the pylon vertical truss of a bucket wheel excavator SchRs630. The excavator SchRs630 pylons, slewing platform, and undercarriage were numerically modelled. Numerical calculations were performed for a variety of load situations that depict the loading of a structure at various points during its operational life. The load that causes gusset plate stress concentration (crack incidence) has been identified.

Rosen Mitrev, Dragan Marinkovic (2019): In this investigation was done on the dynamic stability of a hydraulic excavator while executing lifting operations in this research. The created six-degree-of-freedom dynamic model takes into account the base body's elastic relationship to the terrain, as well as the front digging manipulator connections. Using the Lagrange formalism, a set of nonlinear differential equations characterising the dynamic behaviour is generated. The excavator dynamic overturning is studied using numerical experiments. Finally, a small-scale experimental model was used to validate the mechanical system concept.

Sumar HadiSuryo, Athanasius Priharyoto (2018): The largest stress of a bucket tooth is located in its terminal section, which is in direct contact with the earth, according to simulation results. During use, it can cause wear, bend, crack, and fracture in the bucket teeth end. The finite element method was discovered to be effective in improving the quality of in geometry forms. Calculation of bucket curling force yielded the largest force value from the excavator. The greatest force value that may be obtained has a magnitude of 8285.06 N.

IV. DESIGN OF EXCAVATOR ARM

The UK standards "FOS=5 should also be applied with better-known materials that are to be used in unpredictable environments or under to uncertain stressors." Because the backhoe is subjected to varying stresses depending on the angle of digging, for example, if the bucket angle is about 45° , the digging force experienced by the bucket will be less, and if the bucket angle is moved away from 45° , the force required will be larger.

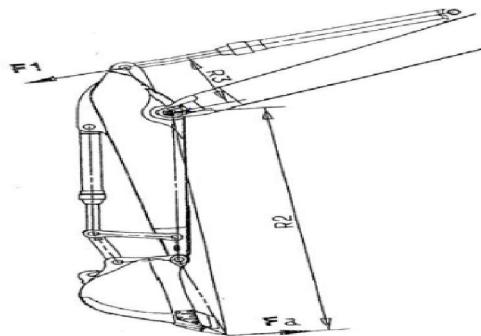
Table 1:Properties of medium strength alloy steel

Sr.No.	Property Name	Value
1	Ultimate Strength	690 MPa
2	Yield Strength	450 Mpa
3	Poisons ratio	0.29
4	Density	7.85g/cm^3
5	Tensile Strength	850 Mpa
6	Shear Modulus	80 Mpa
7	Bulk Modulus	140 Mpa

Assumptions Made in Calculation

The boom cross section is idealized to channel section, 175*133, plate thickness = 6mm. The stick cross section is idealized to box cross section, 142*117, plate thickness = 6mm. The maximum bending stress does not exceed the allowable yield strength 138N/mm²

Calculation of Bucket Digging and Arm Digging Forces



Bucket digging force is defined as maximum digging force due to bucket cylinder in tangential direction at bucket tooth. Pressure of Bucket Cylinder: It is the pressure of bucket cylinder according to the operation pressure of hydraulic oil, depending on the next formulation: $F_2 = (\pi/4) D_b^2 * P_b$. Bucket digging force: $F_b = (F_2 * A * C) / (R_1 * B)$.

Values Found by Actual Practical Observation:

A= 600 mm B= 800 mm C= 470 mm R₁= 1300 mm D_b= 115mm P_b= 0.049Mpa

Calculations:

$$F_2 = (\pi/4) D_b^2 * P_b = 138 \text{ kN.}$$

Arm Digging Force

Arm digging force is defined as maximum digging force due to arm cylinder in tangential direction at bucket tooth in position where bucket tooth force due to bucket cylinder is maximized.

Values Found by Actual Practical Observation:

R₂= 3700mm R₃= 650mm D_a= 135mm P_a= 0.049Mpa

$$F_2 = (\pi/4) D_a^2 * P_a = 123.21 \text{ kN}$$

V. MODELLING OF EXCAVATOR ARM

The approach for modelling EXCAVATOR ARM in CATIS V5 is as follows. The dimensions are added to a basic-2D design of the base for support, which is subsequently developed into 3D using the pad command. Then go to generative form design and give volume extrude to the 2D sketch of the boom. Then, after exiting the workbench, construct the arm D sketch and use the pad and shell command. After that, make a 2D sketch of the bucket side, followed by a pad and shell command.

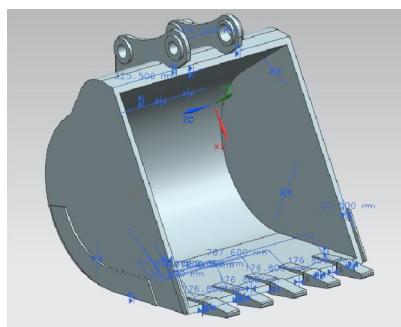


Figure: 3D – Model of bucket

VI. ANALYSIS OF EXCAVATOR BUCKET

The software requires all three dimensions to be defined in order to do analysis. It won't be able to perform calculations unless the geometry is completely described. As a result, the Excavator arm's CAD model is transformed to a STEP file, which can be used to import the geometry of the excavator arm model into ANSYS 16.0's design modeller. After you've finished importing the geometry for the excavator arm, you'll need to apply the materials. Physical preferences in Ansys meshing technology serve to automate the meshing process. A mesh can typically be built in batch with an initial solution run to discover regions of interest for an initial design. After then, the mesh can be fine-tuned to improve the accuracy of the solution. Default The model is meshed, and the resulting mesh is shown in the picture.

Material Properties Required for Analysis

1. **SM50A:** This steel material is used for all the plates or sheets of bucket.
Mechanical Properties: Young's Modulus: 2*105 MPa, Tensile Strength: 800 MPa, Yield Strength: 450 MPa, Elongation: 8-25%, Physical Properties: Density: 7700 kg/m³
2. **SCNCrM2B:** This is low alloy steel used for the tooth of the bucket.
It contains proportion of materials as C=0.25- .35%, Si=0.08%, Mn=1.00%, Ni=1.6-2% Cr=0.3-0.9%, Mo=0.15-0.35. Mechanical Properties: Young's Modulus: 2*105 MPa, Tensile Strength: 880 MPa, Yield Strength: 685MPa, Elongation: 9% Physical PropertiesDensity: 7700 kg/m³

Static structural analysis

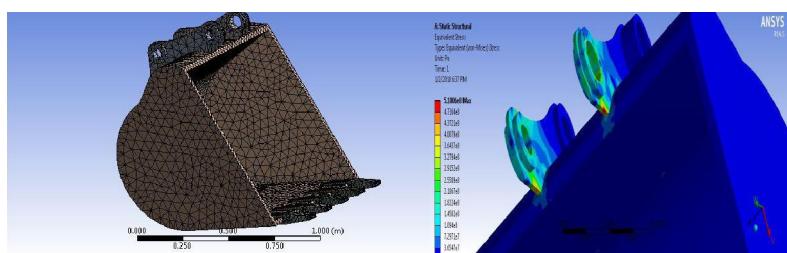


Figure: Excavator Bucket

a) meshing

b) Analysis

Fatigue Life Calculation:

From the given results we can calculate fatigue life of excavator bucket. Fatigue life calculation: By using Goodman's Fatigue life calculation method prediction of fatigue life as: Mean Stress(X) = $\sigma_{max}+\sigma_{min2} = 510.06+36.542 = 273.27$ MPa, Alternating Stress(Y) = $\sigma_{max}-\sigma_{min2} = 510.06-36.542 = 236.73$ MPa Now, Slope (m) = $\sigma_{alternate}/\sigma_{mean} = 236.73/273.27 = 0.86$, Coordinate (Y1) = Endurance limit-mX=400-(0.86*273.27) = 164.98 MPa, Margin of Safety = Y1/Y = 164.98/236.73 = 0.69 Margin of Safety < 1 so that design is not safe Fatigue Life = (1-(1/Margin of safety)) = 449259 cycles = **121.30hrs**

We discovered that the bucket's life is significantly less than 200 hours based on the calculations and results above. This state of the bucket is undesirable, so it must be optimised in order to provide a life of at least 1000 hours. Optimization is the process of identifying the areas of the system that fail when under stress and redesigning those areas in a way that will provide us with the best possible results. By analysing the above data, we discovered that the most stress is applied to the bucket's lugs, which is the cause of the bucket's failure. We're now optimising that bucket by widening or thickening the bucket lugs. by 4mm apiece, as well as some radial alterations at the lug's end and a reduction in chamfer. In order to achieve the best result, we will also raise the welding thickness for improved strength.

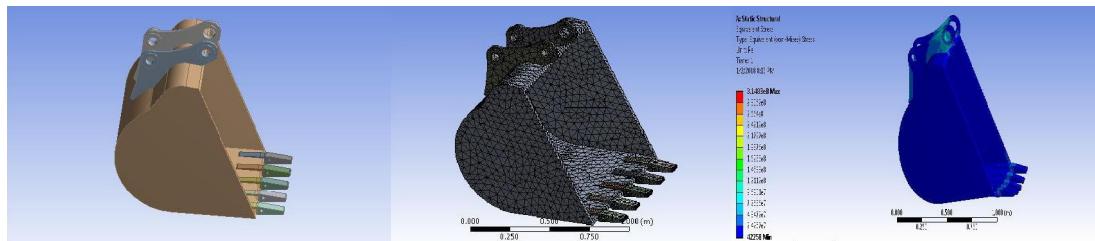


Figure: Optimised Bucket a) Model b) Meshing c) Analysis

From the Analysis following results were carried out $\sigma_{max} = 314.83$ MPa 2) $\sigma_{min} = 0.0422$ MPa, Using Goodman's Fatigue life calculation method, Mean Stress(X) = $(\sigma_{max}+\sigma_{min})/2 = (314.83 + 0.0422)/2 = 157.43$ MPa Alternating Stress(Y) = $(\sigma_{max}-\sigma_{min})/2 = (314.83 - 0.0422)/2 = 157.39$ MPa Slope (m) = $\sigma_{alternate}/\sigma_{mean} = 157.39/157.43 = 0.99$ Coordinate (Y1) = Endurance limit-mX=450-(0.99*157.43) = 294.14 MPa Margin of Safety = Y1/Y = 294.14 / 157.39 = 1.86

Result: Margin of Safety > 1 so that design is safe Fatigue Life= (1-(1/Margin of safety)) = 4623655 cycles = 1248hrs.

VII. CONCLUSION

Excavator buckets are designed to undertake excavation tasks in light construction projects. Calculations are used to determine the bucket and arm digging forces. CATIA software is used to produce the model, which is then analysed in Ansys. The safety factor, breakout force, and maximum lifting capacity are all significant aspects to consider while building an excavator arm. Excavator buckets are designed to undertake excavation tasks in light construction projects. The excavator bucket is subjected to finite element analysis using various material characteristics and static force loads. The fatigue life is calculated using stress values, and the cycle time life is converted to hours. The stress points are carried out and the optimum bucket is created using the results model is created.

REFERENCES

- [1] S. M. Metev and V. P. Veiko, *Laser Assisted Microtechnology*, 2nd ed., R. M. Osgood, Jr., Ed. Berlin, Germany: Springer-Verlag, 1998.
- [2] J. Breckling, Ed., *The Analysis of Directional Time Series: Applications to Wind Speed and Direction*, ser. Lecture Notes in Statistics. Berlin, Germany: Springer, 1989, vol. 61.

- [3] S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low-temperature poly-Si TFT," IEEE Electron Device Lett., vol. 20, pp. 569–571, Nov. 1999.
- [4] M. Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, "High resolution fiber distributed measurements with coherent OFDR," in Proc. ECOC'00, 2000, paper 11.3.4, p. 109.
- [5] R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.
- [6] (2002) The IEEE website. [Online]. Available: <http://www.ieee.org/>
- [7] M. Shell. (2002) IEEtran homepage on CTAN. [Online]. Available: <http://www.ctan.org/tex-archive/macros/latex/contrib./supported/IEEETran>
- [8] FLEXChip Signal Processor (MC68175/D), Motorola, 1996.
- [9] "PDCA12-70 data sheet," Opto Speed SA, Mezzovico, Switzerland.
- [10] A. Karnik, "Performance of TCP congestion control with rate feedback: TCP/ABR and rate adaptive TCP/IP," M. Eng. thesis, Indian Institute of Science, Bangalore, India, Jan. 1999.
- [11] J. Padhye, V. Firoiu, and D. Towsley, "A stochastic model of TCP Reno congestion avoidance and control," Univ. of Massachusetts, Amherst, MA, CMPSCI Tech. Rep. 99-02, 1999.
- [12] Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification, IEEE Std. 802.11, 1997.

Tinkercad: A Blended Teaching and Learning Tool

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Abstract: *Tinkercad is a teaching and learning tool which could be used for electronic circuit implementation, software coding and 3D model designing. Technical skill sets improve by practicing designing and coding using Tinkercad simulation. The realistic view of the components gives real time feeling like students doing practical in laboratory. This paper will elaborate the design and development of basic electronic circuit, Arduino based circuit and a 3D model. An effective blended pedagogy which will help the students to understand the designing concept and its implementation. Tinkercad is an open-source free -ware simulation tool hence it's possible to every student to practice lab work with it. In the situation where physical laboratory work was not possible, Tinkercad provided a helping hand for Teachers and students to perform practical virtually.*

Keywords: Tinkercad, Simulation Tool, Blended, Pedagogy, etc.

I. INTRODUCTION

To keep pace with the fast-growing technology blended teaching and learning tools play an important role in education. Tinkercad simulation tool helps Teachers and learners to overcome these obstructions and get acquainted to technology. Few important features of Tinkercad are:

1. Tinkercad is a free web/cloud-based software. It is used for 3D modeling, electronic circuits design & board simulation that helps beginners to start designing.
2. Tinkercad designs created are stored in your account and will be available in your account when login.
3. Tinkercad designs are automatically saved to your account as you work. Whenever you can return to your designs, you can tinker with them anytime from any internet enabled computer.
4. New Wire Options available in Tinkercad Circuits for example alligator.
5. Annotation i.e., Notes tool for explaining designs or provision for feedback.
6. Online Lessons and projects are available for learning and building your own projects.
7. Create your Tinkercad class by sharing class link or class code to join screen on home page.
8. Eleven built-in Libraries are available in Tinkercad as shown in figure 1.

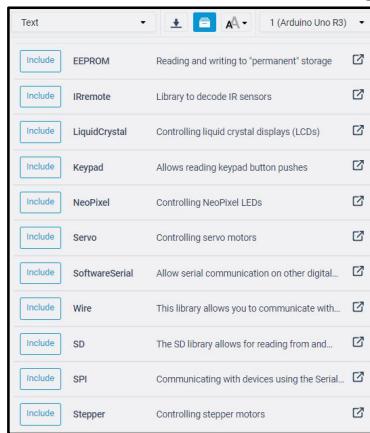


Figure 1: Eleven built-in Libraries available in Tinkercad

II. METHODOLOGY

This paper elaborates some examples of design and development of basic electronic circuits using Arduino, microcontroller and a 3D model. Basic circuit assemblies are also available like LED dimmer, multiple LEDs etc in Tinkercad. Sensors like temperature sensor, PIR sensor, tilt sensor, soil moisture & ultrasonic distance sensors are available for simulation.

Example 1: Relay interface with Arduino UNO board.

Components required are Arduino UNO, Function Generator, Multimeter, Transistor TIP120, Resistor-100 ohms, LED, bulb.

Algorithm for Relay interface with Arduino UNO board:

1. Assign Arduino UNO Digital pin no. 8 as output.
2. Turn ON relay to glow bulb.
3. Wait for 5 sec.
4. Turn OFF relay to switch OFF bulb.
5. Wait for 5 sec.
6. Repeat step 2.

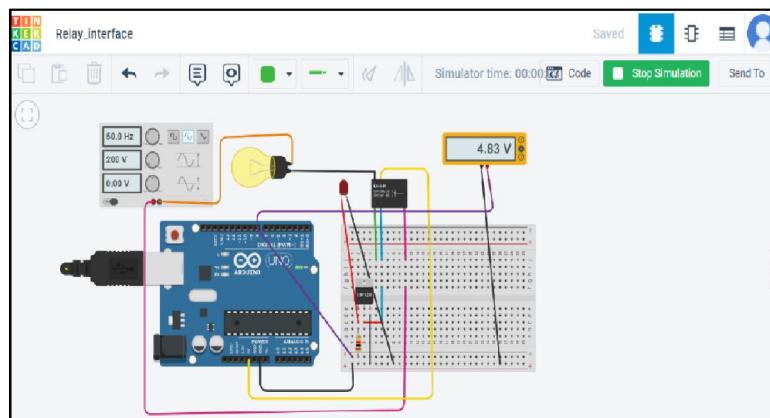
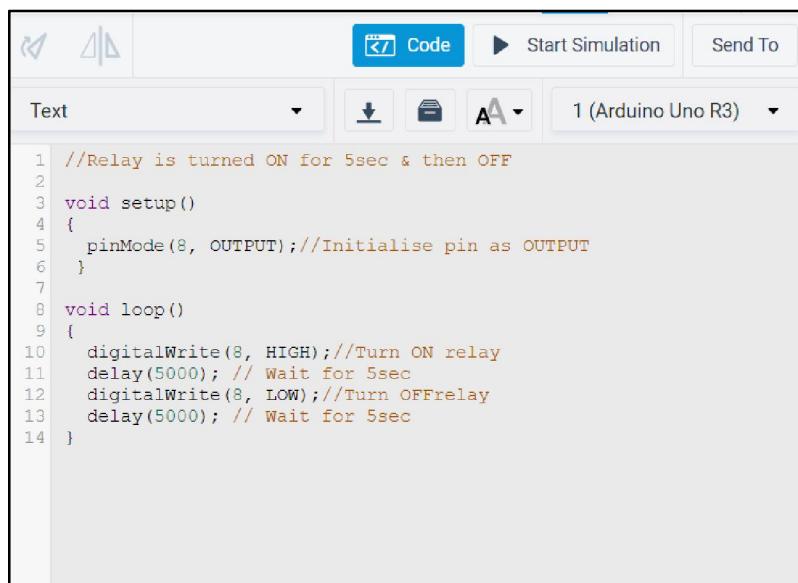


Figure 2: Example of Relay interface with Arduino UNO board.



```

1 //Relay is turned ON for 5sec & then OFF
2
3 void setup()
4 {
5   pinMode(8, OUTPUT); //Initialise pin as OUTPUT
6 }
7
8 void loop()
9 {
10  digitalWrite(8, HIGH); //Turn ON relay
11  delay(5000); // Wait for 5sec
12  digitalWrite(8, LOW); //Turn OFF relay
13  delay(5000); // Wait for 5sec
14 }

```

Figure 3: Code of Relay interface with Arduino UNO board.

Example 2: Robot hand using Arduino UNO board

In this example every individual Robot finger is controlled by servomotor. Robot hand is created using flex sensors. Flex sensor is a bend sensor which converts the motion of finger into corresponding change in resistor. Servo rotates each finger in Robotic hand.

Components required are: Arduino UNO, Servomotor, Flex sensors, Resistor-100 ohms and breadboard.

Algorithm for Robot hand using Arduino UNO board:

1. Assign fingers to servo.
2. Attach servo Thumb to Digital output pin no. 10 & servo Index finger to pin 11 of Arduino UNO.
3. Read information from flex attached to analog input.
4. Map flex output with servo minimum & maximum values.
5. Servomotor rotates.
6. Repeat step 3.

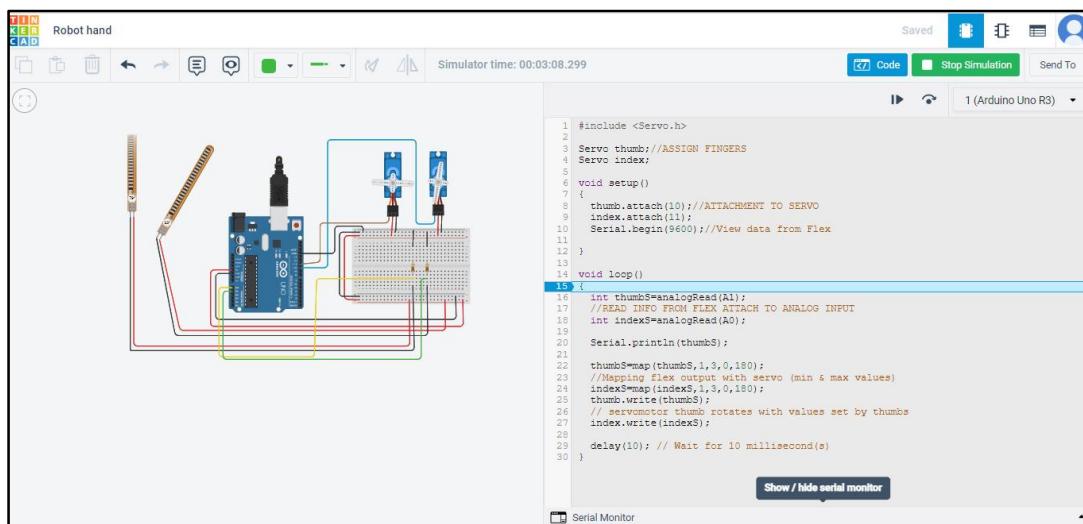


Figure 4: Example of Robot hand using Arduino UNO board with code.

Example 3: Temperature sensor with Arduino UNO

Components required are: Arduino UNO, LCD display, Temperature sensors TMP36, Potentiometer- 1 Kilo-ohms and breadboard.

LCD display is connected as shown in figure. Register select pin of LCD display is connected to D13 pin. Potentiometer is connected for contrast control.

Algorithm for Temperature sensor with Arduino UNO:

1. Include LCD library files.
2. Assign Liquid Crystal LCD pins (13, 12, 8, 9, 10, 11) for (rs, en,d7,d6,d5,d4) respectively and read/write pin to be grounded.
3. Set number of sixteen columns and two rows for LCD.
4. Measure Temperature by reading Temperature sensor input at Analog input pin A0 of Arduino UNO.
5. Mapping the ADC output: 0 to 1023 for 0 to 5 Volt range.
6. Select position of the cursor.
7. Display Temperature in Celsius.
8. Wait for some seconds.
9. Repeat step 4.

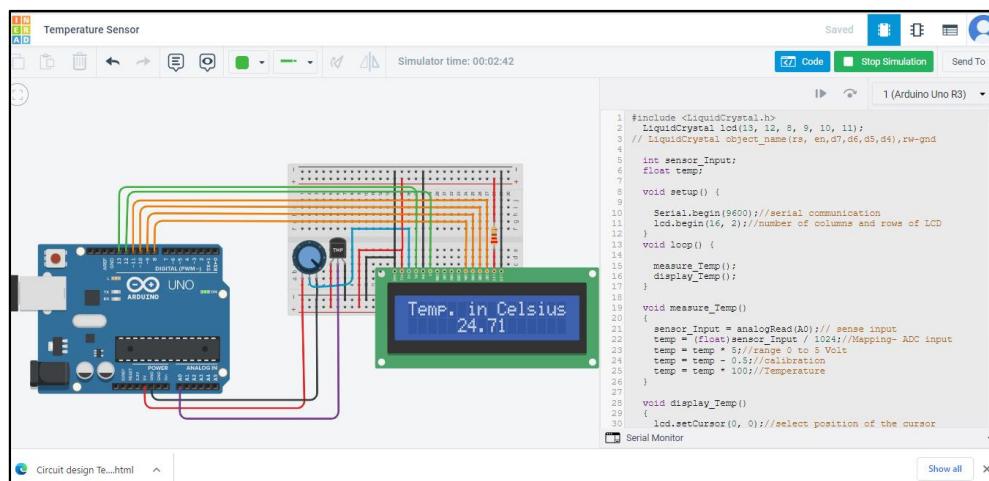


Figure 5: Example of Temperature sensor with Arduino UNO with code

Example 4: Microcontroller application

Microcontroller coding use two different approaches.

Block coding: Blocks code editor contains colored blocks that can be dragged and rearranged as per the program code.

Text coding: Text code is a regular style of coding.

Editor will automatically generate text-based code (C++) from blocks' code.

By switching the code view to (Blocks + Text) the logic of the block code is translated to C++ code.

Modifications made to the blocks code will instantly update in the text view, providing insight into the logic and syntax of C++.

Microcontroller boards—*micro:bit*

A pocket-sized computer with an LED light display, buttons, sensors and many input/output features, when programmed interacts with real world. The new micro:bit with sound adds a built-in microphone and speaker.

Coding & debugging- For micro:bit programming Python code or block coding is used. Debugging is done by adding breakpoints on the line number. When the cursor is placed on the variable its value in the program can be seen. To resume the simulation or step one line at a time a forward arrow button is provided on the upper side.



Figure 6: Example of Microcontroller board with python code

Example 5: 3D Modelling

Features available in Tinkercad for 3D modelling are

1. Shapes library with basic shapes, vehicles & machines, electronic parts, hardware, objects, structures & Scenery, creatures & characters etc.
2. Grouping, ungrouping, alignment, mirror etc.
3. Standard .OBJ, .STL, .glb file formats available for 3D printing.
4. .SVG file format available for laser cutting.

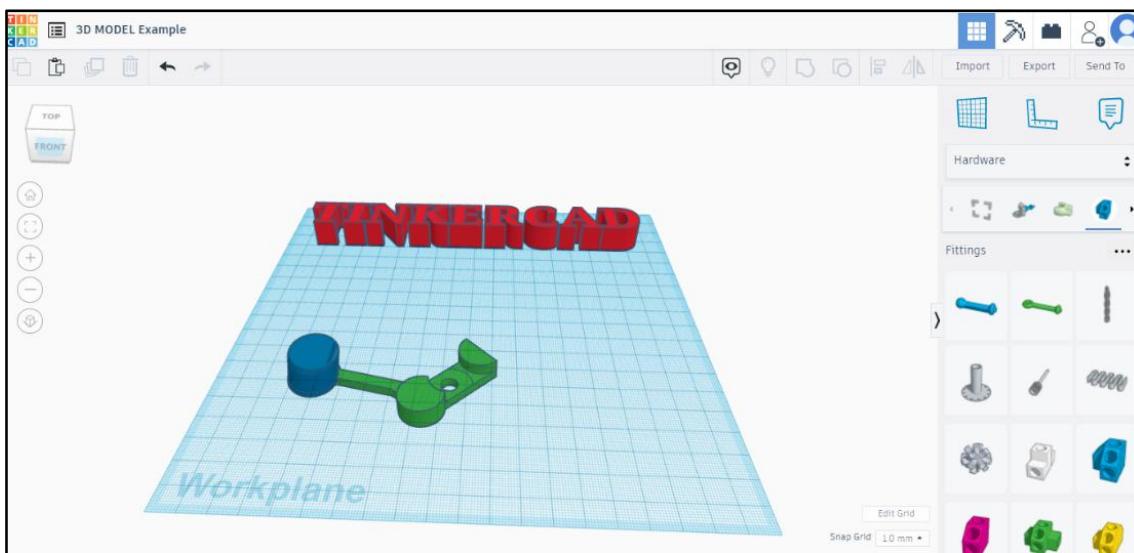


Figure 7: Example of 3D Modelling

Bridging 3D design & circuits: Electronic circuits can be embedded in 3D design for creating prototype or final product as shown in figure 8.



Figure 8: Example of Bridging 3D design & circuits

III. LITERATURE REVIEW

Selami et. al. [1] carried out study of students to find the use of Tinkercad to improve computational thinking skills and perceptions in computer programming education. They found students should be highly motivated by parents at home to increase frequency of using the software. Alex [2] in his book explained circuit simulation technique step by step in detail. Enjang et. al. [3] carried out study of online learning process of students and observed that students can independently or with some help can practice electronic circuits.

Radha et. al. [4] in his paper said the actual lab environment of Tinkercad simulation helps students to understand the concept. This simulation software is simple to work. Dr. Semin et. al. [5] in his research paper designed & developed Arduino based mobile application.

IV. RESULTS & DISCUSSION

In this study, Teachers & students are recommended to use Tinkercad software for electronic circuit learning, designing & creating.

This simulation software can be used for troubleshooting and 3D modelling for project work.

Tinkercad designs can be shared for public. By default, design in Tinkercad is considered as private. To share private designs between the users or students, design must be made first public to Tinkercad gallery. Then design can appear in Tinkercad Gallery search results. Public designs also include HTML code that you can use to embed your designs on a website.

V. CONCLUSION

Innovative teaching- learning methods should be used. Blended teaching- learning is the need of the education system. New simulation tools need to be explored. So, keep on discovering resources and technologies. Students should build skills by practicing and love learning.

ACKNOWLEDGEMENT

I appreciate the support from the Principal and Management of Y. B. Patil Polytechnic for motivating me for conducting various activities for both teachers and students to explore various options available in Tinkercad to help students effectively for designing the electronic circuits and projects.

REFERENCES

- [1] Selami ERYILMAZ and Gülanım DENİZ, Gazi University, Ankara, Turkey, "Effect of Tinkercad on Students' Computational Thinking Skills and Perceptions: A Case of Ankara Province", TOJET: The Turkish Online Journal of Educational Technology – January 2021, volume 20 Issue 1.
- [2] Alex Reyes, Electronic Circuit Basics with TinkerCAD 2, Digital Maestro Magazine digitalmaestro.org.
- [3] EnjangAkhmadJuanda*, Falah Khairullah, Universitas Pendidikan Indonesia Bandung, Indonesia, "Tinkercad Application Software to Optimize Teaching and Learning Process in Electronics and Microprocessors Subject", Advances in Social Science, Education and Humanities Research, volume 520, Proceedings of the 6th UPI International Conference on TVET 2020 (TVET 2020).
- [4] Radha Aburi, Manne Praveena, R.Priyakanth, BVRIT HYDERABAD College of Engineering for Women, Hyderabad, Telangana, India, "TinkerCad - A Web Based Application for Virtual Labs to help Learners Think, Create and Make", Journal of Engineering Education Transformations, Volume 34, January 2021, Special issue, eISSN 2394-1707.
- [5] Dr. Semin Kim & Prof. Hyung-Jin Mun, Korea, "Design and Development of a Self-Diagnostic Mobile Application for Learning Progress in Non-Face-to-Face Practice Learning", Applied Science 2021, 11, 10816.

Heart Failure Prediction Technique using Complex Event Processing

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Abstract: According to the WHO (World Health Organization) chronic diseases such as cancer, coronary heart disease, diabetes mellitus type 2, and chronic obstructive pulmonary diseases are among the world's most common diseases constitute because of this about 60% of all deaths occur in world. Here, we propose new health monitoring techniques to the prediction of heart failures. In this, we propose edge-computing based Complex Event Processing (CEP) techniques with the Remote Patient Monitoring (RPM) for the remote healthcare applications. This approach is based on the CEP it is combined with the statistical approach. For the extraction heart defects of patients C4.5 algorithm and, to the prediction of heart failure multilayer perceptron (MLP) model will be consider. First phase is to collects health parameters. Second phase is to process the collected data using an analysis rule. This proposed system continuously monitors heart patient and it predicts heart failures strokes based on the related symptoms. When a critical condition occurs then it alters patients and cardiologist.

Keywords: Heart Failures Prediction, C4.5, WHO, Remote Patient Monitoring and Multilayer Perceptron. etc.

I. INTRODUCTION

Real-time health data collection is very common nowadays. This data is processed by various signal processing and machine learning algorithms. The procedure of mining and reasoning are similar in different applications. Researchers and engineers working with real-time signals perform similar pre-processing and processing steps prior to derivation. The collected data can be used to get real-time offline multiple results of the condition of the patient [2]. However, the use of health is very limited, due to the processing of the network requirements of the infrastructure. The real health app requires real-time analysis of high-resolution sensor data as well as data from other sources. At the same time for many users and local processing of all the data on a single computer can be achieved by calculation constraints, reliability, recovery scalability, fault/power supply problems, etc. it is not practical.

Recently, there has been a great interest in optimizing algorithms and increasing the efficiency of the system through system implementation [3]. But these methods only suggest a solution to a particular problem. They include design decisions that are difficult to generalize due to certain assumptions in the problem. The application of these challenges requires the implementation of a dependent machining platform efficient enough to work under real-world hardware and software constraints. It also applies to commonly enough support problems at the same time. This work and the construction of this problem will solve the intelligent distribution of the computational load published contract scheme.

Symptoms can be detected when the readings are higher or lower than the threshold. Early detection of symptoms of heart failure can support the prediction of heart failure stroke and so they can be avoided. Therefore, the most important task is to define the "Accurate" threshold. The accuracy of the analysis depends strongly on the accuracy of the threshold used.

The cardiologist defines and updates the thresholds based on the measurements of the patient and the conducted interview with the patient [4]. In fact, cardiologists confirm that the values of the thresholds are not the same for all patients and can vary even for the same patients. As a result, there are two goals for this work. Firstly, propose a monitoring approach to remotely extract health parameters from patients suffering from heart failure. It will then define an analytical approach to automatically calculate and update the health threshold at the run time.

A smart home monitoring system for tracks vital signs in patients with CHF. The system collects vital signs (SpO₂, Electro Cardio Graph (ECG), Blood Pressure (BP), and Body Weight) and sends them to a hospital information system that is evaluated by a physician. The aim of this system is to reduce the number of face-to-face visits of each patient with help of CHF.

In this paper study about the Literature Review done, in section II, the Proposed Approach Modules Description, Mathematical Modeling, Algorithm and Experimental setup in section III and at final we provide a Conclusion in section IV.

II. LITERATURE REVIEW

Here we present the literature review of existing techniques:

Here, they present a review on the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) and guidelines of database search was conducted between 2005 and 2016. Key elements of the selected research-health care sub-areas, data mining techniques, types of data analysis, and data sources-provide a systematic view of development in this area they know that the existing literature is mainly examining the analysis in clinical and administrative decision making. The popularization of the electronic Karte in the clinical care is considered, the utilization of the data which the human produces are the mainstream. However, analysis-based websites and social media data have been on the rise in recent years.

The use of automatic devices for monitoring biological parameters in real time is an effective tool for improving the quality of life of patients. The integration of mobile communication with wearable devices has facilitated the transition from clinical-oriented monitoring to patient-oriented monitoring. This paper proposes a real-time monitoring system; this system is conceptualized for the providing an instrument for patients, with the help of which they can easily monitor, analyze and save their own vital signs using wearable sensors and Android devices such as smartphone or tablet, offering an effective solution in terms of decrease in time, human error and cost [2].

Storing information is also a problem due to a large amount of sensor data generated by each sensor. In this [3], they proposed the HEAL (Health Event Aggregation Lab) model that provides developers with services to use previously processed similar data and relevant identified symptoms. The proposed Architecture is cloud-based and provides services for input sensors, IOT devices, and content providers. The ultimate goal of the system is to fill the gap between symptoms and diagnostic trend data to accurately and quickly predict health anomalies.

In this paper, they propose real-time heart monitoring techniques, taking into account the cost, ease of use, accuracy, and security of data. The system is conceived to provide an interface between doctor and patients for two-way communication. The aim of this work is to assist remote cardiac patients in obtaining the latest medical services, which otherwise could not be possible due to the low doctor-patient ratio. The developed monitoring system is then estimated for 40 people (ages 18 to 66 years) using wearable sensors, the holding device (Fig. smartphone under the supervision of experts). Performance analysis shows that the proposed system is reliable and useful due to high speed [4].

In this, they presented PhysioDroid this technique provides personalized tools for remote monitoring and evaluation of user conditions [5]. The PhysioDroid system provides a comprehensive and continuous analysis of vital functions such as Heart Rate, Electrocardiogram, Skin Temperature, Respiration Rate, and Body Movement, it also helps to empower patients and improve clinical understanding. PhysioDroid consists of a wearable monitoring device and an Android application that provides the storage, collection, and processing of physiological sensor data. The versatility of the developed application allows you to use it for both ordinary

users and professionals, and the reduced cost of PhysioDroid makes it available to most people. To illustrate the capabilities of PhysioDroid, two examples of use for health assessment and sports training are presented.

The Complex Event Processing (CEP) uses an event-driven approach and correlates various sensor flows with spatiotemporal constraints to detect anomalies. This article presents CEP techniques which are CEP based Remote Health Monitoring System (CRHMS). The proposed CRHMS uses biosensors (Respiration Rate, Heart Rate, Blood Pressure, and ECG) to collect vital parameters and environmental sensors (Global Positioning System (GPS), Accelerometer) to identify the context of an elderly patient who is home alone. These sensor parameters are collected on the android phone and sent as a stream to this system to detect anomalies in vital signs and generate alerts [6].

Timeliness and flow processing are critical to justify the need to develop a new class of systems capable of processing not only general data but also event notifications from various sources to identify interesting situations with respect to the traditional Database Management System (DBMS). Accordingly various systems namely Information Flow Processing systems (IFP), have emerged and are competing in recent years. In this paper, they propose how semantic technologies can contribute to the field of complex events and explore their support in health monitoring. This approach combines the semantic web methodology and the CEP model in the health monitoring platform [7].

Advances in the development of medical devices and in widespread use the existence of networks of data transmission allow you to equip more patients' devices telemetering. As a result, the interpretation of the data collected is becoming increasingly complex. Medical observations are traditionally interpreted in two competing ways: using established rule-based theories and statistically (possibly leading to new theories). In this article, they learn a hybrid approach that allows both evaluating a fixed set of rules and coexisting with machine learning [8].

This article describes Wanda (Weight and Activity with Blood Pressure Monitoring System); a study that uses sensor technology and wireless communication to monitor health-related measurements of patients with CHF. The WANDA system is a three-tier architecture that consists of sensors, web servers, and server databases. The system was developed in conjunction with the UCLA School of nursing and the California wireless Institute of health for early detection of major clinical symptoms indicative of CHF-related decomposition [9]. This article presents an Edge-Computing-Based complex event processing (CEP) Architecture for remote patient monitoring (RPM), which is an important issue in the context of remote health [10]. In this architecture, the identification of complex events that may indicate impending health problems is performed on a mobile device that receives data from sensors attached to the patient's body. Identified a set of activities are sent to the hospital Server in the cloud for further processing. Modern technology used RPM for the mobile device as an agent of the gateway of the Internet of things to forward streams of sensor data to health on a remote server of the hospital where the detected complex event.

III. PROPOSED APPROACH

A. Problem Statement

Develop a health monitoring application that remotely extracts health parameters from patients which are suffering from heart failure disease. Second, we define an analysis approach that automatically computes and updates health thresholds values at runtime.

B. Proposed System Overview

The block diagram of the proposed architecture is shown in Figure 1 below. Detail description of this architecture: Congestive Heart Failure (CHF) occurs when the heart is unable to provide enough blood for a healthy physiological condition. CHF usually occurs when the heart tissue becomes ischemic due to blockage of the coronary vessels. The data used for data analysis is Linear Regression, Missing Enrollment Data, Search Signal, Clinical Data Security Projects, and Early Adaptive Alarm.

The proposed system including models such as server and data warehouse processing, pre-processing, characterization of extraction, classification of heart defects using C 4.5, prediction of heart failure using multi-perceptron model (MLP), the recommendation of treatment of patients as a gym, stress management level.

In this architecture, the threshold values are automatically computed by using statistical approaches. The generated thresholds depend on the patient state and his/her historical measurements. The idea consists of detecting heart failure symptoms and consequently predicting critical situations (i.e., strokes). Modules of this system architecture are given below:

- **Processing Servers and Storage:**

Here firstly stored data in a database such as Mysql, No-SQL. So, the history of patients is created.

- **Data Preprocessing:**

In data pre-processing stage, data is pre-processed and missing values of replace with threshold values or zero.

- **Feature Extraction:**

After data pre-processing, feature values of data are calculated using the principal component analysis techniques. The goal of PCA is to data reduction and ranking of high impact columns.

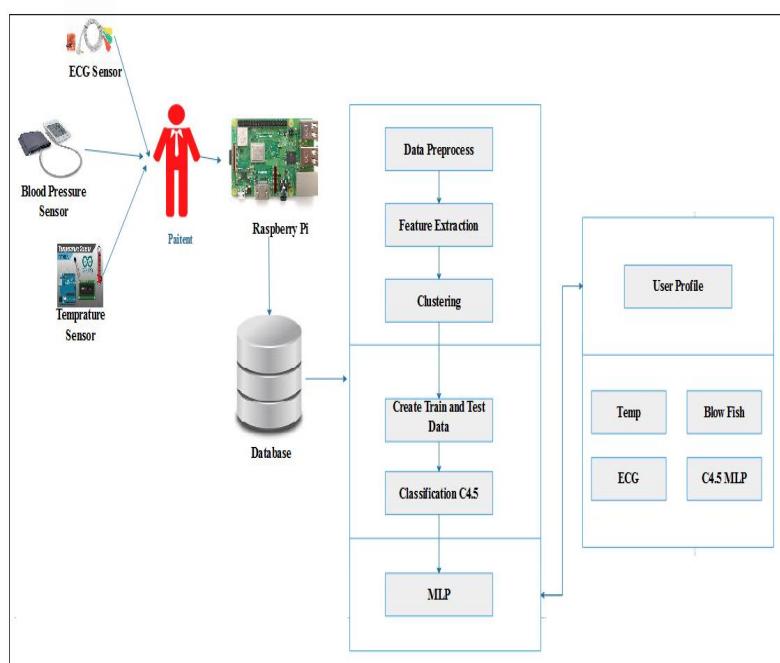


Figure 1: Proposed System Architecture

- **Classification of heart failures classes are detected using C4.5:**

After selecting highly impacted columns we extract features like weight, blood presser, body temperature and ECG. Then we are creating training, testing files using extracted features and perform classification using C4.5.

- **Prediction of Heart failures by MLP:**

Here, the classified data is provided as input MLP algorithm and prediction of heart failures is calculated using multi-perceptrons model (MLP).

- **Recommendation of treatment to patients:**

Finally, this system recommends treatment to patients like Gym, stress level management.

C. Algorithm

Algorithm 1: K-Means Clustering Algorithm

Let, $X = \{x_1, x_2, x_3, \dots, x_n\}$ be the set of data points and $V = \{v_1, v_2, \dots, v_c\}$ be the set of centers.

1. Randomly select 'c' cluster centers.
2. Calculate the distance between each data point and cluster centers.
3. Assign the data point to the cluster center whose distance from the cluster center i is minimum of all the cluster centers.
4. Recalculate the new cluster center using ' c_i ' where ' c_i ' represents the number of data points in the i^{th} cluster.
5. Recalculate the distance between each data point and new obtained cluster centers.
6. If no data point was reassigned then stop, otherwise repeat from step 3.

Algorithm 2: C4.5 Algorithm

Process:

1. Check for the below base cases:
 - i. All the samples in the list belong to the same class. When this happens, it simply creates a leaf node for the decision tree saying to choose that class.
 - ii. None of the features provide any information gain. In this case, C4.5 creates a decision node higher up the tree using the expected value of the class.
 - iii. An instance of previously-unseen class encountered. Again, C4.5 creates a decision node higher up the tree using the expected value.
2. For each attribute a , find the normalized information gain ratio from splitting on a .
3. Let a_{best} be the attribute with the highest normalized information gain.
4. Create a decision node that splits on a_{best} .
5. Recur on the sublists obtained by splitting on a_{best} , and add those nodes as children of the node.

Algorithm 3: Multi-Level Perceptron Model (MLP) Algorithm:

1. Initialize weights at random, choose a learning rate η
2. Until network is trained:
3. For each training example i.e., input pattern and target output(s):
4. Do forward pass through net (with fixed weights) to produce output(s)
 - a. i.e., in Forward Direction, layer by layer:
 - i. Inputs applied
 - ii. Multiplied by weights
 - iii. Summed
 - iv. 'Squashed' by sigmoid activation function
 - v. Output passed to each neuron in next layer
 - b. Repeat above until network output(s) produced
5. Back-propagation of error
 - i. Compute error (delta or local gradient) for each output unit δ_k
 - ii. Layer-by-layer, compute error (delta or local gradient) for each hidden unit δ_j by back-propagating errors (as shown previously)
6. Next, update all the weights Δw_{ij} by gradient descent, and go back to Step 4

The overall MLP learning algorithm, involving forward pass and back propagation of error (until the network training completion), is known as the Generalized Delta Rule (GDR), or more commonly, the Back Propagation (BP) algorithm.

D. Mathematical Model

Let, S be system such that, S = Let S be the system such that

$$S = \{I, P, O, Sc, Fc\}$$

Where;

I = Input of system

P = Process in system

O = Output of System

Sc = Success case of output of system

Fc = Failure case of output of system

I = {I₁, I₂... I_n};

Where;

I = Input dataset

Process: Collection of data from different sensor of patients' body part.

1. $P_1 = \{I_1\}$ // Read dataset

2. $P_2 = \{P_1\};$

$P_2 = \{P_{21}, P_{22}... P_{2n}\}$

Where, P₂ represent the set of features and P₂₁, P₂₂...P_{2n} are number of features.

3. **Pre-processing of data:**

In this section, data is converted into the CSV files.

4. **Feature Extraction:**

Here features are extracted.

5. **Moving Average (MA):**

$$\text{Simple MA } (t) = \frac{\sum_i^P \text{Values}_i}{P}$$

The Weighted Moving Average (WMA):

$$\text{Weighted MA}(t) = \frac{\sum_i^P (p - l) \text{Values}_i}{\sum_i^P (p - l)}$$

6. **Clustering:**

$$M_i^{t+1} = \frac{1}{|S_i^t|} \sum_{x_i \in S_i^t} X_j$$

Where each x_i is assigned to exactly one S^t.

7. **Classification:**

$$S = - \sum_{i=1}^k \{ [freq(c_i, S) / |S|] \log_2 [freq(c_i, s) / |S|] \}$$

Where, |S| is the number of cases in the training set, C_i is a class, i = 1, 2... k, k is the number of classes, freq(C_i, S) and is the number of cases in C_i.

8. **MLP:**

The two common activation functions are both sigmoids, and are described by

$$y(v_i) = \tanh(v_i)$$

and

$$Y(v_i) = (1 + e^{-v_i})^{-1}$$

The first is a hyperbolic tangent that ranges from -1 to 1, while the other is the logistic function, which is similar in shape but ranges from 0 to 1. Here, y_i is the output of the ith node (neuron). V_i is the weighted sum of the input connections.

IV. RESULT AND DISCUSSION

Expected Result: Table 1 shows that comparison between existing system C4.5 algorithm and proposed systemMLP algorithm. A proposed technique is more accurate than the existing techniques.

Table 1: Comparison of C4.5 and MLP Algorithm

Algorithm	Accuracy in %
C4.5	90
MLP	93

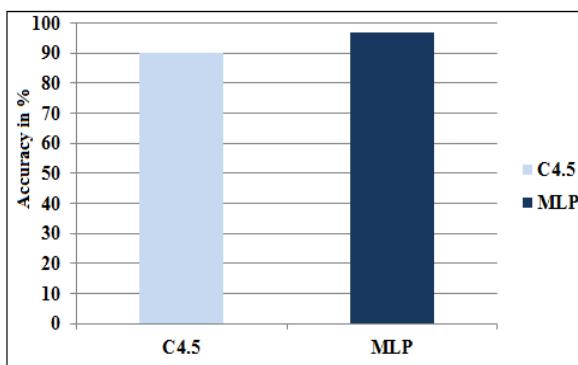


Figure 2: Comparison Graph of C4.5 and MLP Algorithm

V. CONCLUSION AND FUTURE SCOPE

In this, we present a new health monitoring techniques to the prediction of heart failures. In this, we develop edge-computing based Complex Event Processing (CEP) techniques with the Remote Patient Monitoring (RPM) for the remote healthcare applications. We firstly stored data in a database such as Mysql, No-SQL and history of patients is created. After that data is pre-processed and missing values of are replaced with threshold values or zero. Feature values of data are calculated using the principal component analysis (PCA) techniques. Here, extracted features are given to the classification using C4.5 algorithm and prediction of heart failures is calculated using multi-perceptron's model (MLP). This technique can be used to the prediction of heart failures of patients. Form score of the result it is recommended of treatment to patients like Gym, stress level management etc.

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The authors would like to thank the researchers as well as publishers for making their resources available and teachers for their guidance. We are thankful to members of the NCETEST-2022 conference, organized by Pimpri Chinchwad Polytechnic, for their constant guidelines and support. We are also thankful to the reviewer for their valuable suggestions.

REFERENCES

- [1] F.Alqadah, Ju. Hu and H. F. Alqadah,“Bioclustering Neighborhood Based Collaborative Filtering Method for Top-n Recommender Systems”, Knowledge Information System, Springer, [2015].
- [2] A. Javari and M. Jalili, “A Probabilistic Model to Resolve Diversity Accuracy Challenge of Recommendation Systems”, Knowledge Information System, volume-44, no.3, [2015].
- [3] Y.Rao, N. Zhang, and H. Zou, “Adaptive Ensemble with Trust Networks and Collaborative Recommendations”, Knowledge Information System, volume. 44, No. 3, PP. 663–688, [2015].
- [4] Gu.Xu, Do. Wang and Sh. Deng, “Exploring User Emotion in Microblogs for Music Recommendation”, Expert Systems with Applications, Volume-42, Page No.:9284–9293, Elsevier, [2015].

- [5] ShuiGuang DengJian Wu and Zhao Hui Wu, "Trust-based personalized service recommendation a network perspective", JOURNAL OF COMPUTER SCIENCE AND TECHNOLOGY, Volume-29, Page No-69–80, Springer, [2014].
- [6] S. Dhillon, Hsiang Fu Yu, and I. S. Dhillon, "Parallel Matrix Factorization for Recommender Systems", Knowledge and Information Systems, Springer, [2014].
- [7] Ha. Park, M. Ishteva, and R.Kannan, "Bounded Matrix Factorization for Recommender System", Knowledge Information System, Springer, [2014].
- [8] ShuiGuang Deng, Guandong Xu, and Longtao Huang, "Social Network Based Service Recommendation With Trust Enhancement"; Expert Systems with Applications, Volume 41, Issue 18, Pages 8075-8084, , Elsevier-15,[2014].
- [9] Kuan Zhang, EePeng Lim, and David Lo, "Mining Indirect Antagonistic Communities from Social Interactions"; Knowledge and Information Systems, Volume 35, Issue 3, pp 553–583, Springer, [2013].
- [10] BalazsHidasi and DomonkosTikk, "Initializing matrix factorization methods on implicit feedback databases"; Universal Computer Science, vol. 19, no. 12, [2013].

Web Personalization with Usage-Based Clustering

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Abstract:Information on World Wide Web has been filling in a remarkable way. This raises a serious worry on data over-burden difficulties for the clients. Recovering the most significant data from the web according to the client prerequisite has become hard on account of the enormous assortment of heterogeneous archives. One way to deal with beat this is to customize the data accessible on the Web as indicated by client necessities. This is called Web Personalization process that changes data/administrations conveyed by a Web to the necessities of every client or gathering of clients, taking their standards of conduct. Successive Sequential Patterns (FSPs) that are separated from Web Usage Data (WUD) are vital for dissecting and understanding clients' way of behaving to work on the nature of administrations presented by the World Wide Web (WWW). Client standards of conduct are expected to fabricate profiles of every client, it is made to utilize which Personalization of site.

Keywords: Data Mining, Web Mining, Web Usage Mining, Web Personalization, etc.

I. INTRODUCTION

Data on World Wide Web has been filling in a momentous manner. This raises a genuine concern on information over-trouble hardships for the clients. Recuperating the main information from the web as indicated by the client essential has become hard by virtue of the gigantic grouping of heterogeneous documents. One method for managing beat this is to modify the information available on the Web as shown by client necessities. This is called Web Personalization process that changes information/organizations passed by a Web on to the necessities of each client or get-together of clients, taking their principles of direct. Progressive Sequential Patterns (FSPs) that are isolated from Web Usage Data (WUD) are essential for taking apart and understanding clients' approach to acting to deal with the idea of organizations introduced by the World Wide Web (WWW). Client principles of lead are supposed to manufacture profiles of each client, using which Personalization of site is made.

Web Personalization gives clients through what they as a matter of fact need or essential, without asking or quest for it straightforwardly. It very well may be achieved by taking advantage of client's navigational lead, as uncovered through the handling of web use logs, and furthermore the client's attributes and solaces. In WUD, a visit by a client is logged for over a time-frame. The time stamp partnered through an exchange in this occurrence will be a period span which is fearless and focused on the exchange through the information pre-processing process.

Separated FSPs from WUD helps in understanding also, anticipating the clients' way of behaving, with the goal that the server execution might be worked on through web personalization procedures that understudy diminishes client's apparent inertness subsequently refining the greatness of Web conveniences, In this work, we investigate different FSP mining calculations to separate FSPs of a site for a period that differs from week by week to quarterly and perform investigation on nature of the FSPs to be further utilized in web personalization application.

II. DATA MINING

The application of data mining techniques depends on data types: Web content mining, web structure mining, and webusage mining.

Web Mining

Web mining is a data mining technique of exploring the information from the web as per user usage. Web mining is classified into following types:

i) Web Content Mining

Web content mining is a process of analyzing the content of web pages. It is used to identify the most frequently accessed information. It allows scanning of entire web to retrieve needed information from clustered pages and provide the same to search engines. Web content mining also helps to give high quality results to the users when required to search engines. Due to this it increases the productivity because of direct use of content mining of text and visuals.

ii) Web Structure Mining

Web structure mining deals with linking of different web pages which might be static or dynamic. The linking is through XML tags and hyperlinks.

iii) Web Usage Mining

WUM is a technique of identifying user preferences within a particular site. Depending on user access patterns i.e., which information the user access or search frequently, the user choices are identified. This is done through page references and session information of the user. Information is also collected from web server and application server tags. The patterns collected through WUM helps to understand the visitor's preferences. It also helps to organize the site efficiently and create a personalized view of the page or site to the user. Typical data sources for web usage mining are web structure data, web content data, user profile and weblog.

III. WEB USAGE MINING AND PERSONALIZATION

For realizing the more personalized, user friendly and business web services the essential tool used is Web usage mining. As we discuss above to avoid surplus of information on website web personalization is used. By using web usage mining based on web personalization we are able to identify needs and preferences of each user about web navigation. WUM is the process of discovering and interpreting patterns of user access to web systems by digging the data collected from the user and machine interactions. Typically, WUM system based on 4 layers:

1. **Data Collection/Tracking:** In this phase, user interactions are captured and acquired. In data collection phase, the data is collected from the web servers and from the information sent by the client. Packet which is sent across the network is also monitored. This data collection is used for personalization.
2. **Data Preprocessing:** In this phase, we find out from where the data is received. This information is collected from the session information. Techniques are used to filter the data and use it in the next stage.
3. **Pattern Discovery:** The discovered patterns are usually represented as collections of pages, objects, or resources that are frequently accessed by groups of users with common interests. To determine the effective marketing strategies and optimizing the logical structure of the website analyzing of the users, how website is accessed is critical. According to the patterns required for web personalization which corresponds to the interests of the user. At this stage by applying the learning methods we insist the construction of user models.
4. **Knowledge Post Processing:** This is the last phase where extracted data is evaluated and represented in the human understandable forms such as reports and visual techniques.

IV. PERSONALIZATION

Personalization who stores, collects, combines the information from transaction of sites, scrutinize the information and according to the result it produces the information for people who visit the website. Any action that adapts information or services provided by a website to the needs of user by taking advantage of the knowledge gained from the user's navigational behavior is web personalization. Web personalization's techniques are used by websites to send customized advertisements to the customers and recommendation of different products. It is used largely in marketing tactics to increase the ecommerce business.

Web personalization can be done in the following methods:

1. **Implicit:** Implicit personalization will be performed by system or web page based on the user behavior on the web.
2. **Explicit:** User will be able to modify the system using the feature provided by the system itself.
3. **Hybrid:** It is a combination of both implicit and explicit. A Web personalization system can offer a variety of functions. The personalization functions are: memorization, guidance, customization and task performance support. Each of these is examined in more detail below.

Memorization: This is the simplest form of personalization method where the system records and stores information about the user in its memory. For example, name and browsing history. The past history of the user is displayed without the further processing whenever the user returns to the site. Memorization is offered as complete personalization solution rather than a standalone function.

Guidance: It refers to make an effort to assist the user in getting the information the user is in search of and also provide the user with alternative browsing options.

Customization: It refers to modification of web page in terms of content, structure and layout in order to understand user's knowledge, preferences and interests. The main purpose is the management of information load for easy interaction of the user with the site.

Task Performance Support: Task performance support is a client-side personalization system which acts on behalf of the user. It is very similar to the adaptive learning systems used in educational models.

V. APPROACHES TO WEB PERSONALIZATION

During the evolution of the web, personalization has been recognized as a remedy to the information overload problem and as a means of increasing visitor loyalty to a Web site. Considering the importance of web personalization for customized services following are the approaches in brief:

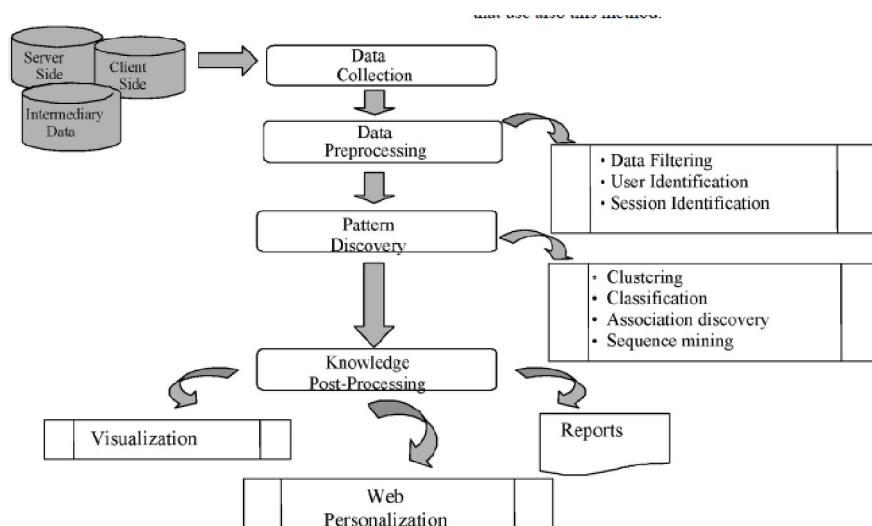


Fig 1: Web usage mining process

- a) **Manual Decision Rule Systems-** In this approach the designers design the web contents through different usermodel. Two examples from a wide range of products that adopt this approach are Yahoo!'s personalization engineand web sphere Personalization (IBM).
- b) **Content-Based Filtering Systems-** In this approach the users browsing patterns are analyzed and accordinglydifferent filtering systems are used. The personal preferences of the user are taken into consideration when the page is shown to him next time. These models can be used to filter news items according to each user's requirements.
- c) **Social or Collaborative Filtering Systems-** In this approach, a particular service of the website is personalized taken into consideration the ratings and the statistics information obtained from customer browsing. Most commonly used in amazon.com electronic shop. The Recommendation Engine (Net Perceptions) and web sphere personalization (IBM) are examples of products that use also this method.

VI. CONCLUSION

The dramatic development in the size of information in data assets, its confounded structure and the variety of client bunches utilizing it are increment the intricacy of web use. The weighty utilization of WWW as a data vault gives a ton of data Web log information. It has an inescapable significance in electronic climate. If we use this web log information insightfully, this will become one of the fundamental assets to depict client access conduct. These client qualities are as various leveledconstruction of related data.

Thisdata can be utilized for information mining errandsfor client standard of conduct investigation andin this manner tailor the site page contentsas indicated by the client inclinations.Web mining is the best gadget which candefinitely assist with trading the monstroussocial affair of data into important informationwhat's more, learning. Web use mining is one of thegenuine sub-locales of web mining, which is a utilizationof information mining frameworks to observe utilization plans from web data. A portion of the normallyinvolved advancements in web mining are clientaccess design examination, bunchingcharacterization and data separating.

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REFERENCES

- [1] Madhavi M.Mali,Sonal S.Jogdand, Deepali P. Shinde, "Web Personalization Using Usage Based Clustering", International Journal of Advanced Research in Technology, Engineering and Science (A Bimonthly Open Access Online Journal) Volume1, Issue3, Nov-Dec, 2014.ISSN: 2349-7173(Online).
- [2] Madhavi M.Mali,Sonal S.Jogdand, Deepali P. Shinde, "Personalized Look and Feel Through Web Usage Mining", International Journal of Current Research Vol. 7, Issue, 02, pp.12396-12399, February, 2015.
- [3] Kartik Menon and Cihan H. Dagli, "Web Personalization using Neuro-Fuzzy Clustering Algorithms", Smart Engineering Systems Laboratory University of Missouri – Rolla, 2003 IEEE.
- [4] D.Vasumathi, A.Govardhan, K.Suresh, "Effective Web Personalization Using Clustering", 2009 IEEE.
- [5] BamshadMobasher, Robert Cooley, Jaideep Srivastava, "Creating Adaptive Web Sites Through Usage-Based Clustering of URLs", IEEE.
- [6] Doddegowda B J, G T Raju, Sunil Kumar S Manvi, "Extraction of Behavioral Patterns from Preprocessed Web Usage Data for Web Personalization", IEEE International Conference on Recent Trendsin Electronics Information Communication Technology, May 20-21, 2016, India.

A Comparative Study on Internet of Things (IoT) and Its Applications in Smart Agriculture

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Abstract: Agriculture plays a vital role in country's economy and it has an extensive contribution towards human civilization. Due to the growing expansions in sensor devices, RFID and Internet protocols the architecture of Internet of Things (IoT) has been made to support agriculture by making a Smart agriculture. This paper describes the implementation of various IoT techniques and intelligent decision support systems used in agriculture. It provides a wide review on methods and technologies like ANFIS and PLSR Model predictions, experiences in various challenges as well as further work are discussed through the review article.

Keywords: Internet of Things, RFID-Radio Frequency Identification, ANFIS, PLSR, etc.

I. INTRODUCTION

Coping with agriculture and its demands are really a challenging one nowadays. Agriculture serves as the heart of Indian economy and half of the population in India survives because of agriculture. Farmer suicides up 40 per cent in a year, 1,2 Official sources said that the Agri-crisis was becoming worse due to poor rain and climatic conditions. From 2015 to till date farmers are suffering from severe scarcity and difficult to recover from drought.

The IoT is a technology which serves as a solution to the problem. It uses various sensors which is connected through internet and also with the integration to the satellites it does wonders in all sectors. It also uses various protocols by enabling the IoT to grow faster.

II. SYSTEM ARCHITECTURE

Agriculture plays a vital role in country's economy and it has an extensive contribution towards human civilization. Due to the growing expansions in sensor devices, Intelligent Systems and Internet protocols the architecture of IoT has been made to support agriculture by making a Smart agriculture.

The Figure 1. shows the overall architecture of the system of how IoT is involved in various agricultural activities. Each smart system uses different techniques and IoT serves as the central part of all the smart works. It includes sensor devices, protocols, satellite imaging, drones and gateways which are all connected different techniques and IoT serves as the central part of all the smart works. It includes sensor devices, protocols, satellite imaging, drones and gateways which are all connected to cloud servers.

Each developed system captures its down data's such as soil moisture, temperature, humidity, pH level, oxygen requirements are collected and appropriate decisions are taken. Still the system is enhanced by totally automating the agriculture thereby increasing the economy of country.

III. IOT IN AGRICULTURE

Irrigation Nowadays water scarcity is becoming very high and it has to be used efficiently. It is an important source for Agricultural development and thereby increasing the country's economy. A new technique called an automatic smart Irrigation decision support System (SIDSS in short) is anticipated to effectively manage and irrigate the Agricultural fields. The Irrigation estimate is done as a weekly basis.

So every week the soil characteristics, climatic conditions and weather predictions are calculated. To achieve the SIDSS two machine learning techniques such as ANFIS and PLSR are proposed. The implementation was done and tested by the human experts and other research scientists. Various sensors are used to implement the SIDSS. One among this is a Soil sensor which detects the different crops and conditions and the device is modelled with GSM/GPRS modem to gather information from various locations. The environment variables such as Rainfall, humidity, depth of water level needed etc. are given as input to the system. Measuring the Irrigation needed for agriculture is a challenging one. The irrigation varies from place to place in a field. So when and where how much of water is needed to irrigate has to be determined and it is done by ANFIS and PLSR techniques.

3.1 ANFIS and PLSR Model Predictions

The amount of water needed to irrigate the field is accurately predicted by ANFIS inference system which generates the fuzzy rules. The other technique which is used for predication is PLSR. It is a statistical method which is used to obtain the values of predictor variables ANFIS shows the better performance than PLSR to determine the water required for Irrigation. The experimental set up and the comparison of different sets of variables for the two machine learning techniques (ANFIS & PLSR) are shown. The soil moisture can be detected accurately by VWC sensors. Set of input variables which are necessary for the system is inputted and this process is done in a weekly basis.

Soil sensors detect the moisture level and its relative temperature is found. Three various VWC's are used to find the volumetric water content depth level. Experiments have been conducted in various regions such Spain and Murcia countries with the network of 45 agro-meteorological stations and other stations located in the zones where Irrigation is required. In this scenario continuous soil measurements is required to exactly predict the need for irrigation required for crops. Human experts are needed to compare the analysis of results of prediction to obtain the correct understanding of variables and crops. The historical information of the crops are maintained for further enhancements. In the case of new plantation which has not previous history of information VWC sensors are removed. Further research focuses on different regions and with several conditions.

3.2 IoT in Detecting Nitrate Level in Surface and Ground Water

Nitrates are a well-known pollutant which is found possibly in fruits, vegetables and especially water. It is a harmful one and when its concentration is increased above the expected level it can cause methemoglobinemia which is said to be a variation in blood with the presence of ferric ion.

It can cause many diseases in humans as well as plant and the basic cause is increase in nitrate level. Similarly, if the same nitrate is increased in ground water it affects the growth of plants and crops which ultimately affects the growth of Agriculture.

To overcome this a smart nitrate sensor is introduced to monitor the amount of nitrate which is present in surface and ground water. The system is well equipped with relevant devices such as planar inter digital sensor, instrumentation, and along with electrochemical impedance spectroscopy which reports the amount of nitrate in soil moisture.

The system is proficient and can measure the level of nitrate deliberations in the range of 0.01–0.5 mg/Liter in both the ground and also surface water. There are many different methods to identify the nitrate-nitrogen in water other than spectrophotometric method.^{3, 4,5,6} The sample of water from river, lake and also from ground water are collected and tested on a monthly basis for nitrate detection. Moreover the system is aimed to be developed at low cost. According to the Protection Agency, the suitable level of nitrate-N in drinking water is 10 mg/Liter.

Previous research work has shown good accuracy under different conditions. But there is a variation in temperature across fields at certain conditions. Hence the compensation of temperature effect is needed and it is done using temperature compensated sensor to calculate the nitrate level at low cost. The sensing system is linked with Cloud server which is based on IoT through a Wi-Fi connectivity. The experimental setup its performance and evaluation are shown in paper.⁵ Planar-type inter digital sensors⁷ have been used to identify the concentration of Nitrate in water.

The Nitrate is detected based on the variations in electric field which is generated. The temperature has a great impact on the ions which is found in water hence it is essential to quantify the varying temperature of sensor at different temperatures levels. The complete experimental set up of all devices required are shown, such as Hikoi 3522-50 LCR meter, SCIRO-GEX MS 7-H550 Digital Hotplate stirrer of Hikoi 4-terminal probe 9140, mercury thermometer, and computer for data gaining. Coming to the results and discussions of the paper various experiments have been conducted on (i)

The exact Measurement of Temperature –Same sensor can be used to measure the temperature of ground water and its resistance and reactance of the impedance are expressed in ohms(Ω). The result shows that there is an increase in temperature if impedance is decreased. (ii) Stream water Testing–Several tests have been done even with stream water samples. The concentration of nitrates in stream water has been analyzed using spectrophotometric method. (iii) The collected data has been sent to IoT cloud server. (iv) The Impedance measurement factor has been compared with the actual developed system and LCR. Moreover, various Improvements have been made on Temperature Compensation in the system. Finally, the developed system has shown good results in measuring and detecting the nitrate level in the sample water with the help of sensing devices and spectrophotometric method.

3.3 IoT Imprecision Agriculture and Ecological Monitoring

This paper reviews on building a precision agriculture and monitoring the ecological factors based on IoT. Various sensor nodes are utilized and deployed in addition to IoT Protocols and tools. The proposed system can be executed using different platforms and cloud technologies. In the past years monitoring the maritime environment has become a challenging factor. Nowadays the environment is highly polluted due to small particles, use of plastics, human wastes, and litter and greenhouse gases. The increase in pollution thereby increases the acidity in oceans, obstructing the marine life etc. The goal of the project is to control the pollution and improving the agriculture by monitoring the ecological factors.

3.4 Prediction of Precise Agriculture

The overall system is made to support smart Irrigation, smart pests controls by monitoring the health of plants thereby leads the way to smart spray of pesticides. In our scenario a grape vineyard is taken and infected parts of the field are identified by the help of drone. The information about the relative humidity, temperature, ultra-violet radiation are collected every 15 min. The developed system requires remote sensing technologies and IoT, Cloud servers, intelligent systems and agricultural experts. The IoT nodes are located at various places across the field which collects the appropriate information and retransmit the information back to servers. The drones catch the images from field very precisely or by satellite imaging methodology. The IoT nodes have the capability to send data to cloud directly based upon the captured image, decision can be made to spray the pesticides only in affected parts of the vineyard. The Figure 2 represents infection caused by plasmopara viticola grape. Mainly this particular infection caused during summer period.

3.4 Mariculture and Ecological Monitoring

The environmental protection agency (EPA) of Montenegro was well known from the year 2008. The aim of EPA is to continuously monitor, control and reduce the pollution in the Environment. The important factors such as temperature from sea and air, humidity, Oxygen level at different locations are tested in a periodic basis. Precise digital images are captured using drones and the image is sent to cloud server and it can be retrieved from cloud at any time by the agricultural expert. The IoT platform is configured with IoT nodes and sensor data's are described in the complete description is shown in detail. The below diagram shows the prediction of ecology with the help of smart devices and cloud computing. The topmost part of the diagram shows the towers connected and it interacts with cloud which is connected to users. The IoT nodes are located in the farms at particular locations which has direct access to cloud servers.

- The IoT nodes can collect information's and send to cloud directly. In Figure-3, the ecological Monitoring system finds the pollution in the fertile land. The IoT is literally helping for communicating with each

IoT Machine to collect the polluted data. The users can specify the area coverage to capture the images and it is intelligently done by drones and field cameras. The expert can access the images from cloud using smart phone app or tablets. Each specific nodes and devices communicated through API's. The developed system is deployed in private cloud

- The IoT nodes are designed using Arduino, Raspberry Pi. It achieves good quality attributes such as reliability, scalability, availability and performance. The system is evaluated in three lemon trees of south east part of Spain and best results are noted.

3.5 IoT in Secure User Authentication

Coping with agriculture and its demands are really a challenging one nowadays. Agriculture serves as the heart of Indian economy and half of the population in India survives because of agriculture. Farmer suicides up 40 per cent in a year, Official sources said that the Agri-crisis was becoming worse due to poor rain and climatic conditions. From 2015 to till date farmers are suffering from severe scarcity and difficult to recover from drought. The IoT is a technology which serves as a solution to the problem. It uses various sensors which is connected through internet and also with the integration to the satellites it do wonders in all sectors. It also uses various protocols by enabling the IoT to grow faster

3.6 BAN and AVISPA Logic for Privacy and Security

In agriculture various parameters related to climate such as CO₂, soil moisture, acidity humidity, temperature is collected and stored as a dataset. Any kind of changes such as inserting, deleting, updating of original data by unauthenticated persons may lead to great loss for the farmer as well as the crop which in turn affects the country's growth. So, an authentication method has to be developed for security as well as privacy. In this regard a Burrows-Abadi-Needham (BAN) logic is used to ensure that the exchanged information is trustworthy or not and then simulated using AVISPA (Automated Validation Information Security Protocol application) which is a push button tool to specify the security properties. The survey says that although there are various authentication mechanisms developed, they all lacks in any one aspect as in one aspect as in IoT.^{8,9,10,11,12} The WSNs are widely used as a sensor node with restricted storage capacity. In 2009,¹³ still the system is expanded and freed from security issues by the name Das's scheme and it lacks in finding insider attacks and then it is further improved. Later in 2010, Khan et al discover the security issues from Das's scheme such as lack of mutual

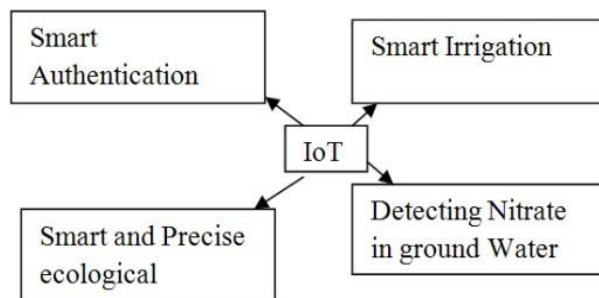


Figure 1: Architecture of IoT in agriculture

Authentication etc. A new mutual authentication method has been adopted to overcome the security threats. Still in 2012 it has been found that the system has various attacks such as stolen attack and impersonation attacks. Even after developing a authentication protocol the system is not able to resist with malicious insider attacks.¹⁴ Even in the years 2014 the authentication scheme doesn't provide good results due to spoofing attacks.^{15,16} In 2016, a remote authentication scheme with WSN's are developed which minimized the issues and attacks found in previous reviews. A fine protocol was developed with BAN and AVISPA tool which overcomes all types of attacks. The various qualities of security are achieved in this scenario. (i) Confidentiality (ii) Integrity (iii) Strong user and mutual authentication (iv) Security and privacy in contradiction to any type of attacks. The proposed scheme is implemented as different phases like (i) setup phase (ii) registration phase(A unique ID &

Password will be generated) (iii) login /authentication phase(A random number will be generated) (iv) Session key agreement phase.

3.7 Phases

AVISPA and BAN logic is implemented in various phases. Furthermore, perfect and even formal security analysis can be done using widely-recognized AVISPA (Automated Validation of Internet Security Protocols and Applications) tool, and ensures that the proposed scheme is secure against both passive and active attacks including the replay method and man-in-the-middle attacks. More security functionalities (confidentiality, Integrity etc) along with reduced computational costs for the mobile users make the system more suitable for the real-world applications as compared to Tsai–Lo’s scheme and other connected schemes. Authentication and validation scheme should be designed using the efficient cryptosystems and other security standards to support secure mutual authentication and user secrecy without using SSL. The Figure 4 shows that the authentication scheme is implemented with the BAN & AVISPA logic. Various sensors such as ph sensor, oxygen sensor, and moisture sensor are used, through the access point which is connected to base station are communicated with cloud. The system is free from security threat and it achieves good quality parameters.

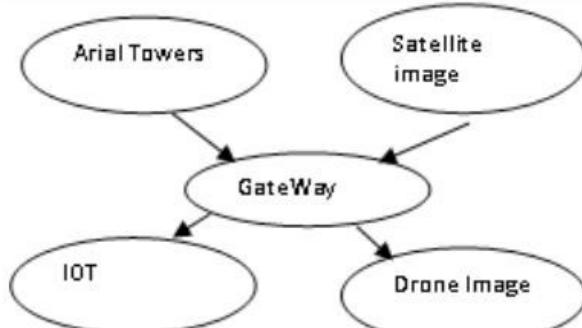


Figure 2: IoT in ecological Monitoring

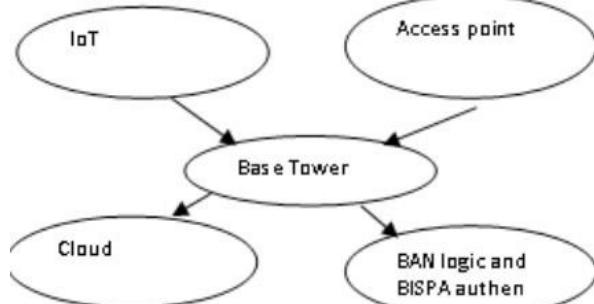


Figure 3: Smart authentication in Agriculture.

IV. BENEFITS AND FUTURE ENHANCEMENTS

The agriculture is getting automated day by day by simplifying the work of farmers and optimizing the crop production. On the IoT in agriculture works by collecting information from soil, humid level, and temperature monitoring is easy and can be done in a regular basis which is helpful in predicting the ecological factors. The Mari culture can also be improved in this scenario. IoT together with cloud can improve the efficiency of country's production. Since water scarcity is becoming high, using this system the water is highly conserved

V. FUTURE ENHANCEMENTS

From the above information collected from various researches the work can be further extended in two broad ways. (i) Few parameters such as reliability, scalability can be improved and the open source programming languages such as R and python could be used as a program.¹⁷ The development of smart Irrigation system could be implemented in other plantations such as citrus crops and analyzing the performance. The data set can be still increased to improve the accuracy of the system In authentication scheme further complexities of the protocol are reduced without compromising security features. The entire work can be even merged with cloud computing environment.¹⁵ From the previous work some of the new decisions can be made in crops. There are sensors which can do amazing things in the agriculture. The country lacks in good agriculture and it could be made still smart. The data set is maintained for every smart work in agriculture and can be used for further reference.

Using drone with all the weather and temperature information the type of crop which has to be planted in agriculture can be found. Which crop suits to which environment, that historical information can be found and send to agricultural experts? With those data he can plant new crops. Also if the field has the capability to grow by spreading the seeds. It can also be automated. A new device may be invented and made to spread the seeds across fields based on soil type information. And if the climate is changed it can also be intimated through intelligent systems so that some different seeds can be speeded. Big data plays a great role in maintaining the dataset for weather information, soil type characteristics, based on the data collected the seeds can be thrown by agricultural experts or by drone like device to spray the seeds. Another important challenge is that the research has shown that the type of fertilizer can be identified for a particular soil. Similarly in future the type of pesticide to be sprayed across the field based on the crop can be identified in advance to save the plants. Those data's such as type of soil, crop type to be planted and the appropriate pesticide and fertilizer can be structured as a dataset.

Year	Research work on	Technologies /Devices Used	Outcome
2015	Wireless Sensor Networks(WSN) for agriculture: The state –of-the-art in practice and future challenges	Wireless Communication Technologies- Zigbee, GPRS/3g/4g modules , Wi-Max, Wi-Fi, Bluetooth and Various Sensors (Soil moisture Sensor, Temperature Sensor and other electronic devices are used.	Increase in Cost , Scalability has to be improved.
2016	A Decision Support system for managing irrigation in agriculture	PLSR (Partial Least Square Regression)and ANFIS (Adaptive neuro Fuzzy Inference Systems) machine learning techniques used	Good performance, Accurate Prediction of field related information.
2017	Architecting an IoT-enabled platform for precision agriculture and ecological monitoring	Sensors for data collection, Web portal implementation using PHP and laravel framework, Paas cloud deployment, drone for capturing images. Arduino and Raspberry Pi is used.	Accurate and regular monitoring of precision agriculture, aquaculture and monitoring various ecological factors, and very precise image taken by drone.
2017	A Temperature Compensated Smart Nitrate-Sensor for Agricultural Industry	Spectrophotometric method along with a planar type interdigital sensors are used to detect the nitrate level in soil, Arduino Yun has been used to produce sinusoidal volt and soil and temperature sensors has been used.	Portable, Linear across different nitrate levels, Performance improved with this method.
2017	A secure user authentication and key-agreement scheme using wireless sensor networks for agriculture monitoring	Wireless Sensor Networks based on IoT and BAN (Burrows-Abadi-Needham) and AVISPA tools are used for protocol validation.	Highly Secured, Cost is reduced
2017	Measuring Macro Nutrients Of The Soil For Smart Agriculture In Coconut Cultivation	Macro Nutrients such as Nitrogen(N),Potassium(P),along with that phosphorous(K) are collected deficiency level is identified using data forwarding algorithm	Improved Productivity Cost and time is also saved.

REFERENCES

- [1]. Farmers' suicides in India Wikipedia, the free encyclopedia.
- [2]. Kellman JL, Hillaire-Marcel C. "Evaluation of nitrogen isotopes as indicators of nitrate contamination sources in an agricultural watershed," Agriculture, Ecosyst. Environ. 2003;95(1):87-102.
- [3]. Alahi EE. Student Member, IEEE, Li Xie, Subhas Mukhopadhyay, Fellow, IEEE, and Lucy Burkitt,"A Temperature Compensated Smart Nitrate-Sensor for Agricultural Industry". 2017;1:7333-41.

- [4]. Dymond J, Ausseil A-G, Herzig PR A, McDowell R. "Nitrate and phosphorus leaching in New Zealand: A national perspective," New Zealand J. Agricultural Res. 2013;56(1):49-59.
- [5]. Yan-e YD. Design of Intelligent Agriculture Management Information System Based on IoT Fourth International Conference on Intelligent Computation Tech nology and Automation. 2011;1:1045-9.
- [6]. Xiangyu Hu, S. Q. (n.d.). IOT Application System with Crop Growth Models in Facility Agriculture. IEEE 14.
- [7]. Rifaqat A, Arup KP, Saru K, Marimuthu K, Mauro C. "A Secure Authentication and key aagreement scheme using WSN for agriculture Monitoring". 2017;1:1- 16.
- [8]. Li X, Niu JW, Ma J, Wang WD, Liu CL. Cryptanalysis and improvement of a biometrics-based remote user authentication scheme using smart cards. Journal of Network and Computer Applications. 2011;34(1):73-9

Enriching the English Language Skills of Students from Vernacular Mediums

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Abstract: The present research paper aims at enriching the English Language Skills of Students across India. It has been observed that there is a great demand for Indian professionals around the world. Every year thousands of students enter the vocational arena as job seekers. India has always taken an initiative in achieving excellence in education, technology, agricultural and industrial development at the national as well as international level. In today's global situation, these students, not only require subject knowledge but also need to develop English language skills and soft skills to accelerate in academic and professional life. Every year these students, some from vernacular medium schools and with vernacular speaking backgrounds strive hard to match the standards of other English medium school students. It becomes essential for them to improve their communicative competence which is reflected in their demeanor and behavior. In such situations, the role of teachers who teach English language becomes challenging. The paper tries to explore challenges faced by the English teachers in teaching students from vernacular mediums and also offers few techniques or strategies which may help them to improve their English Language Skills.

I. INTRODUCTION

Communication is exchanging or sharing information mutually and over a platform. This is one of the most sort after skills for any individual to survive in society and be recognized for his or her academic and professional competence. Students acquire subject knowledge both theoretical and practical during their tenure in academic institutions. This acquired knowledge should fetch them good social and economic recognition. Hence, they have to exhibit their knowledge to the world through their skill of communicating and exhibiting their ideas on a wider platform. Moreover, good communication also builds a good relationship with people in the profession field and is also very important for career development.

It is rightly said that good communication skill is an application of knowledge. Language is a tool of communication and to cater to a wider audience internationally the language used should be of the masses. English has over the years has been used as a tool for communication nationally as well as internationally. Hence to improve communicative competence in the current globalized environment students should be well versed with communicating in English. Communicative competence is nothing, but it is one's capacity to use language effectively and appropriately. Lack of English Language Skills can become an obstacle in the development of personal as well as professional development of an individual. It may be noted that students from vernacular mediums face more difficulties in expressing themselves and sharing their knowledge. Therefore, it can be said that English Language Skills has a great significance in getting jobs and expressing knowledge with confidence. Enriching students with English language communication is more challenging for the teachers than the students. The main objective of this study is to focus on the tools and methods to develop and improve language skills of professionals in the country by correlating growing needs of the industries with the academic input.

The initiatives taken by the various universities and boards is to develop task-based activities and exercises are meticulously planned in the curriculum to develop and improve the language skills of the students and provide them with a more interactive platform.

II. CHANLLENGES FOR THE ENGLISH TEACHING FACULTY IN COLLEGES

The *National Commission on Education – 1964-66* described English as ‘a library language’ and a language of higher education. This library language over a period of six decades has become a language of schools and higher education. But the students demand equal stature and recognition as per that given to any technical or vocational subject. But students do not give the subject its due by neglecting achieving expertise in it like any other skill or technical course. This is the main hurdle and a shortcoming on the parts of students. They do not realize that the tool to achieve technical expertise is first learning the language it is delivered in. Therefore, the attitudes of such students need a paradigm shift.

English language as a profession needs to be planned for complementing other Indian languages in a diverse and multilingual country like India. However, meeting the social demand for upward mobility is seen as a major challenge given the diversity in curriculum planning and implementation. Typology of higher education institutes and the quality of English language teaching could be seen as the determinants of English language environment in schools and colleges.

III. SUGGESTIONS FOR ENRICHING LANGUAGE SKILLS AND SOLUTIONS FOR CHALLENGES

English as a language is one of the most popular languages across the globe. While propagating the use of English in schools and colleges one important point to be noted is the peer pressure associated with it. This is due to the discomfort associated with English. It is seen that students while interacting with each other are mostly comfortable communicating in their mother tongue.

So, the cultivation of English should be at the grass root level and then and then only the fear associated with it will evaporate. Also, extracurricular activities like debates elocutions etc. should be promoted in Institutes with credits attached to the which will encourage students to participate in these activities. The students should realize that a linguist is a person with exceptional logical skills and Intelligent quotient. The greater number of languages you learn the better will be your logical thinking.

The teachers have to take efforts with little more patience when dealing with multilingual surroundings. They have to play the roles of guides, counsellors and facilitators to the students making them continuously realize the importance of English communication skills in their academic, professional and social life.

IV. CONCLUSION

Nowadays, competency in English language is the need of the hour due to globalization. Therefore, it is an important tool to deliver technical education effectively. The stigma attached to English is a deterrent to the students in owning the language. The students should Endeavor to acquire language skills effectively and efficiently. Both aspects can make students proficient in personal life and professional life. The language teachers should choose a practical approach of teaching English with pre-designed ways.

To conclude, it becomes essential for all the students, teachers, higher education institutes and to come together and take responsibilities of developing interest for learning English. They should put all efforts together to enrich English language skills.

REFERENCES

- [1] Nagaraj, Geetha. 2008. English language teaching: Approaches, methods, techniques. OrientBlackswan, New Delhi, 2008.
- [2] Patil, A. S. 1997. Engineering and technical education in India – current issues andtrends. Proc. 1stAsia-Pacific Forum on Engineering and Technology Educ., 1997,Melbourne,Australia, pp.172-174.
- [3] Pathak, B. V. 2000. Communication skill: Communication and grammar. Pune: NiraliPrakashan.
- [4] AICTE. Model Curriculum, <http://www.aicte.ernet.in/aictc/ee3.htm>
- [5] <http://www.dte.org.in>
- [6] <http://www.msbte.com>
- [7] Meganathan, Ramanujam. (2020). Research in English Language Education in India. 57. 7-74.

A Review of Non-Premixed Combustion Models: Study and Comparison

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Abstract: The present work gives information about development in field of non-premixed combustion focusing on various models developed for non-premixed combustion. Key aspects of non-premixed combustion such as ignition, extinction and lift-off are first analysed and then summarised. The review also outlines the various CFD modelling approaches that have been carried out for validating the result that has been experimentally found out. This study will help in understanding the modelling of non-premixed combustion.

Keywords: Fatigue Life, Resistance Spot Welding, Finite Element Analysis, etc.

I. INTRODUCTION

Combustion is important in many engineering applications; combustion of hydrocarbons is still by far the most common source of energy in the world. Computational fluid dynamics (CFD) is to predict the fluid behavior numerically such as the motion of fluids when they are mixed with each other. There has been a drastically increase in use of computation-based tools to model industrial processes within the chemical, metallurgical, and power generation industries. Combustion problems involve a series of coupled phenomena, such as fluid dynamics, heat transfer and chemical kinetics of gaseous species and soot. Chemical reactions directly affect the temperature and chemical species fields and, therefore, the heat transfer, which is interdependent with the temperature. Therefore, an accurate description of the chemical reactions and the heat transfer mechanisms is of great importance for simulations of combustion systems.

On the other hand, within the realm of Reynolds Average Navier–Stokes (RANS) models, modeling chemical kinetics is a difficult task due to the highly nonlinear dependence of average reaction rates on the fluctuating temperature and species fields. Eaton et al. (1999) provided a comprehensive revision of the commonly used Computational Fluid Dynamics (CFD) models for non-premixed combustion. The models are generally based on the conservation equations of mass, momentum, energy and chemical species, while the problem closure is achieved by turbulence models such as the k-ε (Lauder and Sharma, 1974; Launder and Spalding, 1972) or the k-ω (Wilcox, 1988).

Several combustion models are available, such as the Arrhenius finite-rates, the Eddy Dissipation Concept (Magnussen and Hjertager, 1976), the Eddy Break-Up (EBU) (Spalding, 1971), or a combination of some of these models, such as the EBU/Arrhenius. The more recent flamelet-based models (Liew et al., 1981; Williams, 1975) are also very popular, such as the Steady Laminar Diffusion Flamelet (SLDF) (Peters, 1984, 1986) and the Flamelet-Generated Manifold (Gicquel et al., 2000; Pierce 2001; Pierce and Moin, 2004; Van Oijen and De Goey, 2000, 2004) models, among others.

II. MATHEMATICAL FORMULATION

[1] Mass Conservation

The Continuity equation can be written as

$$\nabla \cdot (\bar{\rho} \tilde{u}) = 0 \quad \dots \dots \dots (1)$$

Where $\bar{\rho}$ means the density of mixture and \tilde{u} is the mean velocity vector.

Momentum Conservation

The equation of motion for fluid flow is given as

$$\nabla \cdot (\bar{\rho} \tilde{u} \tilde{u}) = -\nabla \tilde{p} + \nabla \cdot \left(\mu \left[\nabla \tilde{u} + (\nabla \tilde{u})^T - \frac{2}{3} \nabla \tilde{u} I \right] \right. \\ \left. - \mu_t \left[\nabla \tilde{u} + (\nabla \tilde{u})^T \right] - \frac{2}{3} \bar{\rho} \tilde{k} I \right), \quad \dots \dots \dots (2)$$

Where \tilde{p} is the time-averaged total pressure, μ is the gaseous mixture dynamic viscosity, t is the eddy viscosity and I is the unity identity tensor?

[2] The $k - \varepsilon$ model

The equations for the mean turbulent kinetic energy, \tilde{k} , and its mean dissipation rate, $\tilde{\varepsilon}$, are

$$\nabla \cdot (\bar{\rho} \tilde{u} \tilde{k}) = \nabla \cdot \left[\left(\mu + \frac{\mu_t}{\sigma_k} \right) \nabla \tilde{k} \right] + G_k - \bar{\rho} \tilde{\varepsilon}$$

and

$$\nabla \cdot (\bar{\rho} \tilde{u} \tilde{\varepsilon}) = \nabla \cdot \left[\left(\mu + \frac{\mu_t}{\sigma_{\varepsilon}} \right) \nabla \tilde{\varepsilon} \right] + C_{\varepsilon 1} \frac{\tilde{\varepsilon}}{\tilde{k}} G_k - C_{\varepsilon 2} \bar{\rho} \frac{\tilde{\varepsilon}^2}{\tilde{k}} \quad \dots \dots \dots (3)$$

Where G_k is the term that controls the generation of the turbulent kinetic energy due to the average velocity gradients, $C_{\varepsilon 1}$ and $C_{\varepsilon 2}$ are the constants that control the production and destruction of the dissipation rate of the turbulent kinetic energy, respectively, and σ_k and σ_{ε} correspond to the turbulent Prandtl numbers to \tilde{k} and $\tilde{\varepsilon}$, respectively. The constants of the model are $C_{\varepsilon 1} = 1.44$ and $C_{\varepsilon 2} = 1.92$ found out by experiments.

The term G_k is modeled according to the Boussinesq hypothesis

$$G_k = \mu_t * \tilde{S}^2 \quad \dots \dots \dots (4)$$

Where \tilde{S} is the module of the tensor of the average strain rate, such that

$$\tilde{S} = \sqrt{2 * \widetilde{S_{ij}} * \widetilde{S_{ij}}} \\ \widetilde{S_{ij}} = \frac{1}{2} [\nabla \tilde{u} + (\nabla \tilde{u})^T] \quad \dots \dots \dots (5)$$

The eddy viscosity, μ_t , in turn, is calculated by a secondary algebraic expression, combining $\sim k$ and $\sim \varepsilon$, given by

$$\mu_t = \bar{\rho} C_{\mu} \frac{\tilde{k}^2}{\tilde{\varepsilon}} \quad \dots \dots \dots (6)$$

Where C_{μ} is a constant of the model.

[3] Energy Conservation

Assuming Lewis number to be unity i.e., the thermal diffusivity to be equal to mass diffusivity we obtain the following relation.

$$\nabla \cdot (\bar{\rho} \tilde{u} \tilde{h}) = \nabla \cdot \left[\left(\frac{f}{c_p} + \frac{\mu_t}{Pr_t} \right) \nabla \tilde{h} \right] + \tilde{S}_{rad} \quad \dots \dots \dots (7)$$

Where mean total enthalpy of mixture is

$$\tilde{h} = \sum_k \tilde{Y}_k \tilde{h}_k \quad \dots \dots \dots (8)$$

The $\sim Y_k$ and $\sim h_k$ are the mean average mass fraction and mean total enthalpy of the kth chemical species, f is the thermal conductivity of the mixture, P_{rt} is the turbulent Prandtl number, $\sim S_{rad}$ represents the source of thermal energy due to the radiative transfer . The term $\sim h_k$ can be written

$$\tilde{h}_k = \sum_{k=1}^{N_k} \left[\frac{\overline{h_f^0}}{W_k} + \int_{T_{ref}}^{\bar{T}} c_{p,k} d\bar{T} \right] \quad \dots \dots \dots (9)$$

Where $\sim T$ is the mean temperature of the mixture, h_0^f is the molar enthalpy of formation, T_{ref} is the reference temperature and W_k is the molecular mass of kth chemical species.

[4] Chemical Species Conservation

Chemical Species conservation uses Arrhenius model with the two global chemical reactions involves six species: oxygen, methane, nitrogen, water vapor, carbon dioxide and carbon monoxide. A conservation equation is required for each species, with the exception of the nitrogen, which is computed taking into account that the mass fraction summation must be equal to 1. Thus, assuming unity Lewis number and no thermal diffusion, the conservation equation for the kth chemical species is given by

$$\nabla \cdot (\bar{\rho} \tilde{u} \tilde{Y}_k) = \nabla \cdot \left(\bar{\rho} \bar{D}_k \nabla \tilde{Y}_k + \frac{\mu_t}{Sc_t} \nabla \tilde{Y}_k \right) + \tilde{R}_k \quad \dots \dots \dots (10)$$

Where Sc_t is the turbulent Schmidt number which is defined as the ratio of momentum diffusivity and mass diffusivity and $\sim D_k$ and $\sim Y_k$ are, respectively, the mass diffusivity and the mean mass fraction of the kth chemical species. The term $\sim R_k$ is the mean mass rate of formation or destruction of the kth chemical species.

The Non-Premixed Combustion Models

Any commercial simulation software package provides three options for description of the system chemistry when we use the non-premixed modeling approach. These options are:

1. The Flame Sheet Approximation (Mixed-is-Burned)

The simplest reaction scheme is the flame sheet or “mixed-is-burned” approximation. This approach assumes that the chemistry is infinitely fast and irreversible, with fuel and oxidant species never coexisting in space and complete one-step conversion to final products. This description allows species mass fractions to be determined directly from the given reaction stoichiometry, with no reaction rate or chemical equilibrium information required. This simple system description yields straight line relationships between the species mass fractions and the mixture fraction, as shown in Figure1.

Because no reaction rate or equilibrium calculations are required, the flame sheet approximation is easily computed and yields a rapid calculation. However, the flame sheet model is limited to the prediction of single-step reactions and cannot predict intermediate species formation or dissociation effects. This often results in a serious over prediction of peak flame temperature, especially in those systems that involve very high temperature (e.g., systems using pre-heat or oxygen-enrichment).

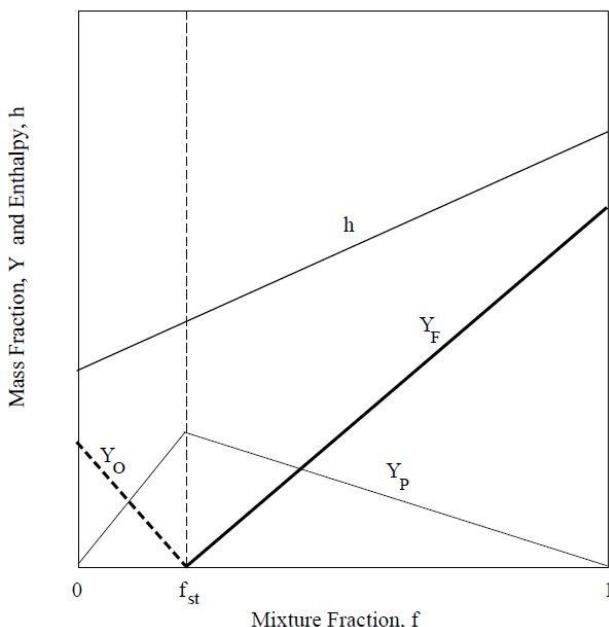


Figure 1: Species Mass Fractions and Enthalpy Derived Using the Flame Sheet Approximation

2. Equilibrium Assumption

The equilibrium model assumes that the chemistry is rapid enough for chemical equilibrium to always exist at the molecular level. An algorithm based on the minimization of Gibbs free energy is used to compute species mole fractions from mixture fraction f .

The equilibrium model is powerful since it can predict the formation of intermediate species and it does not require a knowledge of detailed chemical kinetic rate data. Instead of defining a species multi-step reaction mechanism, you simply define the important chemical species that will be present in the system. software then predicts the mole fraction of each species based on chemical equilibrium.

3. Non-Equilibrium Chemistry (Flamelet Model)

In combustion models where non-equilibrium effects are important, the assumption of local chemical equilibrium can lead to unrealistic results. Typical cases in which the equilibrium assumption breaks down are modeling the rich side of hydrocarbon flames, predicting the intermediate species that govern NOx formation, and modeling lift-off and blow-off phenomena in jet flames.

4. Probability Density Function Model

Any commercial simulation software applies the assumed shape probability density function (PDF) approach as its closure model when the non-premixed modeling approach is used. The probability density function, written as $p(f)$, can be thought of as the fraction of time that the fluid spends at the state f . Figure 2. illustrates this concept. The fluctuating value of f , plotted on the right side of the figure, spends some fraction of time in the range denoted as Δf . $p(f)$, plotted on the left side of the figure, takes on values such that the area under its curve in the band denoted, Δf , is equal to the fraction of time that f spends in this range. Mathematically it is written as,

$$p(f) \Delta f = \lim_{T \rightarrow \infty} \frac{1}{T} \sum_i \tau_i$$

Where T is the time scale and τ_i is the amount of time that f spends in the Δf band. The shape of the function $p(f)$ depends on the nature of the turbulent fluctuations in f . In practice, $p(f)$ is expressed as a mathematical function that approximates the PDF shapes that have been observed experimentally.

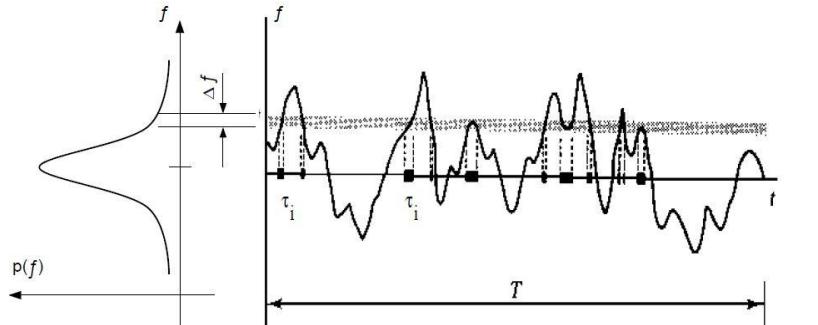


Figure 2: Graphical Representation of Probability Density Function

Researchers have made use of above discussed non-premixed combustion models, validating the results obtained by performing the experiments computationally, with the results that have been obtained experimentally.

III. NUMERICAL ANALYSIS

Cristiano Vitorino da Silva et.al (2018) in their paper “Assessment of combustion models for numerical simulations of a turbulent non-premixed natural gas flame inside a cylindrical chamber”, presented a Computational Fluid Dynamics (CFD) study of the non-premixed combustion of natural gas with air in an axisymmetric cylindrical chamber, focusing on the contribution of the chemical reaction modeling on the temperature and the chemical species concentration fields.

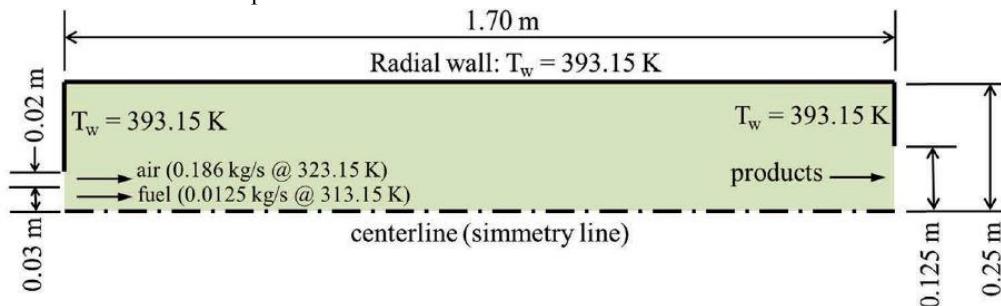


Figure 3: Combustion Chamber Geometry

The problem under consideration was a cylindrical combustion chamber, as shown in figure 3, operating with natural gas at approximately 600 kW with a fuel excess of 5%. Natural gas is injected into the chamber by a duct aligned with the chamber centerline. The fuel mass flow rate is 0.0125 kg/s at a temperature of 313.15 K, while the air mass flow rate is 0.186 kg/s, at a temperature of 323.15 K.

The fuel enters the chamber through a cylindrical duct having a diameter of 6 cm, while the air enters the chamber through a centered annular duct having diameter of 10 cm. For such mass flow rates, the fuel and air velocities are 7.76 and 36.29 m/s, respectively. The inlet air is composed of oxygen (23% in mass basis), nitrogen (76%) and water vapor (1%), while the fuel is composed of 90% of methane and 10% of nitrogen. The Reynolds number at the fuel inlet is approximately 18,000, characterizing a turbulent flow. Buoyancy effects are neglected due to the high velocities.

Boundary condition assumed were that the combustion chamber walls were kept at the constant temperature of 393.15 K. In addition, impermeability and no-slip conditions were assumed on the walls. In the symmetry line, it was assumed that both the radial velocity and the velocity gradient were null. In the outlet, null diffusive fluxes were assumed for all variables, the axial velocity component was corrected by a factor to satisfy mass conservation and the radial velocity was imposed to be null. The walls were assumed gray, diffusive emitters with an emissivity of 0.6. The inlet and the outlet were modeled as black surfaces at the respective temperatures.

While the first one has a prescribed temperature, the outlet temperature was equal to the outlet flow bulk temperature which is a function of the combustion and heat transfer processes.

Mesh used consisted of 50 divisions in radial direction and 340 division in axial direction as shown in following figure:

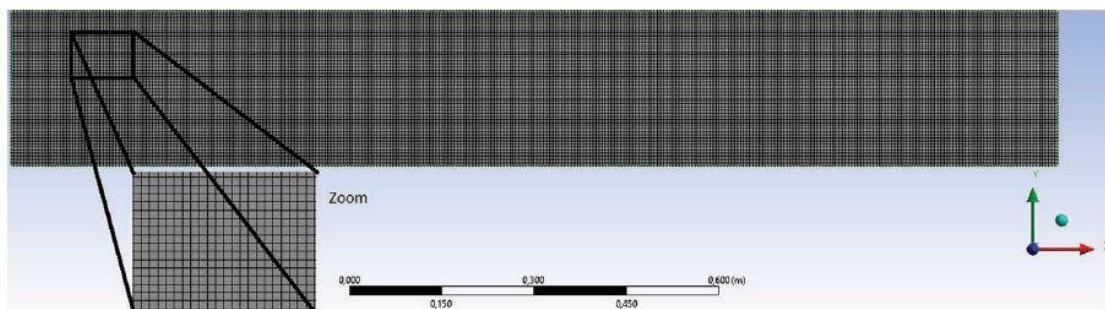


Figure 4: Mesh with 50×340 radial and axial equally spaced control volumes

The main goal of this investigation was the analysis of the effect of the combustion model on the numerical simulation of a non-premixed combustion of natural gas in a cylindrical chamber. Temperature and chemical species concentration profiles obtained with the EBU/Arrhenius and SLDF models were then presented and discussed. All results were compared with experimental measurements of Garréton and Simonin (1994) presented in Magel et al. (1996).

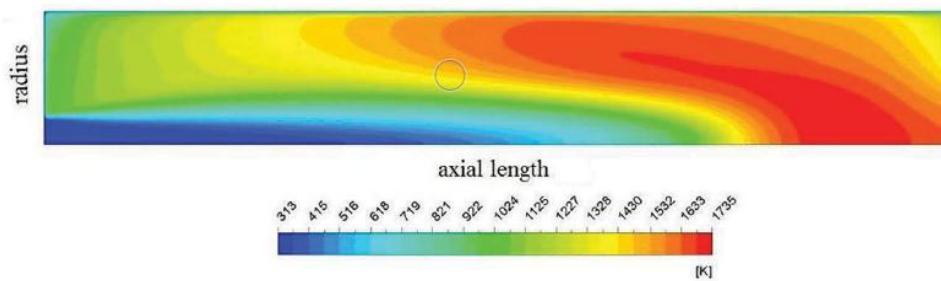


Figure 5: Temperature profile obtained by EBU/Arrhenius model.

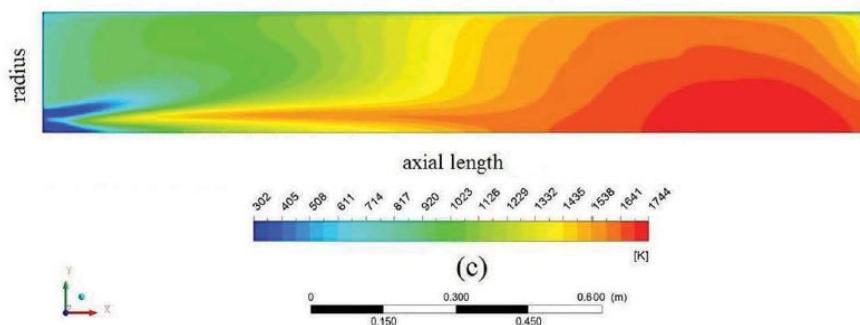


Figure 6: Temperature profile obtained by SLDF model

Figure 5 clearly shows that the best fit regarding the experimental data for the temperature was achieved with the combined EBU/Arrhenius model. This model considers simultaneously the turbulent mixing time scale (EBU) and the chemical time scale (Arrhenius) when estimating the average reaction rate. Thus, in the first half of the chamber, the jet core region presents low temperatures, resulting in a chemical limitation that delays the

flame ignition. As temperature increases, the chemistry becomes fast and the reactions are progressively more controlled by turbulent mixing.

IV. RESULT AND DISCUSSION

1. The PDF transport model is accurate enough to predict the most important details of the flame. The simulation results and the experimental results are in good agreement with each other.
2. A non-premixed flame structure is influenced by an air micro jet. However non-premixed flame is sensitive to the fuel jet velocity rather than micro jet and co-flow jet velocities.
3. Based on the temperature profile, the air micro-jet cools down the bottom region of the flame and maintains high temperature at the upper region of the flame.

REFERENCES

- [1] Fluent Inc.,Fluent User's Guide, New Hampshire, November 28, 2001.
- [2] T. Dabade, et.al.,“CFD Simulation of Confined Non-Premixed Flames in microjet assisted burner”, Proceedings of the ASME 2012 Summer Heat Transfer Conference,2012.
- [3] C. Silva et.al., “Assessment of combustion models for numerical simulations of a turbulent non-premixed natural gas flame inside a cylindrical chamber”, Combustion Science and Technology,2018.
- [4] M. Zhou, “Non-premixed Combustion Model of Fluidized Bed Biomass Gasifier for Hydrogen-Rich Gas”, Chinese Journal of Chemical Physics, 2006.
- [5] A. Sinha et.al., “Control of confined non-premixed flames using a microjet,” International Journal of Heat and Fluid Flow,2004.
- [6] L. Ziani et.al., “Numerical simulations of non-premixed turbulent combustion of CH₄-H₂ mixtures using the PDF approach”, Int. J. Hydrogen Energy,2013.
- [7] B. Launder et.al., “The numerical computation of turbulent flows”, Methods Appl. Mech. Eng.,1974.
- [8] I. Harun et.al, “Evaluation of non-premixed combustion and fuel spray models for in-cylinder diesel engine simulation”, Applied Energy,2013.
- [9] R. Ravikrishna and A.Sahu, “Advances in understanding combustion phenomena using non-premixed and partially premixed counterflow flames: A review”, International Journal of Spray and Combustion Dynamics, 2017.

Contrast Enhancement of Gray Image Using Discrete Cosine Transform

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Abstract: In this paper a new method for contrast enhancement based on the discrete cosine transform is discussed and implemented. The technique converts the image into DCT domain and the DCT coefficients are modified using proposed mask then the enhanced image is reconstructed using inverse DCT. The discrete cosine transform outperforms with better image quality and with highest PSNR value.

Keywords: Contrast, PSNR, Discrete Cosine Transform, etc.

I. INTRODUCTION

Image Contrast Enhancement process enhances images quality in which features are hardly detectable by eye. It improves the visualization of features of image. Basically, contrast is developed due to luminance reflected by two surfaces. In satellite, medical field the contrast enhancement techniques are used to enhance the images brightness and contrast. Histogram equalization is one the most well-known method for contrast enhancement. This approach generally useful for images with poor intensity distribution. By enhancing edges in image enhances the contrast. Multi scale edge enhancement approach, takes all resolution levels into account MSR softens the strongest edges and keeps the faint edges almost untouched. The strategies are different, but methods allow the user to see details which were hardly distinguishable in the original image, by reducing the ratio of strong features to faint features.

The wavelet approach consists of first transforming the image using the dyadic wavelet transform. Then the two wavelet coefficients relative to the horizontal and vertical wavelet bands are modified by multiplying by constant at scale and at pixel position. Finally, the enhanced image is obtained by the inverse wavelet transform from the modified wavelet coefficients. Wavelet bases present some limitations, because they are not well adapted to the detection of highly anisotropic elements, such as alignments in an image, or sheets in a cube. In DCT approach by modifying DCT coefficients of sub images can enhance the image properly.

II. OVERVIEW DCT

In this paper, discrete cosine transforms for enhancing the grey image has been proposed. The DCT helps to separate the image into parts with respect to the image's visual quality. As shown in Fig. The popular block-based DCT transform segments an image non overlapping block and applies DCT to each block. It gives result in three frequency sub-bands: low frequency sub-band, mid-frequency sub-band and high frequency sub-band. DCT based enhancement is based on two facts.

The first fact is that much of the signal energy lies at low-frequencies sub-band which contains the most important visual parts of the image. The second fact is that high frequency components of the image and it is noise.

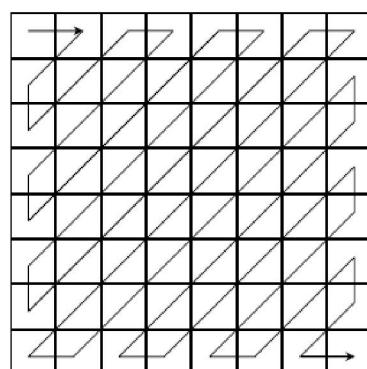


Figure 1:Zigzag Ordering of DCT Coefficients

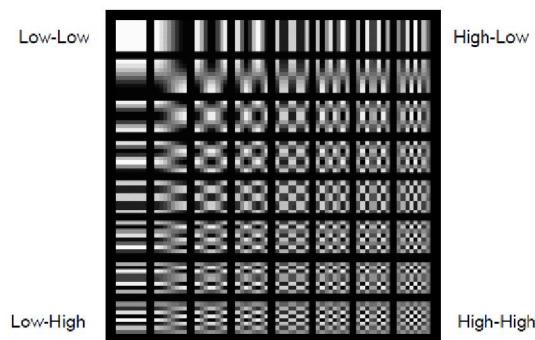


Figure 2:DCT Coefficients

M	m	m	m	m	m	m	m
M	m	m	m	m	m	m	n
M	m	m	m	m	m	n	n
M	m	m	m	m	n	n	n
M	m	m	m	n	n	n	n
M	m	m	n	n	n	n	0
M	m	n	n	n	n	0	0
M	n	n	n	n	0	0	0

Figure 3:ProposedDCT8*8 Scaling Mask

III. PROPOSED METHODOLOGY

In this paper, a technique based on discrete cosine transform has been proposed for enhancing the contrast of grey images. Discrete cosine transform is applied to extract the features of an image. The DCT converts the spatial domain into frequency domain represented by its DCT coefficients. DCT separates higher and lower frequency components in two parts.

The important information is present in low frequencyDCT coefficients. Hence separating low and high frequency coefficients and modifying DCT coefficients by multiplying proper scaling factor, a new enhanced grey image is obtained. For obtaining enhanced image from modified coefficients inverse DCT is used. Assume A is a grey image, \bar{A} is an enhanced image.

The following are the steps for proposed technique.

Step1: Read a grey image A.

Step2: Divide the input image into 8*8 non-overlapping sub blocks.

Step3: Apply DCT to each sub block.

Step4: Using designed mask each sub block DCT coefficients are modified.

Step5: By applying inverse DCT reconstruct the enhanced image \bar{A} from modified DCT coefficients.

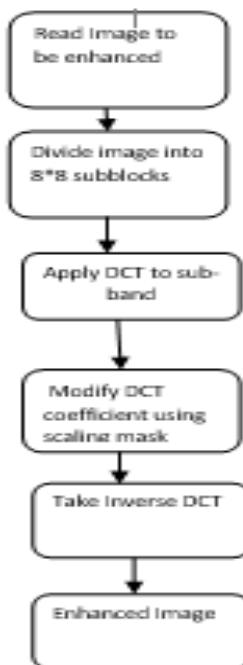


Figure 1: Flowchart

IV. RESULT

For obtaining better result different scaling factors are analyzed and best scaling factors are used to enhance the image.

Output for test image without noise



Figure 2:a) input image

b) enhanced image

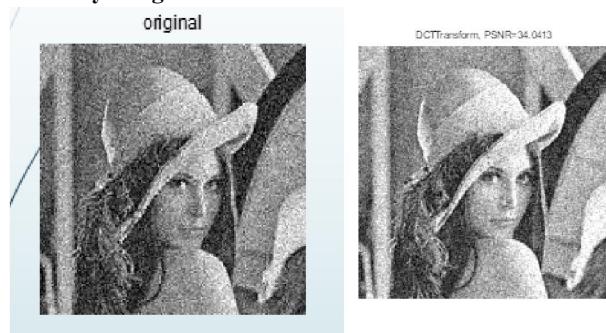
Output for test image with noisy image


Figure 3:a) input noisy image **b)** enhanced image

Table 1: DCT Scaling factor analysis

Lena.jpg	Scaling Factor		For noiseless image		For noisy image	
Sr.no.	m	n	PSNR	Contrast	PSNR	Contrast
1	0.7000	0.8040	24.1805	0.1660	24.3919	0.7229
2	0.8000	0.8080	24.5534	0.2025	24.7919	0.8022
3	0.9000	0.8120	26.2177	0.2406	26.5022	0.8911
4	1.0000	0.8160	51.6302	0.2937	33.6584	1.0030
5	1.1000	0.8200	75.4320	0.3304	42.0890	1.1002
6	1.2000	0.8240	93.2853	0.3595	47.9023	1.1794
7	1.3000	0.8280	Inf	0.3829	51.9566	1.2449

Above table shows the PSNR and contrast values for various values of m and n scaling factor and DCT outperforms for m=1.2 and n= 0.8240.

V. CONCLUSION

From above result we conclude that for enhancement of grey image without noise discrete cosine transform outperforms but for enhancement of noisy image DCT enhances noise also so DCT can be used to enhance the noiseless images only. For noiseless image enhancement using discrete cosine transform gives highest PSNR value i.e. 96 dB.

REFERENCES

- [1] “Enhancement Techniques for Gray Scale Image in Spatial Domain”, International Journal of Emerging Technology and Advanced Engineering, ISSN: 2250-2459. [9] A. K. Jain, Fundamentals of Digital Image Processing.
- [2] Englewood Cliffs, NJ: Prentice Hall, 1989. [10] Foisal Hossain, “Image Enhancement Based on Logarithmic Transform Co-efficient and Adaptive Histogram Equalization”, International Conference on Convergence Information Technology.
- [3] W. K. Pratt, Digital image processing, Prentice Hall, 1989. [12] Bedi, Rati Khandelwal, “Various Image Enhancement Techniques: A Critical Review”, International Journal of Advanced Research in Computer and Communication Engineering, ISSN: 2278-1021.
- [4] Gyu-Hee Park, Haw- Hyun Cho, “A Contrast Enhancement Method using Dynamic Range Separate Histogram Equalization”, IEEE Transactions on Communication, Networking and Broadcasting, Page: 1981-1987, Publication year: 2008.

Bendable Concrete-A Concrete for Future

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Abstract: We know that Concrete is one the major and largest materials used in construction industry. The performance of concrete depends upon the type and nature of ingredients used for making concrete. By many measures, concrete is an excellent construction material. Conventional concrete is prepared by using cement, sand, aggregates and water along with some admixtures. The concrete thus prepared can't take much of tensile load; it is almost unbendable and has limited strain capacity. Therefore, there is a need to address some of the deficiencies in conventional concrete structures like, Brittle failure under severe loading, Deterioration under normal service loading and Lack of sustainability of RC structures etc. The lack of bendability is one major causes of failure of concrete. However, the mechanical properties and functional characteristics of concrete will have to be improved, in many ways, and these improvements are already taking place in the industry up to certain extent. To overcome many drawbacks of conventional concrete, a Bendable concrete or engineered cementitious Composites (ECC) is the one of the best alternatives. In this concrete the ductility of concrete is increased by use of fibres and other cementitious materials. This paper deals with review of the various properties, applications and advantages of bendable concrete.

Keywords: Cementitious, Composites, Bendability, Ductility, Ingredients, Fibres, Conventional, Flexural Strength, etc.

I. INTRODUCTION

Bendable concrete is a class of highly ductile fiber reinforced cementitious composites, which uses silica fume, fly ash, blast furnace slag etc. and works on the principle of micromechanics. It has numerous advantages as compared with the conventional concrete, these includes, improved durability, ductility, Flexural strength and workability. The cost of ECC is nearly three times that of normal concrete, however in the long run construction cost is saved in through use of smaller structural member size, reduced or absence of steel reinforcement, elimination of other structural protective systems, and speedy construction process by the unique fresh and hardened properties of bendable concrete. This concrete can provide enhanced structural stability, safety, durability and sustainability. ECC makes use of low quantities of discontinuous, discrete fibres of about 2% by volume of cement, Bendable concrete contains little Polyvinyl Alcohol-fibres coated with a thin (nanometre thick), slick coating and fine silica sand.

This surface coating allows the fibres to start slithering as soon as it is dispersed in the mix, so they are not fracture. Coating prevents the fibres from rupturing that can cause big cracking. Therefore, bendable concrete deforms greater than a conventional concrete. It is lighter in weight and flexible also therefore it is also called as flexible concrete.

II. LITERATURE REVIEW

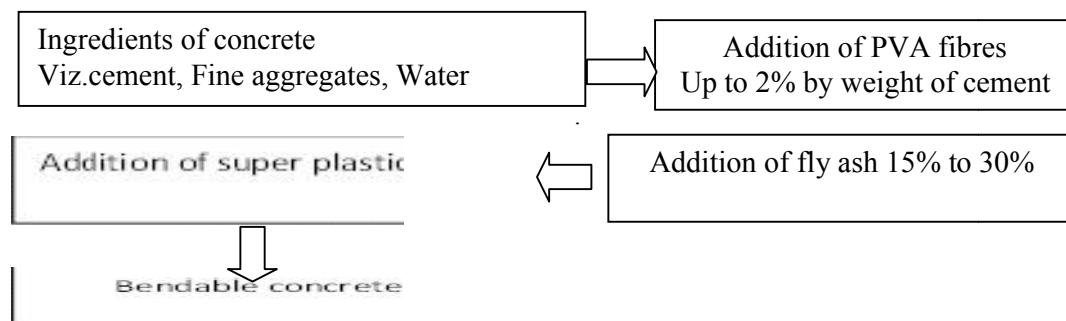
Agarwal (2020) carried the research work to assess the strength parameters of the concrete specimens made by inducing bacteria along with a suitable cement replacing substance.

Richard and P. Krithika (2019) carried out on growing the self-healing property of ECC with PP and PVA fibers with percentage of microorganism in water content. It indicated that PVA fibers provide higher overall performance as compared to PP fibers and self-healing takes place beneath distinct exposures of the ECC specimens.

Pan Z.(2015) Assessed un-oiled polyvinyl alcohol fibres and hybrid PVA fibres in ECC and had been taken into consideration and additionally the combined proportion changed into redesigned via quantity analysis. In maintaining with the cost and overall performance of PVA-ECC, three normal mixes have been proposed: for M7 has low tensile strength and M17, M21 have excessive tensile strength.

Yadavalli Sandeep, Bandaru Ambika (2019) carried Experimental Investigation on Bendable Concrete concluded that the significant properties of bendable concrete are ductility, durability, compressive strength and self-consolidation. Although the cost procured for designing of ECC is normally higher than that of the normal concrete but it has numerous potential applications. In this project the compression, split tensile and flexural strength measurements of bendable concrete are done. The values are compared with conventional cubes, cylinders and prisms. Therefore, it was proved that the bendable concrete has more strength than conventional concrete

III. METHODOLOGY



3.1 Components of ECC

It includes all the ingredients which are required to prepare the conventional concrete, except coarse aggregates Ordinary Portland Cement-Specific gravity between 3.1 to 3.25

PVA Fibres -Polyvinyl alcohol develops a molecular and chemical bond with the cement during hydration and curing. Ca⁺ and OH⁻ in the cement slurry gets attracted towards PVA fibres. Polymer fibres called PVA are used instead of steel bars which significantly improves the tensile properties of ECC. Percentage of fibers to be added is maximum up to 2% by weight of cement.

Table A

Sr.no	Description	Dimensions
1	Length	6-12 mm
2	Diameter	20-40 micrometer
3	Volume fraction	0.5 to 2 % by weight of cement
4	Elastic modulus	40 Gpa
5	Fibre strength	1600Mpa
6	Internal bond strength	2.01 Mpa

Sand- Good quality river sand, free from organic silt and organic impurities shall be used. Angular shape, passing through 250 micron and retaining on 150micron sand shall be used.

Super plasticizers-Used to improve the rheological properties of concrete. It helps in dispersing the constituents uniformly in the mix. Improves slump properties from 5 cm to 50 cm without adding extra water.

Fly ash- A waste product having pozzolanic properties is used in making this concrete. Fly ash is added with sp.gravity 1.9 to 2.96 to increase paste. There are two types of fly ash 1) F Type -contains equal to more than 70

% as constituents like SiO₂, Al₂O₃, Fe₂O₃ and obtained from burning bituminous coals 2) C type-contains equal to more than 50 % as constituents like SiO₂, Al₂O₃, Fe₂O₃ and obtained from burning sub bituminous coals or Lignite.

The conventional concrete has strain capacity of 0.1% only, which makes the concrete more brittle and rigid. In the ECC or bendable concrete ductility of the concrete is much improved by using natural and artificial fibres like PVA, jute, nylon, glass, silica, steel asbestos etc. The micro fibres give the flexibility. The fibres have slick coating which reduces the friction between the fibres particles and the cement. Partial replacement of cement by fly ash increases the paste content. No coarse aggregates are used therefore it is also called as a mortar concrete. e.ECC has strain Hardening property and can be applied with the conventional equipment's.

3.2 Behaviour of Concrete

Behaviour under Flexural Loading-



Figure a: Behaviour under Flexural Loading

Fig shows the behaviour of ECC under flexural loading. It shows deformation of the member without direct failure. It seems that the different ingredients of the ECC have worked together to take the load applied safely. ECC is 50 times flexible and 40 times lighter than convectional concrete

Self-consolidation-



Figure b: Self-Consolidation

Fig shows the self-consolidation characteristics of concrete. It follows principle of micromechanics ie interaction between fibres, mortar matrix and the interface between them.

Cracking Phenomenon in concrete-



Figure c: Cracking Phenomenon in concrete

Strong molecular bond is formed between PVA fibres and concrete, when the load increases beyond its saturation value during hydration this bond helps to avoid the normal cracking phenomenon. By employing micromechanics-based material design, maximum ductility in excess of 3% under uniaxial tensile loading can be obtained with only 2% fibres content by volume of cement.

3.3 Typical Stress Strain Curve

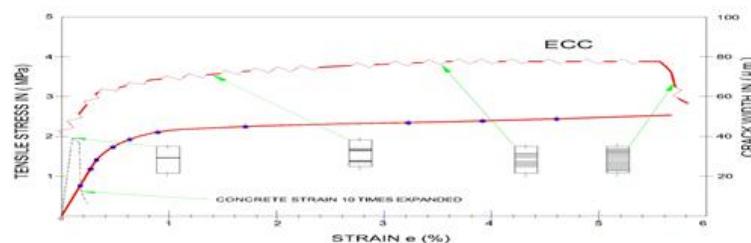


Figure d:Typical stress strain curve

Figure shows typical tensile stress-strain curve and crack width development of bendable concrete, it is seen that strain has much improved, which is an indication of enhanced ductility.

3.4 Self-Healing of Property

A significant percentage of the cement grains stay behind unused and dormant in the concrete mix because they are never getting hydrated and set and because of that cracks are developed in the concrete. The unhydrated grains chemically react with water and carbon dioxide in the air forming calcium carbonates, the thousands of micro cracks which are less than 50 micrometres which gets developed after concreting gets automatically filled with the calcium carbonate. This phenomenon takes place because of self-healing of concrete.

Table B: Comparison with Conventional Concrete

Point of Comparison	Conventional Concrete	Bendable Concrete /Bendable Concrete
Earthquake Resistance	The structures made with the original concrete are prone to earthquakes. They generally form cracks or may collapse during earthquakes	As the flexible concrete does not break easily by the earthquake motion. So, the structures made with flexible concrete are more earthquake resistant.
Self-healing property	The normal concrete has very low self-healing property as it has very low free cement concrete.	The flexible concrete has a very good self-healing property as it can heal the micro-cracks itself by the reaction of carbon dioxide and water.
Repair and Maintenance	The repair and maintenance cost of concrete structures is high as they developed cracks and other defects.	The repair and maintenance cost of flexible concrete is low as it does not develop that many cracks.
Self-weight	The self-weight of conventional concrete is more.	The flexible concrete is 30-40% lighter than conventional concrete.
Curing time	The concrete structure generally requires more curing time (around 28 days).	The flexible concrete generally requires less curing time (around 7 days)
Cost	The cost of construction is less as it consists of common material.	The initial cost of construction is more.
Reinforcement	Required to have tensile strength	Less or nil steel is required to have tensile strength
Durability	Less durable	More durable

3.5 Scope for Use

Conventional concrete is brittle and rigid material that might suffer catastrophic failure. While ECC acts as flexible concrete as compare to Conventional concrete.

It is used with specially-coated small discrete discontinuous reinforcing fibres that keep it together. Because of numerous properties and advantages, it can be used in the construction of

1. Roads and Bridges
2. Earthquake resistant buildings
3. Concrete canvas
4. Used in the coupling beams
5. Pavements.
6. Construction of joint less bridge

3.6 Advantages of Bendable Concrete

1. It is stronger, more durable, and lasts longer than the conventional concrete.
2. It has more resistance to cracking.
3. It does not emit that number of harmful gases as compared to conventional concrete
4. The use of steel reinforcement is reduced
5. The crack width can be reduced.
6. The flexural strength of the concrete can be increased.
7. ECC is green construction material
8. ECC incorporates elevated volumes of industrial wastes including fly-ash, sands and wastes from metal casting processes, wasted cement kiln dust from cement production
9. Reduced emission of Greenhouse gases

3.7 Disadvantages

1. Initial investment is high
2. Requires skilled manpower.
3. Material is not easily available
4. Compressive strength is lesser than standard concrete

IV. CONCLUSION

From the review, it is seen that there are numerous advantages of ECC over convectional concrete, these includes improved ductility, compressive strength, Corrosion resistance, strain capacity, reduced cracks etc, thus overall durability gets increased than the conventional concrete. Waste materials like fly ash, slag is used there it saves environmental degradation. It has less CO₂ emission therefore eco-friendly. It is lighter and flexible and therefore convenient to handle. It has high initial cost but considering life and durability of the structure it proves to economical.

REFERENCES

- [1] C.Victor. Li. "Integrated Structures and Materials Design. "Materials and Structures.
- [2] Yu Zhu, "Use of slag to improve mechanical properties of Engineered cementitious composites(ECCs) with high volumes of fly ash", Journal of construction and building materials, vol. 36, pp.1076- 1081, 2012.
- [3] Jun Zhang, Zhenbo Wang and Xiancunju, "application of ductile fibre reinforced Cementitious composite in joint less concrete pavements", journal of composites, Part B, Vol.50, pp.224-23,2013. 4.
- [4] Yu Zhu,Singh, M., Saini, B., &Chalak, H. D. 2018. Properties of engineered cementitious composites: a review. In International Conference on Sustainable Waste Management through Design ,473-483.
- [5] Mustafa Sahmaran et.al., "Engineered Cementitious Composites. Can composites be accepted as Crack-free concrete?" Transportation Research Record: Journal of the Transportation ResearchBoard, No. 2164, Transportation Research Board of the National Academics, Washington D.C., DOI: 10.3141/2164-01.

pp.1-8

- [6] Jun Zhang, "Properties of Poly Vinyl Alcohol-steel hybrid fibre reinforced concrete composite withhigh strength cement matrix", ASCE, 2015.
- [7] Tahir Kemal Erdem, "Specimen size effect on the residual properties of engineered cementitiouscomposites (ECCs) subjected to high temperatures", Journal of cement & concrete composites, Vol. 45, pp. 1-8, 2014.

A Review on Experimental Study of Ferrocement Beams in Shear, Deflection and Bending

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Abstract: Rapid construction has led to the use of various new methods in the construction process other than regular concreting. Use of ferrocement technology is one of the rapidly growing methods due to its various advantages like less construction time, cost effectiveness and high strength. In this review, experimental results on various parameters like shear, flexure and bending behavior of ferrocement beams from various journals have been discussed.

Keywords: Ferrocement, Box Beam, Shear, Flexure, Strengthening, Wire Mesh, Cement, Fine Aggregate, Coarse Aggregate, etc.

I. INTRODUCTION

Ferrocement is a thin construction element with thickness in the order of 10-25 mm (3/8–1 in.) and uses rich cement mortar; no coarse aggregate is used; and the reinforcement consists of one or more layers of continuous/ small diameter steel wire/ weld mesh netting. It requires no skilled labor for casting, and employs only little or no formwork.

Ferrocement construction technology is being popularized throughout the world in countries like Canada, USA, Australia, New Zealand, United Kingdom, Mexico, Brazil, the former USSR, Eastern European countries, China, Thailand, India, Indonesia, and in other developing countries due to its uniqueness and versatility. Ferrocement is being explored as building materials substituting stone, brick, RCC, steel, prestressed concrete and timber and also as structural components—walls, floors, roofs, beams, columns and slabs, water and soil retaining wall structures; other applications include window and door frames and shutters ferrocement can be fabricated into any desired shape or structural configuration that is generally not possible with standard masonry, RCC or steel. (**Mr. A.S.Burakale 2020**).

II. EXPERIMENTAL BEHAVIOUR OF FERROCEMENT BEAM IN SHEAR

Nagesh Hanche (2016): The experimental investigation includes casting and testing of 24 rectangular beams and 8 cubes. The specimens were divided into eight series; A to H according to the volume fraction of reinforcement, compressive strength of the mortar, and amount of reinforcement was varied in Series A to H by varying the number of layers of wire mesh. Specimens in these series were symmetrically reinforced with 4, 6, 8 and 10 layers of wire mesh, respectively, and were lumped together near each face with a clear cover of 5 mm. The parameter investigated in each series was the shear-span-to-depth ratio a/h , which was achieved by varying the shear span to overall depth ratio from 1 to 2 at increments of 0.5 for the sake of simplicity since several reinforcement layers were involved.

Abeer M. Erfan, Taha A. El-Sayed (2019) [22]: This paper presents an experimental and analytical study of the shear strength of ferrocement composite box section concrete beams. The experimental program includes 7 box section concrete beamstesting using two-point loading system. Beam with expanded wire mesh showed an improvement in ultimate failure load, shear capacity and deflection with respect to beams with reference & welded wire mesh.

Md Ihtesham Hussain,VaijanathHalhalli, P.M.B Raj Kiran Nanduri [23]:This present study deals with the behavior of Ferro cement deep beams under central point load. A total of 27 rectangular deep beams have been

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121

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casted of dimension 125 x 250mm and the lengths of beams have been varied along with the variation of wire mesh and mortar strength. Before testing, the top surfaces of these beams were white washed, to get a clear picture of crack pattern. Along with these beams 27 cubes have been casted with the dimensions 7.06 cm x 7.06 cm x 7.06 cm. the compressive strength of mortar is determined.

Ms. Madhuri N. Savale, Prof. P. M. Alandkar (2013) [11]: In the present study an attempt is made to observe behaviour of ferrocement plate with various mesh patterns. The results give that Increasing the volume fraction (VF) of the wire mesh layer subsequently increases the shear carrying capacity of the plate to attain this advantage, supports and loading points should be design and strengthened to prevent local failure, Shear behaviour of ferrocement plates (SBFP).The stress intensity is determined using FEM (Ansys) and compared with the available results. it is observed that stress intensity as well as cracking shear strength of plate depends upon volume fraction the available equations from literature can be used for analysis of mesh plate.

Mr. Sahan A, Mr. Sumanth, Mr. Vachan Shetty, Ms. Vaishnavi T, Mr. Suraj K S, Mrs. Smitha (2018) [24]: In the compressive strength and shear strength, the values were found on the 28 days which justifies that the value increases and then on further addition offibre it decreases among the two fibres used in this experiment for 0.5%, 1% and 1.5% variation, polypropylene of 1% gives high strength in compressive strength.

Manasa B1 et.al(2018) [25]: This work deals with an experimental study on behavior of ferrocement beams. Mix proportions 1:3 i.e., cement: jelly chips with water cement ratio 0.45 were selected. The overall dimensions of beam are 150x150x2000mm and it is reinforced with compressive strength of about 16.32Mpa. Flexural and Impact test was conducted. The cracks were due to loading and failure cracks developed due to ultimate load. Flexural strength of produced specimens was 13.6N/mm².

Mahmoud Elsayed1 et.al(2018) [26]: In this they investigated the behavior of R.C deep beam with web openings retrofitted by ferrocement laminates. It was observed that the ultimate load carrying capacity was reduced by 31% and 16% due to the existence of opening placed at the shear and flexural span respectively. The results indicated that the ultimate failure load, ductility and uncracked stiffness of strengthened specimen with openings in the shear zone were increased by about 85%.

S.F.Ahmad (1995) [6]: The shear behavior of ferrocement channel beams have been studied by conducting tests under transverse loads for 15 beam specimens. Influence of variation of the dominant parameters were studied through systematic tests. Test results indicate that cracking and ultimate shear strength increases with the increase in the volume of wire mesh and mortar strength, and decreases with the increase in shear span to depth ratio.

Mansur M.A (1991) [4]: An experimental investigation was carried out on a total of 28 simply supported ferrocement I-beams loaded in flexure under two symmetrical point loads. The major parameters considered in the study were the shear span-to-depth ratio, compressive strength of the mortar, and amount of longitudinal and transverse reinforcement. The results of these are presented and discussed. Test results indicate that the beams fail in shear only when the span-depth ratio is less than or equal to 1.5. Beyond this value, failure occurs in flexure. Analyses are presented to predict the cracking and ultimate strengths of such beams in shear as well as flexure. A comparison of theoretical predictions with experimental results shows good agreement.

Shichuan Tian (2013) [13]: This thesis presents the results of an experimental, numerical and analytical study to develop a design method to calculate shear resistance of flanged ferrocement beams with vertical mesh reinforcements in the web. Two groups of full-scale testing were conducted comprising of three I beam and four U beams. The I beam had the same geometry and reinforcement arrangements, but differed in the matrix strength or shear span to depth ratio. The U beams differed in web and flange thickness, reinforcement

arrangements, matrix strength and shear span to depth ratio. The experimental data were used for validation of finite element models which had been developed using the ABAQUS software. The validated models were subsequently employed to conduct a comprehensive parametric study to investigate the effects of a number of design parameters, including the effect of matrix strength, shear span to depth ratio, cross sectional area, length of clear span, volume fraction of meshes and amount of rebar.

The main conclusion from the experiments and parametric studies were: shear failure may occur only when the shear span to depth ratio is smaller than 1.5; the shear strength may increase by increasing the matrix strength, volume fraction of meshes, cross sectional area and amount of rebar. The main type of shear failure for I beams was diagonal splitting while for U beams it was shear flexural. Based on the results from the experimental and numerical studies, a shear design guide for ferrocement beams was developed. A set of empirical equations for the two different failure types and an improved strut-and-tie were proposed. By comparison with the procedures currently in practice, it is demonstrated that the methodology proposed in this thesis is likely to give much better predictions for shear capacity of flanged ferrocement beams.

III. EXPERIMENTAL BEHAVIOUR OF FERROCEMENT BEAM IN FLEXURE

Abhishek G B, Dr. R M Mahalingegowda (2020) [27]:The fundamental point of this task is to explore or consider the quality attributes of Ferro-concrete with and without utilizing coir fiber. By differing the level of fiber included (1%, 2% and 3% of concrete). Likewise contrast the quality of Ferro-concrete and single and twofold layer of square wire work.The mechanical test was performed to check the impact of fibers on improving compressive, flexural and split tensile in Ferro-cement. Since fiber go about as optional fortification, it will keep Ferrocement from small scale splitting and engendering break development and builds the quality. After the expansion of coir strands into ferrocement expands the flexural and spilt elasticity consequently it very well may be utilized more as flexural part in development.

Aziz Ibrahim Abdulla, Zainah Ibrahim, Ubagaram Johnson Alengaram(2014) [18]: The flexural performance of beam specimens with wire mesh layers was compared to beam specimens with carbon fibre and a hybrid of wire mesh–epoxy–carbon fibre composite. The test findings demonstrate that using wire mesh with epoxy to improve the flexural performance of concrete beam specimens is a viable option. Increased wire mesh layers improve flexural strength, cracking behavior, and energy absorption capabilities greatly. In terms of flexural strength and ductility, the wire mesh–epoxy composite outperforms carbon fiber.

Tahmina Tasnim Nahar, Md. Motiur Rahman, Md. Rashedul Haque, Ashish Kumar Saha (2014) [17]:In this paper, Wire mesh has an effect on the strength of R.C.C. beams that have been repaired with ferrocement layers.The findings of the tests carried out in this study show that there is a considerable change in ultimate load, cracking load, and deflection. The load-bearing capacity of the beam is reduced as a result of the failure; to address these issues, a ferrocement coating can be applied, resulting in an increase in load carrying capacity and a decrease in deflection.

Yousry B.I. Shaheen, Noha M. Soliman, Ashwaq M. Hafiz (2013) [15]:The structural behavior of ferrocement concrete composite channels reinforced with various types of reinforcing materials was investigated in this article find that when compared to all of the evaluated beams, the use of welded steel mesh produced the best results. And The use of polypropylene fibres in mortar increases the first crack load, serviceability load, ultimate load, and energy absorption, as well as providing increased stiffness.

H.R. Ronagh, A. Eslami (2013) [12]:In these studies, flexural retrofitting of RC buildings using GFRP/ CFRP is done. Composite sheets are meant to be put at the two end regions of all beams and columns in a feasible flange-bonded system for this purpose. The seismic response of the original structure was compared to the GFRP/CFRP retrofitted structures using a nonlinear pushover analysis with lumped plasticity technique. The nonlinear findings show that both composite materials have a considerable increase in lateral load bearing

capability, with the CFRP improvement being twice that of the GFRP. The latter, on the other hand, has a higher ductility.

Gangadharappa B M, Prakash K E, Suresh G S and Shesha Prakash M N (2013) [14]: Under monotonic tensile stresses, the impact of % replacement of sand by Blast Furnace Slag (BFS) and reinforcing with meshes is investigated in this article. It has been discovered that replacing BFS boosts ultimate strength up to a point and then declines as replacement rises.

Naveen G.M, Suresh G.S (2012) [10]: In this paper Under monotonic and repetitive flexural loads, experimental research on a low-weight ferrocement beam was conducted. And found that under both monotonic and repetitive stress, lightweight ferrocement beams exhibit a good moment of resistance.

Bong, J.H.L, Ahmed, E., (2010) [9]: The structural short-term behavior of a beam reinforced with ferrocement laminate is described in this research, along with its benefits. A ferrocement laminate-strengthened beam is compared to a control beam to determine the benefits of utilizing ferrocement. In compared to a conventional beam, a beam reinforced with ferrocement has a larger cracking load, ultimate load, and lower deflection, according to the experiment.

M.M. Kamal, Y.B. Shaheen, M.A. Saafan and A.A. Nasser, (2005) [8]: The purpose of this article is to show the various production and installation configurations for various ferrocement units used in home building. Many architectural forms may be achieved by using ferrocement in skeleton parts. Panelized ferrocement homes are a revolutionary prefabricated building method.

Hani H. Nassif, HusamNajm (2004) [7]: The findings of an experimental and analytical investigation on composite beams built of reinforced concrete placed over a thin slice of ferrocement are presented in this work (cement paste and wire mesh). A two-point loading technique is used to evaluate several types of beam specimens with varied mesh types (hexagonal and square). To predict the overall non-linear behavior, the results from experimental data are contrasted to those from nonlinear analysis and finite element research. The suggested composite beam has high ductility, cracking strength, and ultimate capacity, according to the results.

M. A. Mansur, P. Paramasivam (1985) [3]: This paper presents the findings of an experimental study on three ferrocement sections subjected to combined bending and axial stresses. Each piece was the same size, but the volume % of reinforcement was variable. A technique for forecasting the ultimate load capacity and, as a result, the interaction behavior of a ferrocement section is described based on standard reinforced concrete analysis. The experimental findings and theoretical predictions are in good accord.

Balaguru, P.N., A.E. Naaman and S.P. Shah (1977) [2]: This paper's study was carried out to predict deflection and fracture widths in ferrocement constructions that were exposed to flexure, Cracks preferentially form in the transverse wires of the mesh's outermost layer, The specific surface of reinforcement did not appear to have as much of an impact on cracking behavior in flexure as it did in tension. This might be due to the particular surface of the tensile zone of mortar in flexure.

N. Jayaramappa (2016) [21]: In this paper experimental studies are carried out to understand the flexural behaviour of Reinforced concrete beams of grade M20 with HYSD reinforcement and Ferrocement hollow beams of cement to sand ratio of 1:3and water cement ratio of 0.4. A total of four beams were cast in which two are straight beams and another two are arched beams. In that two straight beam, one is reinforced concrete beam with minimum reinforcement and another one is Ferrocement hollow beam and in two arch beams, one is reinforced concrete beam and other is Ferrocement hollow beam. All beams are rectangular in cross-section of size 200 x 200 mm and the span length is 2500 mm. The arch beam is provided with a rise at centre of 0.8 m.

The Ferrocement beam is made of mortar with hollow cross section using hexagonal wire mesh with thickness of 40 mm and all the specimens are cured for 28 days. Flexural tests are carried out on conventional RC beam and Ferrocement hollow beams for simply supported condition. The test results are presented in terms of load deflection behaviour, ultimate load, cracking load and crack pattern with respect to reinforced concrete beam and Ferrocement hollow beam.

IV. CONCLUSION

Following conclusions have been drawn from the experimental study on various ferrocement beam sections:

1. Beam with expanded wire mesh showed an improvement in ultimate failure load, shear capacity and deflection with respect to beams with reference & welded wire mesh.
2. Shear failure may occur only when the shear span to depth ratio is smaller than 1.5; the shear strength may increase by increasing the matrix strength, volume fraction of meshes, cross sectional area and amount of rebar.
3. Cracking and ultimate shear strength increases with the increase in the volume of wire mesh and mortar strength, and decreases with the increase in shear span to depth ratio.
4. Increased wire mesh layers improve flexural strength, cracking behavior, and energy absorption capabilities greatly. In terms of flexural strength and ductility, the wire mesh–epoxy composite outperforms carbon fiber.
5. In compared to a conventional beam, a beam reinforced with ferrocement has a larger cracking load, ultimate load, and lower deflection, according to the experiment.
6. The use of polypropylene fibres in mortar increases the first crack load, serviceability load, ultimate load, and energy absorption, as well as providing increased stiffness.

REFERENCES

- [1] M. A. Mansur, P. Paramasivam, "Ferrocement under combined bending and axial loads", The International Journal of Cement Composites and Lightweight Concrete, Volume 7, Number 3, (1985) pp 151-158
- [2] Balaguru, P.N., A.E. Naaman and S.P. Shah, "Analysis and Behavior of Ferrocement in Flexure," ASCE Journal of the Structural Division, Vol. 103, No. ST10, (1977), pp. 1937-1951.
- [3] Mansur M.A. and Ong.K.C.G, "Shear strength of ferrocement Beams", ACI Structural Journal, 84-S2,Jan-Feb 1987,pp.10-17.
- [4] Mansur M.A. and Ong.K.C.G, "Shear strength of ferrocement I-Beams", ACI Structural Journal, 88-S48,July-August 1991,pp.458-464.
- [5] Al-Sulaimani, G.J.Basunbal.I.A and Moussely.E.A, "Shear Behavior of Ferrocement Box Sections, Cement and Concrete Composites1,1991,pp.29-36
- [6] S.F.Ahmad,Sarosh H.Lodi,Juneid Qureshi, "Shear Behavior of ferrocement thin webbed sections", Cement and Concrete Research,Vol 25,Elsevier Sceince Ltd,1995.
- [7] Hani H. Nassif, HusamNajm, "Experimental and analytical investigation of ferrocement-concrete composite beams", Cement & Concrete Composites 26 (2004) pp 787–796
- [8] M.M. Kamal, Y.B. Shaheen, M.A. Saafan and A.A. Nasser, "Ferrocement Buildings: A New and Advantageous Technique", Research gate, (2005) pp 909-929.
- [9] Bong, J.H.L and Ahmed, E., "Study the Structural Behaviour of Ferrocement Beam", UNIMAS e-Journal of Civil Engineering, Vol. 1 (2), April (2010), pp 1-7
- [10] Naveen G.M, Suresh G.S, "Experimental study on light weight ferrocement beam under monotonic and repeated flexural loading", International Journal of Civil and Structural Engineering, Volume 3, No 2, (2012), pp 294-301.
- [11] Ms. Madhuri N. Savale, Prof. P. M. Alandkar, "Shear behaviour of ferrocement plates" International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, Issue 2, February 2013, ISSN: 2319-8753
- [12] H.R. Ronagh, A. Eslami, "Flexural retrofitting of RC buildings using GFRP/ CFRP- A comparative study",

- research gate, Composites Part B Engineering, (2013).
- [13] Shichuan Tian, Thesis submitted to The University of Manchester for the degree of Doctor of Philosophy in the Faculty of Engineering and Physical Sciences, "Shear Behavior of Ferrocement Deep Beams"2013.
- [14] Gangadharappa B M, Prakash K E, Suresh G S and Shesha Prakash M N, "Studies on Light Weight Ferrocement Subjected to Axial Tension" International Journal of Emerging Technologies in Computational and Applied Sciences, 5(3),2013, pp. 239-245.
- [15] Yousry B.I. Shaheen(1), Noha M. Soliman(2) , Ashwaq M. Hafiz(3)" Structural Behaviour of Ferrocement channels Beams" Vol. 4 (3) –Sept. 2013.
- [16] Tahmina Tasnim Nahar, Md. Motiur Rahman, Md. Rashedul Haque, Ashish Kumar Saha, "Effect of wire mesh on the strength of R.C.C. beams repaired using ferrocement layers", International Journal for Research & Development in Technology, Vol. 1, (2014) pp 13-18.
- [17] Md. Motiur Rahman, Tahmina Tasnim Nahar and Anish Kumarsaha, "Effect of wire mesh on the strength of R.C.C beams repaired using ferrocement layers", International Journal for Research and Development in Technology, Vol.1, No.1, PP.13- 18,2014.
- [18] Ismail M.I. Qeshta a, Payam Shafiq a, MohdZamin Jumaat a, Aziz Ibrahim Abdulla b ,Zainah Ibrahim a , Ubagaram Johnson Alengaram ,” The use of wire mesh–epoxy composite for enhancing the flexural performance of concrete beams,” Elsevier 2014.
- [19] Nagesh Hanche, “Behaviour and Strength of Ferrocement Rectangular Beams in Shear- A Experimental Study”, Journal of Civil & Environmental Engineering, 10.4172/2165-784X.1000213,2016.
- [20] N. Jayaramappa, “Experimental Studies on Reinforced Concrete and Ferrocement Beams”, International Journal of Technology & Engineering, ISSN 2455-4480; Vol.05, Issue 03 (2016).
- [21] Abeer M. Erfan, Taha A. El-Sayed “SHEAR STRENGTH OF FERROCEMENT COMPOSITE BOX SECTION CONCRETE BEAMS”, International Journal of Scientific & Engineering Research Volume 10, Issue 5, May-2019.
- [22] Md IhteshamHussain,VaijanathHalhalli, P.M.B Raj Kiran Nanduri, “SHEAR AND FLEXURAL BEHAVIOR OF FERRO CEMENT DEEP BEAMS”, International Journal of Research in Engineering and Technology, eISSN: 2319- 1163 | pISSN: 2321-7308.
- [23] Mr. Sahan A, Mr. Sumanth, Mr. Vachan Shetty, Ms. Vaishnavi T, Mr. Suraj K S,Mrs. Smitha, “EXPERIMENTAL INVESTIGATION ON STRENGTH CHARACTERISTICS OF FERRO-CEMENT WITH AND WITHOUT USING FIBRES”, International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395-0056 p-ISSN: 2395-0072, Volume: 05 Issue: 06 | June-2018.
- [24] Manasa B, Sowmyashree T, Sharath Babu Khedagi,“EXPERIMENTAL STUDIES ON BEHAVIOUR OF FERROCONCRETE BEAMS”, International Journal of Research in Engineering and Technology eISSN: 2319-1163,2018.
- [25] Mahmoud Elsayed, Alaa Elsayed, Yasser Snosy, “Behavior of R.C. Deep Beam with Web Openings Strengthened with Ferrocement Overlays”, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 15, Issue 2 Ver. III (Mar. - Apr. 2018).
- [26] Abhishek G B, Dr. R M Mahalingegowda, “Experimental Study on Ferrocement with Coir Fibers” International Journal of Advanced Science and Technology Vol. 29, No. 08, (2020), pp. 2020- 2032.

Healthcare IoT (HIoT)

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Abstract: The closing decade has witnessed tremendous studies within the discipline of healthcare offerings and their technological upgradation. the Internet of Things (IoT) has proven capability utility in connecting numerous scientific devices, sensors, and healthcare experts to offer best scientific centers in a far-flung location. This has superior affected person safety, decreased healthcare costs, superior the accessibility of healthcare offerings, and improved operational performance within the healthcare industry. The cutting-edge have a look at offers an updated precis of the capability healthcare packages of IoT- (HIoT-) primarily based totally technologies. Herein, the development of the utility of the HIoT has been pronounced from the angle of allowing technologies, healthcare offerings, and packages in fixing numerous healthcare issues.

Keywords: IoT, Healthcare, HIoT, Technologies, etc.

I. INTRODUCTION

In current years, the healthcare commercial enterprise corporation has examined speedy growth and has been a primary sponsor to earnings and employment. A few years ago, the evaluation of problems and abnormalities inside the human modified framework to be best feasible after having a bodily assessment within the medical facility. Most patients had to live in the medical facility for the duration of the treatment. This introduced approximately an extended healthcare rate and furthermore strained the healthcare facility at rural and an extended manner flung locations.

II. ARCHITECTURE OF HEALTHCARE IoT (HIoT)

The framework of the IoT that is applied for healthcare packages aids to mix the advantages of IoT generation and cloud computing with the sector of medicine. It moreover lays out the protocols for the transmission of the patient's records from numerous sensors and medical devices to a given healthcare community.

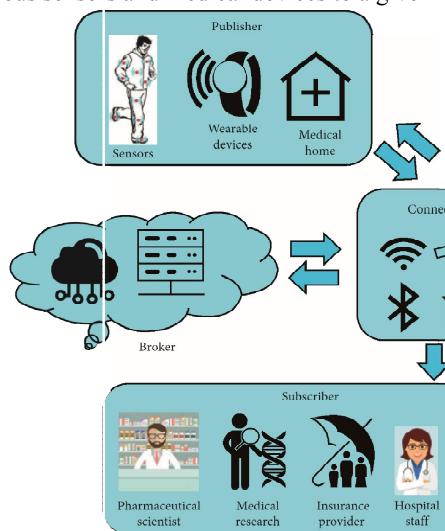
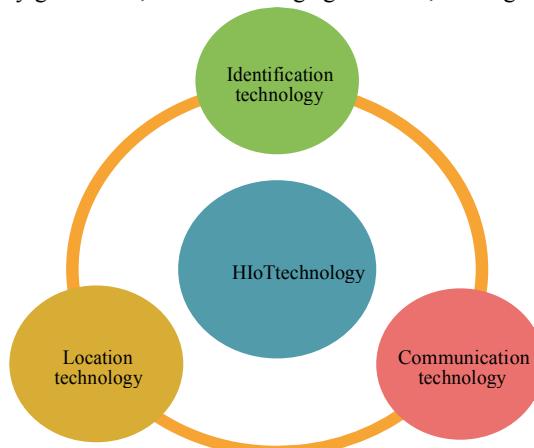


Figure 1: Architecture of an HIoT framework (reproduced from [13] under Creative Commons License)

III. HIOT TECHNOLOGIES

The technology which can be used to broaden an HIoT system is crucial. This is due to the fact using unique generation can beautify the cap potential of an IoT system. Hence, to combine distinct healthcare programs with an IoT system, numerous latest technologies had been adopted. These technologies can extensively be classified into 3 groups, namely, identity generation, verbal exchange generation, and region generation.



Identification Technology. A realistic attention in designing an HIoT gadget is the accessibility of the patient's facts from the legal node (sensor), which can be gift at faraway locations.

Communication Technology: Communication technology ensures the relationship between unique entities in a HIoT network. These technologies may be widely divided into short-varietiy and medium-varietiy communique technology. The short-varietiy communique technology are the protocols which are used to set up a connection a number of the items inside a confined variety or a frame vicinity network (BAN), while the medium-varietiy communique technology generally help communique for a huge distance, e.g., communique among a base station and the primary node of a BAN.

Location Technology: The real-time region gadget (RTLS) or region technology are used to pick out and tune the location of an item inside the healthcare network. It additionally tracks the remedy technique primarily based totally at the distribution of to be had resources. One of the maximum extensively used technologies is the Global Positioning System, that's usually called GPS. It uses satellites for monitoring purposes. An item may be detected via GPS so long as there exists a clean line of sight among the item and 4 one-of-a-kind satellites.

IV. SERVICES AND APPLICATION OF HIOT

The modern improvement withinside the IoT generation has enabled the scientific devices to make real-time assessment that have become now not possible for medical doctors a few years ago. It has moreover supported the healthcare centers to gain more people at a time and deliver extraordinary healthcare provider at a minimal cost. The software program of big data and cloud computing has moreover made verbal exchange some of the affected character and medical doctors more reliable and easier. This caused an advanced affected character's engagement withinside the treatment way with a reduced financial burden on the affected character. The sizable impact of IoT, which has been witnessed in modern years, is contributing to the evolution of HIoT programs that includes sickness diagnosis, private cope with paediatric and elderly patients, health and fitness management, and supervision of persistent diseases.

Services. The services and insights have transformed the health agency by providing solutions to many health issues. More services are added every day with an increase in health care desires and a generation upgrade. These truly become an essential part of designing a HIoT system. Each provider in an HIoT environment offers a hard and fast of healthcare solutions. The definition of these concepts/services is not

unique. The vicinity of know-how of the HIoT systems lies in their programs. Hence, it's far tough to outline a generalized definition of each concept. However, to provide a belief into the topic, some of the most considerably used IoT healthcare services (Figure 3) were described within the subsequent section.

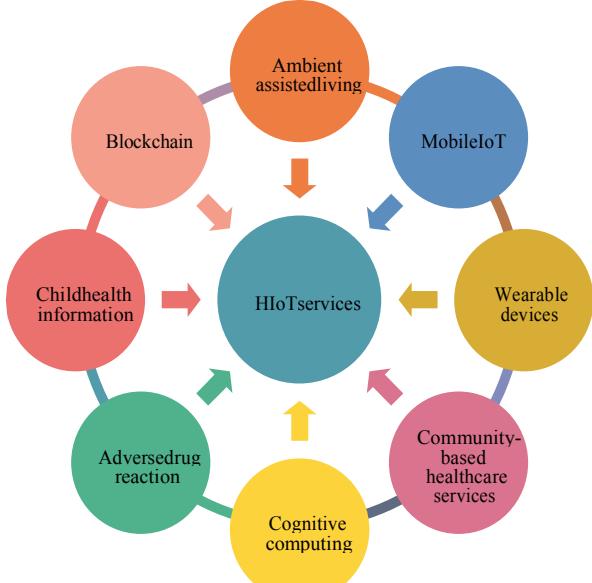


Figure 3: Widely used HIoT Services

Ambient Assisted Living. Ambient Assisted Living (AAL) is a specialized department of synthetic intelligence that integrates with the IoT and is used to help aging humans. The important reason of AAL is to assist aged human beings to stay independently at domestic with comfort and safety. AAL gives a method for real-time tracking of those sufferers and ensuring that they may acquire human service-like help in case of a scientific emergency. Mobile IoT. Mobile IoT or m-IoT depicts the affiliation of cellular computing, sensors, verbal exchange technologies, and cloud computing to song patient's fitness data and different physiological conditions.

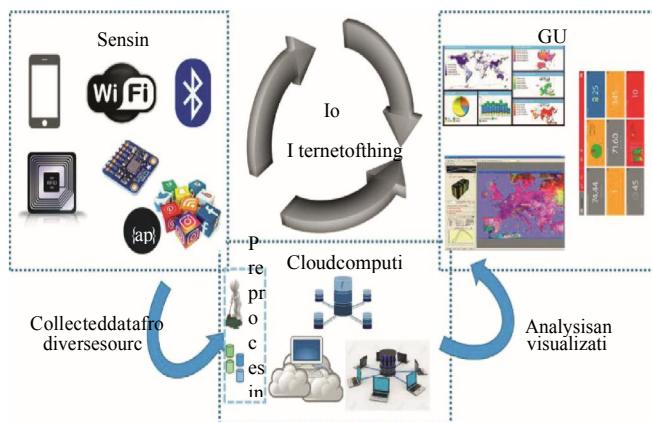


Figure 4: A generalized m-IoT environment (reproduced from [38] under Creative Common License)

Wearable Devices. Wearable gadgets assist healthcare experts and sufferers to address diverse fitness troubles at a discounted cost. These gadgets are non-invasive and can be enhanced with the help of integrating different sensors with wearable devices add-ons to devices used by people, including watches, bracelets, necklaces, t-shirts, shoes, handbags, hats, etc. The sensor connected is used to accumulate the environmental and patient's fitness facts. This fact is then uploaded to the server/databases.



Figure 5: Wearable sensors (reproduced from [27], license no. 496010299387)

Community-Based Healthcare Services. Community-primarily based totally healthcare tracking is a idea of making a healthcare community that covers a nearby network consisting of a personal clinic, a small residential area, a hotel, and so forth to screen the fitness situations of the humans dwelling in that area. In a primarily community-based network, many networks are interconnected and could work together to present a collaborative service.

Cognitive Computing. Cognitive computing refers back to the technique of studying a hassle the manner the human mind does. With the latest advances in the age of sensors and synthetic intelligence, IoT gadgets are currently incorporated with sensors that could mimic the human mind in fixing problems.

Adverse Drug Reaction. A destructive drug response (ADR) may be characterised as a facet impact of taking a medication. The response might also additionally arise both after a unmarried dose or a long-time period administration. This also can be feasible because of the destructive response while distinctive drugs are ingested on the equal time.

Blockchain. The sharing of records amongst distinctive scientific gadgets and healthcare companies performs an essential function in an HIoT community. However, one of the important problems in stable records sharing is records fragmentation. Data fragmentation might also additionally cause an opening in facts throughout healthcare companies, who're related to an unmarried patient.

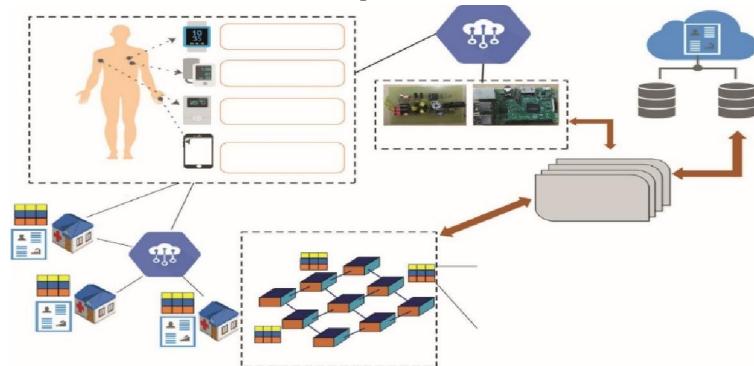


Figure 6: A blockchain-based health monitoring system (modified from [59] under Creative Commons License)
Child Health Information. Child fitness information (CHI) is a idea that offers with developing recognition for a child's well-being. The essential motive of CHI is to teach and empower kids and their dad and mom at the child's universal fitness which include their dietary values, emotional and intellectual state, and behavior.

Applications. HIoT services/standards are used for the improvement of various programs totally based mainly on IoT. Researchers working in the declared fields have offered exceptional standards to the wearer of mankind. In easy words, standards are greater developer-centric, while programs are user-centric.

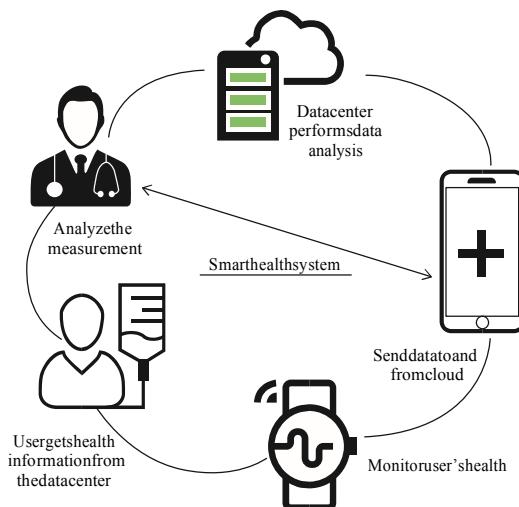


Figure 7: Application of HIoT (reproduced from [40])

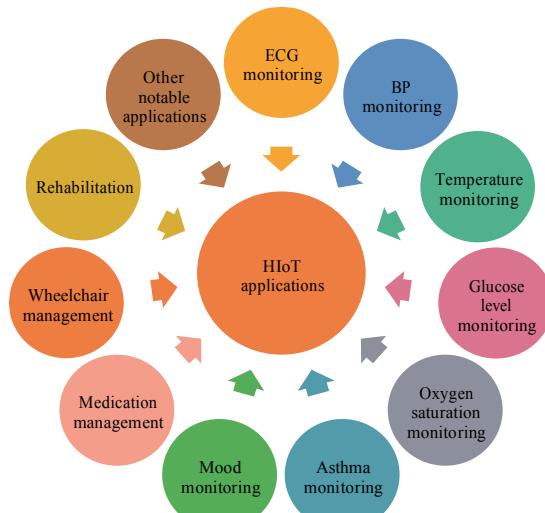


Figure 8: Category of HIoT application

ECG Monitoring. Electrocardiogram (ECG) represents the electric hobby of the coronary heart because of the depolarization and repolarization of atria and ventricles. An ECG affords facts approximately the primary rhythms of the coronary heart muscle tissues and acts as a trademark for diverse cardiac abnormalities.

Glucose Level Monitoring. Diabetes is the circumstance wherein the blood glucose stage within the frame stays excessive for a extended period. It is one of the most common non-unusual diseases in humans. Three foremost sorts of diabetes are typically found, namely, type-I diabetes, type-2 diabetes, and gestational diabetes. The ailment and its sorts may be recognized following 3 tests, namely, random plasma glucose test, fasting plasma glucose test, and oral glucose tolerance test.

Temperature Monitoring. Human frame temperature is a trademark of the renovation of homeostasis and is a vital a part of many diagnostic processes. Additionally, an extrude in frame temperature may be a caution check in a few ailments which include trauma, sepsis, and so on. Keeping music of the extrude in temperature over the years facilitates the medical doctors to make inferences approximately the patient's fitness circumstance in lots of sicknesses.

Blood Pressure Monitoring. One of the obligatory tactics in any diagnostic procedure is the dimension of blood stress (BP). The maximum accustomed technique of dimension of blood stress calls for as a minimum one man

or woman to do the recording. However, the mixing of IoT and different sensing era has converted the manner BP become formerly monitored.

Oxygen Saturation Monitoring. Pulse oximetry is the non-invasive dimension of oxygen saturation and may be used as a critical parameter in healthcare analysis. The non-invasive technique gets rid of the problems associated with the traditional technique and affords real-time tracking. The development within Pulse Oximetry which primarily comes from the IoT mix based totally era has proven capacity utility within the healthcare industry.

Asthma Monitoring. Asthma is a persistent infection which can have an effect on the airlines and can motive issue in breathing. In bronchial allergies, the airlines decrease because of the swelling of the air passage. This follows many fitness problems which include wheezing, coughing, chest pain, and shortness of breath. There isn't any appropriate time for a bronchial allergies assault to come, and an inhaler or nebulizer is the most effective lifesaver at that moment. Hence, there's a capacity want for real-time tracking of this circumstance. Numerous IoT-primarily based totally structures for bronchial allergies tracking had been proposed in latest years.

V. CONCLUSION

The current review investigated different aspects of the HIoT system. Comprehensive knowledge about the architecture of an HIoT system, their component, and the communication among these components has been discussed herein. Additionally, this paper provides information about the current healthcare services where the IoT-based technologies have been explored. By employing these concepts, the IoT technology has helped healthcare professionals to monitor and diagnose several health issues, measure many health parameters, and provide diagnostic facilities at remote locations.

This has transformed the healthcare industry from a hospital-centric to a more patient-centric system. We have also discussed various applications of the HIoT system and their recent trends. Further, the challenges and issues associated with the design, manufacturing, and use of the HIoT system have been provided. These challenges will form a base for future advancement and research focus in the upcoming years. Moreover, a comprehensive up-to-date knowledge on the HIoT devices has been provided for the readers who are not only willing to initiate their research but also make advancements in the said field.

ACKNOWLEDGMENT

Mood tracking offers crucial statistics regarding a man or woman's emotional United States and is used to maintain a healthy highbrow united states. It moreover assists healthcare specialists whilst dealing with several highbrow illnesses which incorporate depression, stress, bipolar disorder, and so on.

Medication Management. Medication adherence is now no longer an uncommon hassle with inside the healthcare industry. Failure to comply with the medicine agenda also can boom destructive complications in patients. Medication nonadherence is particularly placed in elderly humans as they expand medical conditions like cognitive decline, dementia, and so on due to the fact the age progresses. Hence, it's miles difficult for them to strictly study the prescriptions of doctors. **Wheelchair Management.** A wheelchair is an inseparable part of the life of patients with restrained mobility. This offers them frame further to intellectual support. However, the software program of a wheelchair is restricted at the same time as the disability is due to thoughts damage.

REFERENCES

- [1] Z. Ali, M. S. Hossain, G. Muhammad, and A. K. Sangaiah, "An intelligent healthcare for detection and classification to discriminate vocal fold disorders," Future Generation Systems, vol. 85, pp. 19–28, 2018.
- [2] G. Yang, L. Xie, M. Mantysalo et al., "A health-IoT based on the integration of intelligent packaging, unobtrusive bio-sensor, and intelligent medicine box," IEEE Transactions on Industrial Informatics, vol. 10, no. 4, pp. 2180–2191, 2014.
- [3] Y. Yan, "A home-based health information acquisition", Health Information Science and Systems, vol.1, p.12, 2013.

- [4] M. Khan, K. Han, and S. Karthik, "Designing control systems based on internet of things and big data analytics," *Wireless Personal Communications*, vol. 99, no. 4, pp. 1683–1697, 2018.
- [5] P. J. Nachankar, "IoT in agriculture," *Decision Making*, vol. 1, no. 3, 2018.
- [6] V. G. Menon, "An IoT-enabled intelligent automobile system for smart cities," *Internet of Things*, p. 100213, 2020.
- [7] E. Qin, "Cloud computing and the internet of things: technology innovation in automobile service," in *Proceedings of the International Conference on Human Interface and the Management of Information*, pp. 173–180, Las Vegas, NV, USA, July 2013.
- [8] I. Froiz-M'iguez, T. Fernández-Caramés, P. Fraga-Lamas, and L. Castedo, "Design, implementation and practical evaluation of an IoT home automation system for fog computing applications based on MQTT and ZigBee-WiFi sensor nodes," *Sensors*, vol. 18, no. 8, p. 2660, 2018.
- [9] P. S. Mathew, "Applications of IoT in healthcare," in *Cognitive Computing for Big Data Systems over IoT*, pp. 263–288, Springer, Berlin, Germany, 2018.

Survey on Various Image Compression Techniques Used in Image Processing to Improve the Quality of Image

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Abstract: This paper presents study of assorted lossy compression techniques. the 2 techniques are Wavelet Difference Reduction (WDR) based compression and Singular Value Decomposition (SVD) based compression and SVD based compression reduces the psycho visual redundancies present within the image through rank reduction technique. WDR may be a lossy compression technique. It gains compression by taking the discrete wavelet transform of the input image so encodes the transform values using difference compression method. Singular Value Decomposition (SVD) is one in every of the simplest compression techniques. SVD based compression technique gives better visual quality at higher singular values. Various compression parameters like PSNR, MSE and compression ratio are evaluated for the assorted techniques. during this survey, compare how SVD is applied to colour images, the technique of compression and maintain the standard of the image using SVD and also the algorithm to compress a picture using image processing tool MATLAB and compared the WDR SVD lossy compression techniques.

Keywords: Lossy Compression, SVD, WDR, MATLAB, etc.

I. INTRODUCTION

Now a day, every people is keen on collecting the photos, images and videos on multimedia. Not only photos, peoples wish to capture all his memorable moments, that the rise of number of images, photos and videos on multimedia which needs the foremost space. it's obvious that a more amount of memory and quality of image is required to store of those images and videos. If these images are needed to be transmitted, it also requires large bandwidth and quality. So, for that it needs of compression techniques. These compression techniques reduce the disc space for storing occupied by the image with none loss to image quality [4]. Thus, the image size is reduced by selecting proper compression technique liable on the requirement of the user or application. Many of the image processing techniques were developed with application to medical imaging, beholding, face recognition, satellite Imagery, and photo enhancement [4].

The digital streamlining of even the normal day to day routines has caused the usage of multimedia to surge tremendously on a usual. The frequently used multimedia format during this regard is Image. on a daily basis we collect and store many images for various reasons and purposes. This activity finally ends up within the large storage of image files which take up the bulk the memory space of the pc disk. a good resolution for this problem is using compression techniques [1] to chop back the scale of the image. There are various compression techniques, which we are able to choose the acceptable technique supported the kind of image and also the required quality of the image output after compression [13].

1.1 Image Compression

Digital compression technique which compares the image which reduce disc space with maintaining the standard of the image. Basically, a picture compression technique is split into two classes:

1. Lossy Compression

In lossy compression, image is compressed with having some loss of knowledge. After applying decompression original image cannot reconstruct. SVD is that the lossy compression technique.

2. Lossless Compression

In lossless compression it generates the compressed image without loss. Which is same because the original image.

1.2 Singular Value Decomposition

The technique in image processing domain Singular Value Decomposition (SVD) is alleged to be a big topic in algebra by many famous mathematicians. SVD has many practical and theoretical values; Special features of SVD are that it is performed on any input (m, n) matrix. we've got an input matrix A with m rows and n columns, with rank r with $r \leq n \leq m$. Then the input matrix A will be factored into three diagonal matrices: $A = U S V^T$. Every image is represented by variety of pixel values. Pixels represent the intensity of the given image. These pixel values are arranged as a matrix form with rows and columns. The matrix representation of a picture is easily obtained using MATLAB. The key to working with SVD of any given matrix A is to think about AAT and ATA .

$$A = U S V^T$$

A	$=$	U	S	V^T
$m \times n$		$m \times m$	$m \times n$	$n \times n$

The columns of U, that is $m \times m$, are eigenvectors of AA^T , the columns of V, that is $n \times n$, are eigenvectors of A^TA . The singular values on the diagonal of matrix S, that is $m \times n$, are the positive square roots of the nonzero eigenvalues of both AA^T and A^TA . Where A is the image matrix $A_{n \times m}$; Where A is the image matrix $A_{n \times m}$; Where Matrix U is a $m \times m$ orthogonal matrix $U = [u_1, u_2, \dots, u_r, \dots, u_m]$

$$A = USV^T$$

$$A = [u_1 \ u_2 \ \dots \ u_m] \begin{bmatrix} s_1 & 0 & \cdots & \cdots & \cdots & 0 \\ 0 & \ddots & & & & \vdots \\ \vdots & & s_r & & & \vdots \\ & & & 0 & & \vdots \\ \vdots & & & & \ddots & \vdots \\ 0 & \cdots & \cdots & \cdots & \cdots & 0 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ \vdots \\ \vdots \\ v_n \end{bmatrix}$$

Here, S is a $m \times n$ diagonal matrix which is not orthogonal matrix with singular values (SV) on the diagonal. The matrix S can be shown in following for $i = 1, 2, \dots, n$, i's are called Singular Values (SV) of the matrix A. And matrix V is an $n \times n$ orthogonal matrix $V = [v_1, v_2, \dots, v_{r+1}, \dots, v_r, \dots, v_n]$ column vectors i v for $i = 1, 2, \dots, n$, form an Orthogonal sets[14].

1. The matrices U and V are not Unique, however, the singular value $1, \sigma_2, \sigma_3, \dots$ are unique.
2. Since $A^TA = VS^T S V^T$, so V diagonalize A^TA , it follows that the v_i 's are the eigenvector of A^TA .

Algorithm

SVD algorithm for image Compression

Step-1 Read the image (input image). Step-2 Convert the input image (color image) into a gray scale image which is reduce in size.

Step-3 Decompose each component using Singular Value Decomposition i.e. SVD.

Step-4 Select k value and discard the diagonal value of S matrix that are not required. And Construct the image using the selected singular values. The k-value in the m-file represents the number of iterations taken on each layer used in the resulting disintegration. This Is really the rank of the SVD matrix. By increasing the rank we can increase clarity till an ideal image is got.

Step-5 Show the compressed image.

1.3 Wavelet Difference Reduction based Image Compression

The Wavelet Difference Reduction (WDR) is an encoding technique which relies on the difference reduction method. It gains compression by taking the discrete wavelet transform of the input image so encodes the transform values using difference reduction method. [3]

Discrete wavelet transforms divides image into four sub bands LL, LH, HL, HH. Wavelet Difference Reduction encoding uses four steps for encoding: Initialisation, Thresholding, Significant pass and refinement pass.

1. Initialisation: during this the scan order is about. The scan order goes through sub-bands from higher level to lower levels in zig-zag manner. A threshold T_0 is chosen.
2. Update Threshold: Threshold is updated to $T_k = T_{k-1}/2$, for $k=1,2\dots p$ and p 's the number of pixels during a picture.
3. Significance Pass: Here, values of wavelet transform are compared to a specific threshold value. a worth is significant if it's greater than or adequate threshold value. If an index is found to be significant then it's removed from the scan order. Next, difference of these index values is taken and binary expansion of successive difference is completed. Since the MSB in these expansions is usually 1, we are able to ignore this bit and use the signs of the numerous transform values in its place within the symbol stream. The stream consists of 4 symbols that will be encoded using probabilistic model.
4. Refinement Pass: during this, standard bit plane quantization is applied to convey refinement bit. Refined value gives better approximation of transform value.
5. Repeat steps (2) to (4) until you get desired bit budget. To reconstruct the image, WDR decoding and inverse DWT is performed on compressed bit stream. [12] The property of WDR is that it gives perceptually better image at high compression ratio while retaining the desirable features[13].

II. LITERATURE SURVEY

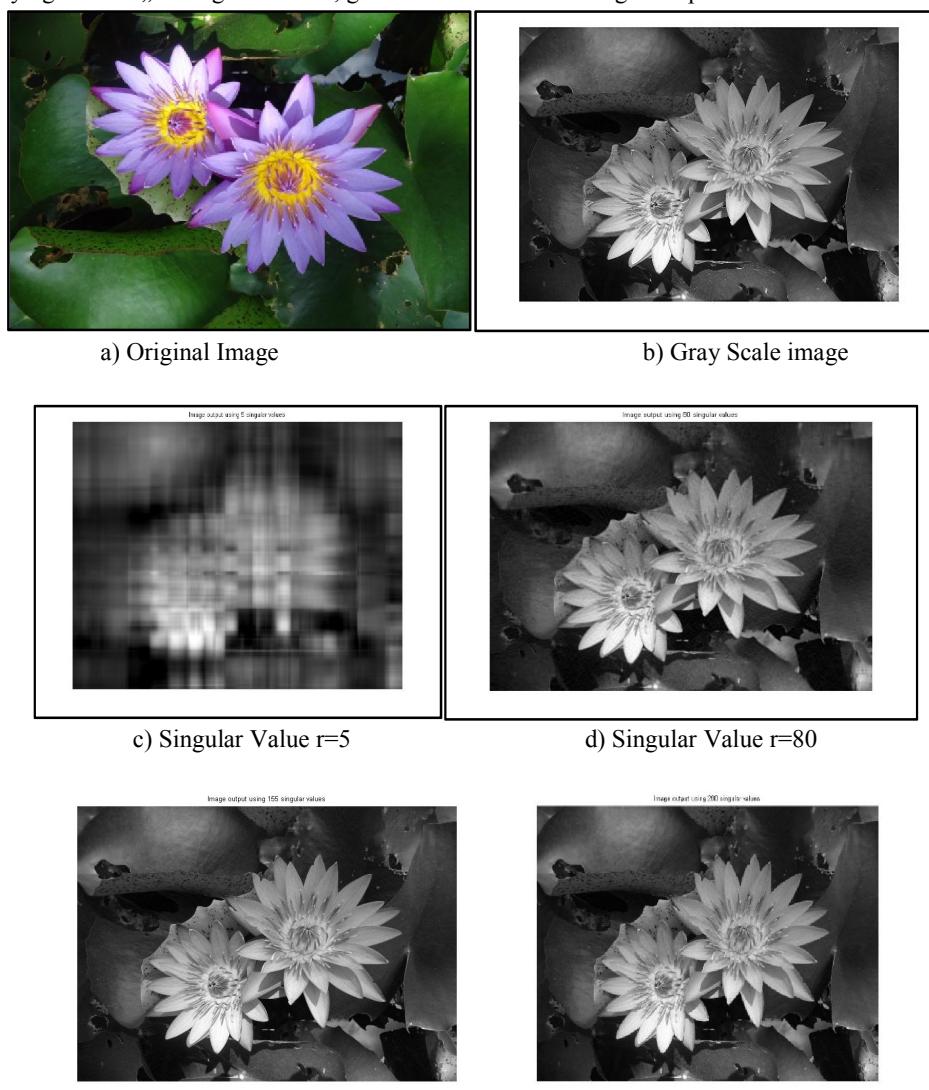
Image signal comprises of an outsized dataset and hence it's hard to proceed with other image processing techniques. So, it's essential to compress the image dataset without compromising any important data from dataset. Zhang and Xiaofei [1] have discussed various compression techniques by learning to reducing the general error mechanisms. RGB and gray scale image component on MPQ-BTC is given in [2]. Gunjan Mathur et al. [3] have elaborated the importance of various lossy compression techniques. K Means clustering has various benefits over other techniques. This unsupervised method is discussed in [4] – [7]. Singular Value Decomposition technique has been proved to be one in every of the foremost frequently used compression methods. it's evidently stated in [8]. Mounika et al. [9] supports plenty in achieving good PSNR values using SVD. Thus, a sturdy background work has been carried to proceed with this paper.

In literature, Ozcelik and A. K. Katsaggelos [1] proposed a mean field annealing method for reducing objects. to chop back artifacts while keeping the required detail present within the primeval image. Proposed technique makes use of a priori information about the pristine image through a no stationary Gauss-Markov model. A maximum a posteriori (MAP) estimation is getting iteratively utilizing mean field annealing [1]. Bredies and Holler [3] proposed a whole variation decompression model for reducing artifacts. a fast primal dual algorithm is developed to unravel this model effectively; it's one of the energy minimization methods.

The work [4][5] the K-SVD method developed to chop back the artifacts present within the image after decompression by improving PSNR. But this methodology (K-SVD algorithm) is kind of computationally demanding, especially when the dimensions of the dictionary rise or the number of coaching signals converts big [3]. Rowayda A. Sadek [5] proposed contribution in using unused SVD characteristics in novel approaches like an adaptive block-based compression, perceptual multiple watermarking, image capacity for thumping information, irregularity measure, etc., of those contributions were experimentally examined and gave talented results compared to established ones. the foremost contributions are a novel perceptual image forensic technique, a replacement potential visualization in using the SVD Properties, reviewing and experimental valuation of the developed SVD based application like compression, a replacement block-based roughness measure for application like perceptual liberal compression furthermore as perceptual progressive data hiding.

III. RESULTS

After applying various „k“ singular values, generates the different image compression result.



Here highest singular value $r=280$ gives the better image quality.

IV. CONCLUSION

The Above survey it can be accomplished that WDR based compression gives good quality compressed images with higher compression ratios and SVD based image compression gives better quality compressed images at higher singular values. For this above compression parameters, the results obtained by WDR based compression are superior than that of SVD based compression. If we amalgamate both these techniques then performance of WDR will get improved. We can get visually better compressed images with high amount of compression ratio if WDR is used along with SVD. This survey paper is for a practical survey of SVD characteristics in various developed image processing approaches for image compression.

This Survey in using unused SVD characteristics in new approaches such as an adaptive block-based compression, these contributions were experimentally checked and gave promising results compared to developed SVD. Singular Value Decomposition (SVD) is a very easy, robust and reliable technique. This SVD image compression technique provides a steady and effective compression method to divide the image matrix into a set of linearly independent matrices to get the different singular values so we can easily find out compressed image.

REFERENCES

- [1] T. Ozcelik, J. Brailean, and A. Katsaggelos, Image and video compression algorithms based on recovery techniques using mean field annealing," Proceedings of the IEEE, vol. 83, no. 2, pp. 304-316, 1995.
- [2] M.-Y. Shen and C.-C. J. Kuo, Review of postprocessing techniques for compression artifact removal," Journal of Visual Communication and Image Representation, vol. 9, no. 1, pp. 2-14, 1998.
- [3] K. Bredies and M. Holler, Artifact-free jpeg decompression with total generalized variationin VISAPP (1), pp. 12-21, 2012.
- [4] K. Mounika, D. Sri Navya Lakshmi, K. Alekya, SVD based image compression,International Journal of Engineering Research and General Science Volume 3, Issue 2, March-April,2015".
- [5] Rowayda A. Sadek, SVD Based Image Processing Applications: State of The Art, Contributions and Research Challenges," (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 3, No. 7, 2012".
- [6] Neethu.K.J, SherinJabbar, Improved Quality of JPEG Compressed Image, IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems ICHIECS"15" Using Approximate K-SVD Algorithm.
- [7] Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MatLab", Prentice Hall, 2006.
- [8] Bernd Jahne, "Digital Image Processsing", Springer, 2002.
- [9] Steve J. Leon; "Linear Algebra with Applications", Macmillan Publishing Company, New York; 1996.
- [10] Lijie Cao, "Singular Value Decomposition Applied to Digital Image Processing".
- [11] K.M. Aishwarya, Rachana Ramesh, Preeti. M. Sobarad and Vipula Singh, "Lossy Image Compression using SVD Coding Algorithm", Proceedings of International Conference on Wireless Communications, Signal Processing and Networking, pp. 1-7, 2016.
- [12] JeongyeupPaek and JeongGil Ko, "K-Means ClusteringBased Data Compression Scheme for Wireless Imaging Sensor Networks", IEEE Systems Journal, Vol. 11, No. 4, pp. 1-12, 2017.
- [13] Sana Shafik Desai and M.S. Chavan, "Comparative Analysis of Singular Value Decomposition (SVD) and Wavelet Difference Reduction (WDR) based Image Compression", International Journal of Engineering Research and Technology, Vol. 10, No. 1, pp. 1-14, 2017.
- [14] Yusra A.Y. Al-Najjar and Der Chen Soong, "Comparison of Image Quality Assessment: PSNR, HVS, SSIM, UIQI", International Journal of Scientific and Engineering Research, Vol. 3, No. 8, pp. 1-5, 2012.
- [15] R. Nandhini and S.R. Aparna, "Study of Security Issues in Internet of Things", International Journal of Research and Analytical Reviews, Vol. 5, No. 3, pp. 1-12, 2018.

Nano Technology

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Abstract: Nanotechnology is the study of extremely small structures, having size of 0.1 to 100 nm. Nanotechnology is considered to be an enabling technology that is likely to have a great impact on our lives over the coming decades. Nanotechnology is truly interdisciplinary; it involves manipulating and controlling individual atoms and molecules to design and create new materials, nanomachines, and nano devices for application in all aspects of our lives. Recent advances and envisioned developments in enabling nanotechnology provide challenges to academia in educating and training a new generation of skilled engineers and competent scientists. Nanotechnology is the technology of manipulation of matter at the nano-meter scale. Nanotechnology has been applied in various sectors including electronics, medicine, diagnostics, military, food industry etc.

Keywords: Nanocomposite, Nanotechnology, Exfoliated Clay, Polymer Layered Silicates, Economic Security, Nanotechnologies, Strategy, Development, Use, etc.

I. INTRODUCTION

The field of nanotechnology is one of the most popular areas for current research and development in all technical disciplines. This obviously includes polymer science and technology which covers a broad range of topics - microelectronics or nanoelectronics, polymer-based biomaterials, nanoparticle drug delivery, mini emulsion particles, fuel cell electrode polymer bound catalysts, layer-by-layer self-assembled polymer films, electro spun nanofibers, imprint lithography, polymer blends and nanocomposites.

Polymer nanocomposites are materials in which nanoscopic inorganic particles are dispersed in an organic polymer matrix in order to significantly improve the performance properties of the polymer. For instance, the layer orientation, polymer-silicate nanocomposites exhibit stiffness, strength and dimensional stability in two dimensions. Due to nano-meter length scale which minimizes scattering of light, nanocomposites are usually transparent. Polymer nanocomposites represent a new alternative to conventionally filled polymers. Because of their nano-meter sizes, filler dispersion nanocomposites exhibit markedly improved properties when compared to pure polymers or their traditional composites or blends which include increased modulus and strength, outstanding barrier properties, improved solvent and heat resistance and decreased flammability.

These materials are endowed with many important properties such as nonlinear optical properties, electronic conductivity and luminescence, and have been proposed for their use in various applications including chemical sensors, electroluminescent devices, electro catalysis, batteries, smart windows and memory devices.

Nanotechnologies positioned as new basis innovation [2], and nano industry is considered as a system of interrelated innovative processes in the framework of transition to 6th technology revolution. Nanotechnologies are also considered as future of such spheres as energy production, electronics, medicine, biology and pharmacology, chemical production, space and defence. Even today obtained with the use of nanotechnologies products stand for 0,01% of world GDP (2010), it is expected that it will increase to 2% by 2015 [3]. Potentialities of nanotechnologies in terms of competitiveness of the country, its technological leadership and national security interests demand active approach to their development and commercialization. The results of nanotechnology rivalry determine the place of the country in world division of labour and its role in world financial system which assigns "technological" rent to the countries-leaders in innovative development.

Besides structural applications, polymer nanoparticle compounds have very interesting functional applications. For instance, γ -Fe₂O₃ polymer nanocomposites are used as advanced toner materials for high quality colour copiers and printers and as contrast agents in NMR analysis, memory devices.

Advancement in the field of nanotechnology and its applications to the field of medicines and pharmaceuticals has revolutionized the twentieth century. Nanotechnology [1] is the study of extremely small structures. The prefix “nano” is a Greek word which means “dwarf”. The word “nano” means very small or miniature size. Nanotechnology is the treatment of individual atoms, molecules, or compounds into structures to produce materials and devices with special properties. Nanotechnology involve work from top down i.e., reducing the size of large structures to smallest structure e.g., photonics applications in nano electronics and nano engineering, top-down or the bottom up, which involves changing individual atoms and molecules into nanostructures and more closely resembles chemistry biology

II. FUNDAMENTAL CONSIDERATIONS

In recent years, growing environmental awareness has led to increased pressure on manufacturers and users of materials to consider the environmental impact of material products. Nanotechnology is no exception. Life cycle assessment (LCA) has recently emerged as a powerful holistic tool for the assessment of the environmental impacts of nanotechnology [3]. Application of LCA to nanotechnology highlights both the positive and negative impacts of nanotechnology on the environment throughout the whole life cycle of nano-products. The life cycle includes all aspects of activities during the life of a product ‘from the cradle to the grave’, such as the extraction of raw materials and resources, production processes and facilities, the usage of products, and post-use management of the product including recycling and disposal. LCA helps to identify the potential risks associated with nanomaterials and nano-enables products in advance. LCA can also clarify the risk-benefit balance during the entire life cycle of the nano-products. However, the LCA of nanotechnology is still in its infancy. The slow progress in the LCA of nanomaterials is due to the many challenges it faces. The major obstacles include the uncertainty arising from the immature nature of the technology and markets, lack of risk-associated information, a high number of nano-specific properties to be considered, and the fast development pace of technology commercialization.

Applications of Nanotechnology The different fields that find potential applications of nanotechnology are as follows: a. Health and Medicine b. Electronics c. Transportation d. Energy and Environment e. Space exploration.

Main part in economic literature economic security is defined as “sufficiency in ensuring of needed level of national security by means of necessary resources, formation of favourable conditions for development of competitive economy, protected state of personal, social and state economic interests from internal and external threats” [7]. Economic security can be understood, on the one hand, as complex system consisting of different sub-systems (scientific technological, energy, financial securities etc.) [8]. In formation of innovative economy scientific technological and resource securities play prioritized role.

On the other hand - as special steady state of national economy which is characterized by constantly improved set of its parameters and abilities allowing to function efficiently in constantly changing medium. The algorithm of formation of economic security suggests stage-by-stage finding out of economic interests and economic challenges. Analysis of economic security state suggests identification of indicators systems and study of its threshold values. Nanotechnologies and nanotechnological activity are considered as one of the key factors influencing national economic security in conditions of globalization. Development of nano-industry in proactive mode demands scientifically grounded optimization of strategic regulation. In developed countries (leading countries which claim for nanotechnologies superiority - the USA, Japan, EU countries – Germany, Finland, Sweden, South Korea - strategic conceptual approaches have been developed to ensure economic security while developing and use of nanotechnologies with due regard to national particularities and priorities of economy.

Elements of strategic management of nano-industry development 1. Ensuring safe development of nanotechnologies necessitates evaluation of: potential risks for human health, environment and labour safety; ethic, legislative and social effects of nanotechnologies' development [9]. While developing nano-industry the following factors must be taken into account: 1) productivity of nanotechnologies; 2) long-term scenarios of economic development; 3) scenarios of social development and convergent technologies; 4) threats to national

security; 5) ethics, risks and uncertainty; 6) legal and international aspects; 7) interaction with public, development of human resources.

III. PUBLIC PERCEPTION OF RISKS AND BENEFITS

Over the past few decades, a new technology has emerged called “nanotechnology”. It has entered the lives of millions of people already and is projected to keep doing so more and more. Nanotechnology is the manipulation of matter on a molecular or even atomic level (Drexler, 1992) and due to its wide range of possible applications in food and packaging for example, its use is likely to increase over the coming years (Kuzma &VerHage, 2008). Aside from food, nanotechnology can also add to care products (e.g., sunscreens) (Shatkin, 2013), or various types of medicine (Maynard, 2006). Public perception of new technologies can be influential for their application (Köhler &Som, 2008), and the sales of genetically modified (GM) foods, for example, were adversely affected by a negative outlook from the public (Ferber, 1999; Gaskell, Bauer, Durant, & Allum, 1999). Knowing the public’s perception on nanotechnology’s risks and benefits is therefore of great importance. This study was conducted to see whether nano-additives in either food, care products, or medicine were perceived differently from other additives. Using nano-additives in different product categories could also possibly unveil differences in perception among nano-products, so this was taken into account as well.

Nanotechnology can be used for a wide range of applications, e.g., military purposes, machinery, the environment, medical purposes, or food (Cacciato, Scheufele, & Corley, 2011). Some current and proposed applications of nanotechnology include self-cleaning and air-purifying surface coatings, self-healing coatings, static and wrinkle-free fabrics, and contaminant detection in drinking water (Shatkin, 2013). However, these possible benefits do not exclude the possibility of accompanying risks, as several studies have pointed to potential risks from producing and using nano-materials (Arnall, 2004; Dreher, 2004; Hoet, BrüskeHohlfeld, &Salata, 2004). It is likely that some nano-particles may be released into the environment during or after the production or consumption of products using nano-materials. By either inhalation, ingestion, or dermal penetration it is possible for nano-particles to get into the human body (Maynard, 2006, Oberdörster, Oberdörster, &Oberdörster, 2005). When considering medical devices and drugs there are two additional means of entry – injection (Oberdörster et al., 2005) and release from implants (Maynard, 2006). It is not yet possible to say what the actual effects of decades of using nanotechnology will or might be on human health and the environment, even if current tests deem it to be safe. The technology has not been in use long enough yet to gather enough data on this.

IV. RISK PERCEPTION

Perceptions about risks and benefits, and subsequently the consumers’ willingness to use nanotechnology, are influenced by several factors. Epstein (1994) distinguishes two separate ways in which people assess risk. One mode of thinking, the experiential system, bases its assessment on affect, associations and connections, past experiences, and encoding reality into images, metaphors, and narratives. This process is rapid and validated through “experiencing is believing”. The other mode of thinking, the analytic system, is based on logic and reason, and encodes reality into abstract symbols, words, and numbers. It’s a slower process and requires justification through logic and evidence. Finucane, Alhakami, Slovic, and Johnson (2000) show how affect comes before, and also directs, judgments of risks and benefits. For example: information stating that a risk is high for a certain technology or activity leads to a decrease in perceived benefits and vice versa. The same holds true when it is stated that a technology or activity has low risk.

The benefits will be inferred to be high. Information about high benefits also suggests low perceived risks. People use trust as another shortcut when making decisions when they lack knowledge or information. People trusting the industry using and applying, and the agencies checking and regulating nanotechnology, assessed nano-applications more positively than the people lacking trust (Siegrist et al., 2007a; Siegrist, Keller, Kastenholz, Frey, &Wiek, 2007b; Siegrist et al., 2008).

Cobb &Macoubrie (2004) found that amount of trust was not significantly related to knowledge about nanotechnology, but it was associated with perceptions of more specific potential risks and benefits. Less trust

also resulted in more participants responding that risks would outweigh benefits. Nanotechnology has been considered to be more risky than more conventional ways of enhancing products. Granted that higher perceived risks are associated with lower trust; the first hypothesis will be: nanoadditives will have lower perceived trust than nano-additives. Here, trust is defined as the confident expectation or reliance upon something with more trust, meaning being more hopeful or confident in a positive outcome.

V. GENERAL FRAMEWORK OF NANOTECHNOLOGY

In the simplest terms, the subject of nanoscience technology is defined as the science and technology of the direct or indirect manipulation of atoms and molecules into functional structures, with applications that were never envisioned before. The prefix “nano” corresponds to a basic unit on a length scale, meaning 10–9 meters, which is a hundred to a thousand times smaller than a typical biological cell or bacterium. At the nano-meter length scale, the dimensions of the materials and devices begin to reach the limit of 10 to 100s of atoms, wherein entirely new physical and chemical effects are observed; and possibilities arise for the next generation of cutting-edge products based on the ultimate miniaturization or so called “nanoization” of the technology. The earliest impetus to the scientific and technological possibility of coaxing individual atoms into the making of useful materials, devices and applications was given by the late Nobel-prize winning physicist Richard Feynman, in a landmark lecture: “There’s Plenty of Room at the Bottom,” delivered at the American Physical Society (APS) meeting at Cal Tech in 1959, in which he said, “The problems of chemistry and biology can be greatly helped if our ability to see what we are doing, and to do things on an atomic level, is ultimately developed - a development which I think cannot be avoided”. Indeed, scanning probe microscopes (SPMs), in recent years, have already given us this ability in limited domains, and spurred a tremendous growth in the pursuit of nanotechnology in the last two decades. A series of scientific and technological discoveries and progresses in a variety of areas in 1970s and 1980s, and the enunciation of visionary scenarios by Eric Drexler in a possible molecular nanotechnology-enabled world, have revived the field in the 1980-90s.

VI. SOURCES OF NANO-TECHNOLOGY

Nanotechnology is a broad field of modern science and also engineering, which creates, potentially, endless possibilities. This term is most often defined as the preparation and use of structures in which at least one dimension is expressed in nano-meters. Usually, the dimensions of these structures are in the range from 1 to 100 nm (more often up to several hundred nm). The term nano-technology was used first time in 1974 by Japanese scientist Norio Taniguchi. He used the term to describe semiconductor processes. His definition of nano-technology was as follows: "Nano-technology mainly consists of the processing of separation, consolidation, and deformation of materials by one atom or one molecule" [1].

Taniguchi considered nanotechnology as a technology of precision manufacture with nano-meter tolerances. Such an approach implied from Taniguchi's background – he had studied the developments in machining techniques. The vision of nanotechnology, however, has deeper roots. The first ideas appeared several years earlier. On December 29, 1959, at California Institute of Technology, Feynman gave a lecture titled “There’s Plenty of Room at the Bottom” [2]. In lecture, he considered the possibility of direct manipulation of individual atoms as a more powerful form of synthetic chemistry than those used at the time. Feynman also suggested that it should be possible, in principle, to make very tiny machines that are able to arrange the atoms the way we want, and do chemical synthesis by mechanical manipulation. At the end of his talk, Feynman announced two challenges and funded prize for each one.

The first task involved the construction of a very small motor, such small that would fit inside a cube 1/64 inches (0.4 mm) on each side. The second one was much more difficult – to find a way to scale down letters small enough so as to be able to take the information on a page of a book and put it on an area 1/20000 smaller in linear scale.

The concepts, as well as tasks presented by Feynman were very abstractive at that time; nevertheless, they gave to researchers a strong motivation to work. In November 1960, to Feynman's surprise, an electrical engineer William McLellan, presented an electric motor which size met posed assumptions. The motor was pure

handcraft engineering. McLellan, to fabricate it, did not use any cut-edge apparatus but typical tools and his experience. Among his tools was a sharpened toothpick which pushed the miniature components into place - appropriately presaging the atom-fine tips of atomicforce microscopes [3]. To meet the second challenge took a little more time. In 1985, Tom Newman, a Stanford graduate student, successfully reduced the first paragraph of A Tale of Two Cities by 1/25,000, and collected the second Feynman prize [3]

VII. CHARACTERIZATION

The vigorous development of polymeric science and extensive utilization of polymeric materials in technology has led in recent years to the increased interest in the preparation and characterization of polymer and its composite films. Characterization is an essential part of all investigations dealing with materials. The important aspects of characterization are chemical composition, compositional homogeneity (chemical homogeneity), structure, identification and analysis of defects and impurities influencing the properties of the materials. Thus, Characterization describes all those features of composition and structure of a material that would suffice for reproducing the material. The advances made in the last few years in characterization techniques, especially in the structure elucidation, have been stupendous and have opened new vistas in solidstate materials. Among the several characterization techniques, X-ray diffraction (XRD), scanning electron micrography (SEM) and infrared (IR) spectroscopy and Thermal analysis are main important techniques.

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VIII. CYBER AND VIRTUAL INNOVATIONS

Dr. Sean Brophy, Purdue University, and Dr. Miriam Heller, Computing Research Association The nanoscience and nanotechnology centers have spawned several valuable cyberinfrastructure resources, some targeting education. The NanoEducation and STEM education communities need to become more aware of these cyberinfrastructure resources. Also, these cyberinfrastructure resources must become more integrated with each other for easier discovery. For instance, despite nanoHUB's widespread use with over 92,000 annual users, many workshop participants were not familiar with it or its capabilities. NanoHUB capabilities need to be better publicized regarding accessibility, content and updates, targeted user levels, customizability to targeted audiences and individual user interface, interoperability with other systems, and end-user.

IX. APPLICATIONS OF POLYMER-BASED NANOCOMPOSITES

Polymer composites comprising nanoparticles are often investigated where reinforcement of the polymer matrix is achieved. While the reinforcement aspects are a major part of the nanocomposite investigations reported in the literature, many other variants and property enhancements are under active study and in some cases commercialization.

The advantages of nanoscale particle incorporation can lead to a myriad of application possibilities where the analogous larger scale particle incorporation would not yield the sufficient property profile for utilization. These areas include barrier properties, membrane separation, UV screens, flammability resistance, polymer blend

compatibilization, electrical conductivity, impact modification, and biomedical applications. Examples of nanoparticle, nanoplatelet and nanofiber incorporation into polymer matrices are listed in Table along with potential utility where properties other than mechanical property reinforcement are relevant.

Application of Nanotechnology in Modified Medicated Textiles

Using nanotechnology newer antibacterial cotton has been developed and used for antibacterial textiles. Developmental works using nanotechnology, new modified antibacterial textiles have been developed. Application of conventional antimicrobial agents to textiles has been already reported. This technique has been advanced by a focus on inorganic nano structured materials that acquire good antibacterial activity and application of these materials to the textiles.

Applications of Nanotechnology in Cancer:

A Literature Review of Imaging and Treatment Niranjan Bhandare* and Ashwatha Narayana Department of Radiation Oncology, Greenwich Hospital/Yale New-haven Health system, Greenwich, CT, USA

*Corresponding author: Niranjan Bhandare Department of Radiation Oncology, Greenwich Hospital/Yale New Haven Health system, Greenwich, CT, USA, Tel: 203-863-3743; Fax: 352-265-0759; Received date: May 12, 2014, Accepted date: Oct 27, 2014, Publication date: Oct 31, 2014 Copyright: © 2014 Bhandare N, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract Recent advances in the application of nanotechnology in medicine, often referred to as nanomedicine, may revolutionize our approach to healthcare. Cancer nanotechnology is a relatively novel interdisciplinary area of comprehensive research that combines the basic sciences, like biology and chemistry, with engineering and medicine. Nanotechnology involves creating and utilizing the constructs of variable chemistry and architecture with dimensions at the nanoscale level comparable to those of biomolecules or biological vesicles in the human body. Operating with sub molecular interactions, it offers the potential for unique and novel approaches with a broad spectrum of applications in cancer treatment including areas such as diagnostics, therapeutics, and prognostics. Nanotechnology also opens pathways to developing new and efficient therapeutic approaches to cancer treatment that can overcome numerous barriers posed by the human body compared to conventional approaches. Improvement in chemotherapeutic delivery through enhanced solubility and prolonged retention time has been the focus of research in nanomedicine.

The sub microscopic size and flexibility of nanoparticles offer the promise of selective tumour access. Formulated from a variety of substances, nanoparticles are configured to transport myriad substances in a controlled and targeted fashion to malignant cells while minimizing the damage to normal cells. They are designed and developed to take advantage of the morphology and characteristics of a malignant tumour, such as leaky tumour vasculature, specific cell surface antigen expression, and rapid proliferation. Nanotechnology offers a revolutionary role in both diagnostics (imaging, immune-detection) and treatment (radiation therapy, chemotherapy, immunotherapy, thermotherapy, photodynamic therapy, and anti-angiogenesis). Moreover, nanoparticles may be designed to offer a multifunctional approach operating simultaneously as an effective and efficient anticancer drug as well as an imaging material to evaluate the efficacy of the drug for treatment follow-up. In recent years, nanomedicine has exhibited strong promise and progress in radically changing the approach to cancer detection and treatment. **Keywords:** Nanotechnology; Cancer treatment; Imaging Introduction Carcinogenesis is associated with progressive modifications/ alterations in the cellular, genetic, and epigenetic characteristics that results in uncontrolled cell division, ultimately leading to the formation of a malignant mass. Cancer is identified by unregulated, uncontrolled tissue growth.

X. CONCLUSION

Novel polymer nanocomposites can be prepared by varying two parameters; first by optimizing polymer to clay or polymer to layered silicate ratio and second by varying the processing techniques [1 & 3]. An exploration in

making the polymer nanocomposites with different clays, surfactants and polymers is a continuing subject of research and interest to both academia and industry.

Fundamental studies in nanotechnologies sphere are of strategic character. In long term their results will be used as foundation of significantly transformed high-tech industries which to a great extent will determine innovative, economic and defense potential of the country. So, nano-industry becomes one of the most important industries which set the pace of innovative development of global economy. Category of nanotechnologies security is vague and must be considered in complex terms. But every element of it can be analyzed separately. Economic security is a state of protection of economy which would provide competitiveness of scientific researches and inventions in the sphere of nanotechnologies and nanotechnological production in internal and world markets, ability of economy for sustainable development and compare negative factors which take place in world markets. By now the threats to national security in nanotechnologies sphere must be formulated. We can use statistics and different indicators for evaluation of the level of security in Russia and foreign countries: indicators of the situation in scientific sphere (mainly it is financing of R&D); investments into fixed assets, use of studies' results and inventions in economy. Development, realization and constant improvement of measures to provide state control over the spread of nanotechnologies including export control.

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REFERENCES

- [1] ArunkumarLagashetty, A Venkataraman; Polymer Nanocomposites; Resonance July 2005.
- [2] ShadpourMallakpour,Zahra Rafiee; New developments in polymer science and technology using combination of ionic liquids and microwave irradiation; j.progpolymsci.2011.03.001.
- [3] Zhang M, Fang S, Zakhidov AA, Lee SB, Aliev AE, Williams CD, et al. Science 2005;309:1215-9.
- [4] Colin Harwood and Anil Wipat, Microbial Synthetic Biology, Academic Press, 2013.
- [5] Marianne Manchester and Nicole F. Steinmetz, Viruses and Nanotechnology, Springer, 2008.
- [6] James Chapman, Timothy Sullivan and Fiona Regan, Nanoparticles in Antimicrobial Materials: Use and Characterization, Royal Society of Chemistry, 2012.
- [7] N. Taniguchi, "On the basic concept of 'nano-technology,'" in Proc. Intl. Conf. Prod. Eng., 1974.
- [8] R. Feynman, "There's plenty of room at the bottom," Eng. Sci., vol. 23, no. 5, pp. 22- 36, 1960.
- [9] J. R. Gribbin and M. Gribbin, Richard Feynman: A life in science. Dutton, 1997, p. 301

Safety in Construction a Management Perspective - A Review

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Abstract: Safety of the workers is the most important norm and should be followed judiciously on the construction site. This has to be seriously reviewed from time to time and monitored carefully by the employer. The authors of the present study therefore present an overview of the different aspects of safety in construction and their implementation. This review displays an investigation into the nuances of the construction industry enabled to enhance safety execution. The main aim of this study is to identify the basic achievement factors responsible for execution and to look into the security administration on site. Safety administration is the basis for the coveted changes in arrangement of work and attitude. It gives everyone working on site specially the workers a feeling of wellbeing in various work activities. It helps in obtaining essential information about the dangers and necessary precautions to be taken. This review reveals the various security lapses and their consequences experienced and sustained by the workers and support staff of the construction industry.

Keywords: Safety, Safety of Worker, Safety Administration, Lapses Execution, etc.

I. INTRODUCTION

Everyone who works needs to know how to work safely and without risking their life. Employers should give their workers the right information, instruction, and training so that they can work safely and take steps to protect themselves from unsafe working procedures leading to hazards. This is not only a legal duty of the employers but it also contributes to the success of their business by providing a hazard free work environment. The construction industry plays a very important role in the development of our country and it is one of the most labor-intensive industries. Hence as a large workforce is involved which is skilled in its work but not literate, ignorance and illiteracy leads to accidents which may have very threatening results. The construction industry seems to be inefficient to some extent, in managing workplace health and safety of the workers. This makes it the most hazardous and risk enduring industry in terms of fatality observed and experienced.

A positive employer society can be a powerful apparatus for improving security in an association and in providing safe working conditions at the workplace. Increasingly in the present decade, employers have demonstrated enthusiasm for a safety and wellbeing of the workers. This is the reflection of the various accidents involved and strict government norms in dealing with the culprits, who have compromised with the safety of their workers.

II. OBJECTIVE OF THE STUDY

The benchmarks have been set up by the government along with legalities to be followed by the employers, but their implementation should be strictly monitored. The employers should shoulder the responsibility of implementing and imposing these benchmarks and strictly monitored if they are being compromised at any level. Strict punishments should be given to employers and employees who fail to abide by the norms set up by the government.

The purpose of this study is to analyze the set benchmarks and whether they are being followed for the safety and health security of the construction contractors, workers and support staff.

III. LITERATURE REVIEW

A review of the existing research articles was carried out by the authors and their study was analyzed for its innovativeness and perception. The views expressed by the various authors are included in the present study.

Abdul-Rashid Ibrahim et.al. [2007] investigated the factors affecting safety performance in large constructions in Egypt and found that safety factors were compromised everywhere. The most neglected part of the construction activity is the safety and health of the workforce [1].

Khan Suguna Raghunath et.al. [2015] investigated the safety work environment in the construction industry. The objective of their study was to investigate the execution of safety management in construction industry. After investigation it was found that the safety of the workers as well as the he construction industry was at stake in various construction sites. The deficits observed were, for example, absence of information about the need of earth association for control apparatuses and absence of learning about links shield from mechanical harms [2]. She further concluded that safety policy, standards, safety training, investigation for hazardous conditions, personal protection programs, safety promotion and management behavior are taken for granted by both the employers and employees.

Kanchana Sivaprakash Joseph et.al. [2015] focused on the large development overall in the construction industry in the past few decades. The author expressed her concerns that the project will be effective if and only if the safety of the structures and that of the staff and workers are of given extreme importance. The safety issues are to be viewed as ideal from the design organization till the completion of the construction activity and handing over of the structure. A proper coordination between workers, management, and support staff is required for safe working conditions and there is a dearth of this in Indian construction companies. Employers can simply check the rule book and draw up an appropriate wellbeing and safety design particular to business working environment and employees [3]. The author further concluded that there is lack of proper coordination between workers, customers, and workforce.

Saat Mohd Subramaniam Shamsudin et.al. [2017] presented that safety performance is one of the new found fields of the construction industry and is now accepted by all as a specialized field. Researchers around are focusing on this area. The paper talks about the prime issues that require before directing an examination on safety performance. This study on safety execution ought to be founded as a multi-level analyses.

ChenYuting. et.al [2017] investigated the malpractices in the construction industry and came up with surprising figures regarding the rate of malpractices over the world due to its high hazard and quick changes in work environment. Safety administrators are one of the key staff mindful and responsible for safe management system. Their quality, integrity and competency are very important for site safety execution. Safety officers are not serious about site safety management [4].

Jothsna Jegan et.al. [2017] present that construction works everywhere throughout the world bearing genuine risk to workers . in this paper the effects of the chronicled, sparing, mental, specialized, procedural, recurrence and the ecological issues are considered regarding how these factors are connected with site safety performance. It was observed to be that the workers have gotten a constrained culture of safety awareness. Economical, psychological, technical and the environmental issues are not considered [5].

Mohammed Shamsul Bakri et.al. [2017] stated that safety management is related with the arrangements, targets, techniques, strategies, parts and capacities that go for controlling peril and hazard . The mindfulness and impression of workers toward safety,wellbeing and their workplace are essential perspective to upgrade the building construction to the better condition of the workers. He also stated that knowledge and attention to safety management framework is very important thought for safety management framework [6].

IV. METHODOLOGY

This is a review paper where in various research works of different authors were studied and the observations were studied and Conclusions were drawn. Site safety is one of the most important issues, especially in construction projects. It is important to pay more attention to safety management in construction projects as there is a direct threat to life

V. CONCLUSION

After reviewing various research works following conclusions are drawn:

1. There is lack of knowledge about how to use equipment's on site and also lack of management.
2. There is lack of awareness among managers, safety officers, supervisors etc.
3. The construction site should have good and structured safety practices namely safety policy, education and training, site safety inspection, safety auditing, safety meeting, site safety organization, personal protective equipment, emergency support and safety measuring devices, fall protective systems, and safety promotions
4. Warning signs, guides or reflector should be displaced where necessary on site.
5. Construction Companies should look to improve their policy.
6. Continuous safety development should include 6 steps. These steps involve creating safety regulation, identify hazard, assess and evaluate risk, decide precaution, record findings, and updating finding in relation to the work condition.

REFERENCES

- [1] Abdul-Rashid Ibrahim, Bassioni Hesham, Bawazeer Faez (2007), "Factors Affecting Safety Performance in Large Construction Contractors in Egypt", PP: 661-670.
- [2] Khan K. Imthathullah, Suguna K., Raghunath P. N. (2015), "Factor Analysis on Safety Management in Construction Projects", Asian Journal of Applied Sciences (ISSN: 2321 – 0893) Volume 03 – Issue 04, PP: 766-775.
- [3] Kanchana S., Sivaprakash P., Joseph Sebastian (2015), "Studies on Labour Safety in Construction Sites", Hindawi Publishing Corporation Volume 2015, PP: 1-6
- [4] ChenYuting, McCabeBrenda, Hyatt Douglas (2017), "Impact of individual resilience and safety climate on safety performance and psychological stress of construction workers: A case study of the Ontario construction industry", Journal of Safety Research, PP: 167-176.
- [5] Jothsna C., Jegan R. (2017), "Factors Influencing Safety in Construction Project and Behavior Based Safety Management Approach", International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume 5, Issue 3, ISSN: 2321-9653, PP: 425-44.
- [6] Mohammed Y.D., Shamsuddin B.M.T., Bakri M.I. (2017), "Assessing Workers Safety Management Knowledge on Construction Site", International Journal of Engineering Research & Science (IJOER), Volume 3, Issue 5, ISSN: 2395-6992, PP: 20-26.

Heat Exchanger Design with Supercritical Fluid

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Abstract: Supercritical fluids are utilised to improve the thermal performance of various heat exchangers all over the world, and their use in power cycles in thermal power plants is also being studied. These fluids boost the ability of low-grade energies, such as heat energy, to be used more effectively. Before beginning the study, various fluids were considered. CO₂ is being considered by a number of studies. To make brayton cycles apps perform better. Simulations were run with isobutane as the supercritical fluid in this investigation. The thermal performance of printed type heat exchanger channels in counter flow configurations was calculated. Isobutane was discovered to be a better option to CO₂ as a working fluid in heat exchangers.

Keywords: Supercritical Fluid, Heat Exchangers, Isobutene, Heat Exchangers, etc.

I. INTRODUCTION

A supercritical fluid is one that has passed its critical temperature and pressure threshold and cannot be distinguished into gaseous and liquid phases. These fluids can emit through solids such as gas or dissolve in materials such as liquids. Researchers originally discovered supercritical fluids while conducting an experiment involving the sound of a flint ball in a fully covered canon. Heat exchangers use supercritical fluids because they have low viscosity, high density, and increased thermal conductivity. When a fluid approaches its critical point, minute changes in its pressure and temperature occur, causing impacts on the density and allowing different properties to be tuned.

The efficiency and compactness of power cycles involving these fluids are extremely high. They're getting more popular these days because they can be used for both nuclear and solar energy. Water and steam are employed as running fluids in modern turbine power plants, and fluids at supercritical stages use fluids with pressure and temperature above critical point. It has the ability to adopt attributes in the middle of the power cycle, resulting in increased usage and higher efficiency over the entire power cycle. Because the density of a fluid increases in its supercritical state, the space occupied by turbines and other components in a powerplant is reduced, resulting in a small plant with cheap costs. The use of supercritical fluid improves a power plant's efficiency and a heat exchanger's performance, allowing low-grade energy to be efficiently utilised.

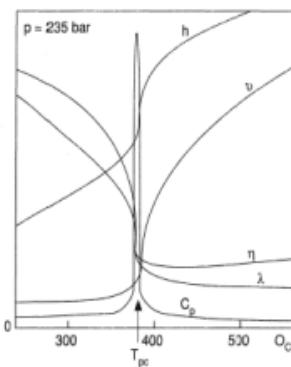


Figure 1: Pseudo critical temperature point

When the thermal characteristics of a fluid are enhanced above their critical point, the main dissimilarity develops in its operation. Dissimilarity occurs along the saturation line and the x-direction pressure line of the

constant temperature line, where distinct phases of water are involved in changing their quantity. The constant temperature line has no slope at a point on the curve where the pressure is critical, p_c . When the fluid temperature exceeds its critical temperature, the constant temperature line does not become discontinuous, and supercritical qualities are obtained. After passing through the critical point of a fluid, a stage occurs where the specific heat of the fluid increases dramatically before decreasing; this point is known as the pseudo critical point of the fluid. Heat exchangers are commonly employed in power plants as a recuperator and regenerator, with increased efficiency and performance resulting in increased stability.

Above the critical point, many investigations on the use of carbon dioxide as a fluid in the heat exchanger are underway. People studying choose carbon dioxide as a heat exchanger fluid because of its low critical point (31C, 7.4Mpa)Plate heat exchangers and double tube heat exchangers are being studied as a recuperator in thermal power plants all over the world. Researchers, on the other hand, are more interested in the Printed Circuit kind. These are a novel type of heat exchanger that features high-efficiency microchannel vaporizers and is densely packed. As a result, they are the centre of attention. Photochemical etching and diffusion bonding were used to create this micro-channel heat exchanger. As a result, when compared to its other varieties, PCHE performs better. PCHE has a number of disadvantages, one of which being pressure drop. As a result, experts have been researching and developing methods to increase its functionality.

Fluid Selection

The selection of fluid was done depending upon their properties. Many fluids had adverse environmental effects. Also, many fluids which had not shown harmful environment effect had high critical point. This means that it would be practically difficult to achieve those operating conditions.

Fluid	Critical properties	Other Properties
R134a	(4.06Mpa,374.01K)	High GWP, Displace oxygen, low toxic
R227ea	(2.92Mpa,374.75K)	High GWP, low heat of vapourisation
R245fa	(3.65Mpa,427.01K)	Zero ODP, high heat transfer performance
R410a	(4.86Mpa,72.8C)	High GWP, volatile, nonflammable,
R290	(4.25Mpa,96.7C)	Natural refrigerant, low GWP
R600a	(3.64Mpa,134.71C)	Zero ODP, low GWP, high energy efficiency
R32	(5.78Mpa,78.105C)	Low GWP, high energy efficiency, less flammable

Among these fluids, the fluid selected was R600a also known as isobutane because of its low environmental impact.

II. LITERATURE REVIEW

Matteo Marchionni et. al (2019): The modelling of the PCHE type of heat exchanger was carried out. The heat exchanger was used as a recuperator in power changing systems. The scope of the lower order models in finding the total heat transfer and performance were studied. The PCHE channels were studied using 1D as well as 3D modelling using ansys software, heat transfer channels were. This study found out that the significance of the 1D modelling can be used in assessing the performance of the heat exchanger. The difference between the results of 1D and 3D modelling was found to be only of 2% thus 1D modelling can be useful in assessing its thermal performance, thus using this simulation time can significantly reduce. Unsteady state analysis was done.

Young-Jin Baik et. al. (2017): The performance of another type of heat exchanger which have wavy shaped channels were studied. The waviness factors of amplitude as well as period on its functioning were studied numerically with the help of ansys. on the PCHE were studied numerically. The comparison was done of wavy channelled heat exchanger to the straight channelled heat exchanger. After calculating the results numerically, it was found out that the performance of wavy channelled heat exchanger was greater than that of straight channelled by 16.4%. The thermal performance of wavy channelled PCHEs monotonically increases as either of the amplitude or period increases. The channel size has not any considerable impact on the thermal performance than the waviness amplitude and period. The thermal performance per unit period increases as the amplitude increases. However, it decreases as the period increases.

Amjad Farah et. al.(2016): Study of a CFD code as well as the capabilities of FLUENT code were determined. The study was done on the tubes with fluid flowing vertically. Water was used as a supercritical fluid in this study. Prediction of the wall temperature was done in the tubes. The simulations were carried out using FLUENT solver. Working fluid was water. The calculations were done by 1D modelling and the results of which were compared with existing corelations. Calculations were carried out using $k-\varepsilon$ as well as $k-\omega$ turbulent models in the pseudocritical region. Study found out that there was an error of 10% in the values of wall temperature when calculated using $k-\omega$ model and of 5% in deteriorated heat transfer area and normal heat transfer area respectively. Thus, it was found out that the of model had higher accuracy as compared of any earlier tested corelation.

Muhammad Saeed et. al. (2019): The study was carried out on PCHE type of heat exchanger; the channels were of sinusoidal in shape. In this study, the thermal as well as hydraulic performance were carried out, a new type of channel shape was proposed. The comparison of zig-zag channel as well as staggered arrangement was done. The working fluid used was CO₂. Response Surface Methodology (RSM) was used to optimize the channel geometry combined with the help of genetic algorithm. At last, thermal as well as hydraulic study were carried out numerically with different values of reynolds number. After this pressure drop and heat transfer correlations were suggested. After calculating the results, it was found out that the sinusoidal shaped channel was showing 2.5 times better performance as compared to zigzag shaped channel. The thermal performance on the cold side and hot side were 21% and 16% better respectively.

Zhongchao Zhao et. at. (2017): In this study, heat transfer as well flow analysis was done. Airfoil fins on PCHE were present. The fluid was liquified natural gas. The characteristics on LNG on the PCHE having airfoil fins depending upon its arrangement was numerically found out. Comparison of straight channelled and airfoil fin were carried out. Effect of staggered pitch and vertical pitch were studied. Discontinuous fins, airfoil fin can increase the thermal performance of PCHE. The arrangement of the staggered fins was more advantageous as compared to the parallel fins. Study found out that the velocity was increased of the supercritical fluid in the fin shaped geometry and then gradually decreased as the vertical pitch was increasing.

Yimeng Zhou et. al. (2019): Thermal and hydraulic performance was determined of the PCHE. The channel was zigzag shaped. The PCHE type of heat exchanger was used for higher pressure as well as for vapourization

for vapourizers. The thermal as well as hydraulic analysis was done in PCHE with zigzag shaped channels numerically. SST k-w model was used. Piecewise polynomial approximations were used to find out thermal as well as physical properties. Properties such as bend angle, inlet pressure, mass flow rate were studied. Their effects on heat transfer coefficient and pressure drop were also studied. Nu and Eu numbers were useful to determine heat transfer as well as pressure drop. It was found that the HTC was increasing and then decreasing along the direction of the stream. The highest value was found near pseudo critical point. As bend angle was increased the pressure drop was also increasing. The local convective heat transfer increases when temperature surpasses pseudo critical point, but changes little with inlet pressure before pseudo critical point.

Jingzhexie et. al (2018): In this study, prediction of supercritical fluid on the heat transfer properties was carried out. The circular tube was used for prediction in crossflow fluid channels. To avoid the studies on circular tubes geometries, studies on pressure at supercritical stage was carried out. The main focus of the study was on the experiments done on different fluids like water, n-decane, etc. their review and study their results. Also, focus of the study was flow across shell and tube type of heat exchangers. These heat exchangers can be used for power cycle systems. The study was carried out for cross flows. In this study, it was found out that heat transfer was 9 significantly depended on the heat flux like it was in in-tube flows. There was a unique feature in thermal as well as physical properties as the boundary conditions changed.

SangwooJeon et. al. (2016): The study was carried out on heterogenous types of printed circuit heat exchanger. The working fluid was carbon dioxide. The proposal of using heterogenous PCHE was suggested and calculation activities was done to determine its performance. Various parameters were considered to check thermal performance, they were variation in the size of channels at the inlet and outlet, the channel space variations. Change in cross section of channels was also done. It was found out that when the channel size was increased its thermal performance was decreasing. This was because of decrease in the flow rate. The thermal characteristics were unaffected by variation of channel size, but it had reduced the structural reliability of the PCHE. The thermal performance was similar for same hydraulic diameter.

Despite there being studies on supercritical fluid, no significant improvement in heat transfer have been found out. The high pressure drop performance were found to be in printed circuit heat exchangers having S shaped as well as others having Air foil fins. In comparison the ZigZag type PCHE flow channels had low pressure drop performance. It was found that these channel with discontinuous fins are not durable under high pressure. Thus increasing the manufacturing and maintenance costs of the heat exchanger. Therefore, it is necessary to study on the continuous channels and their shapes and sizes can be varied.

III. MATERIALS AND METHODOLOGY

Ansys 14.5 Fluent solver was used for the analysis of the PCHE channel. A channel design geometry was of 3mm×4mm with 160mm channel length. The hydraulic diameter of both cold channel and hot channel was taken as 1.5mm.

The hydraulic diameter of a semi-circular channel is

$$D_H = \frac{D}{1 + \frac{2}{\pi}}$$

Where, D_H = Hydraulic diameter

D = channel diameter

The channel diameter of both hot and cold fluid was 2.454mm.

Table 2: Properties of isobutane

Thermal Conductivity(kg/mk)	0.0159
Density(kg/m ³)	2.46
Viscosity(Kg/ms)	7×10^{-6}
Specific heat(J/kgk)	2620

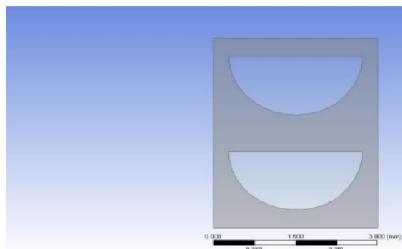
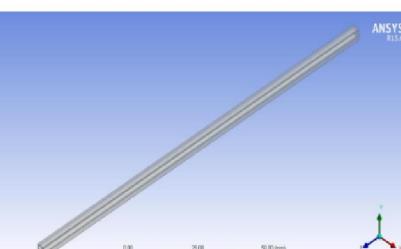
Table 3: Properties of Methane

Thermal Conductivity(kg/mk)	0.0332
Density(kg/m ³)	0.6679
Viscosity(Kg/ms)	1.087×10^{-5}
Specific heat(J/kgk)	4110

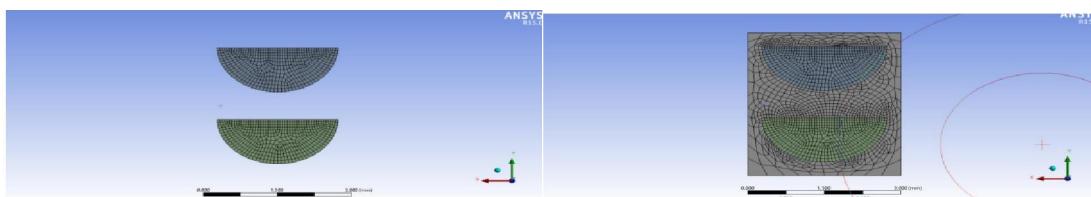
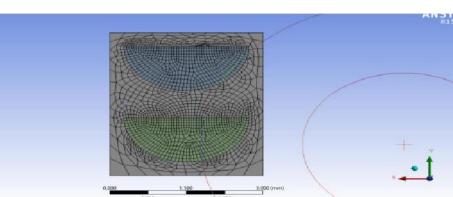
Table 4: Properties of steel

Density(kg/m ³)	8030
Specific heat(J/kgk)	502.48
Thermal conductivity(kg/mk)	16.27
Thermal conductivity(kg/mk)	8330000

IV. GEOMETRY


Figure2:Front view

Figure 3: Isometric view

The geometry was made in the ansys software. For drawing geometry at first units of software were set in mm. a sketch of the geometry including that of flow channels was drawn on the in the x-y plane. Extrude command was applied in the z direction for 160mm. After this the fluid domain was made using the 'Fill' tool on using selecting the inside channels of both hot and cold fluids. The parts were renamed using appropriate names. All the bodies were grouped and formed a new part.


Figure 4: Meshing of fluid channels

Figure 5: Meshing of surface

V. SETUP

In the setup mesh was checked. Units were set, absolute pressure-based model was selected for incompressible flow calculations. Steady state was selected. Gravity in y direction was set at -9.81m/s². Energy equation was set on in the model tab. It is known that than k-ε turbulence model predicts the pressure drop by 30% below under the experiments carried out by Val Abel, thus SST k-ω turbulence model was applied while simulation. Materials were selected from the database which were water, isobutane and steel. Cell zone boundary condition were given to body, cold and hot fluid.

Boundary conditions of the inlet of both the fluid were mass flow rate inlet where cold fluid enters the domain at 1.95kg/s and hot fluid enters at 1.95kg/s. the cold fluid enters at 239C, 136 bar and leaves considering the fluid remains in the supercritical state all the way. The hot fluid enters at 650C, 1.06 bar. The outlet conditions of both the fluid were set as pressure outlet. The pressure and velocity were coupled using the SIMPLEC algorithm. The spatial discretization least square based gradient was selected whereas the pressure and momentum using second order upwind method, whereas turbulent kinetic energy, specific dissipation rate using first upwind. Standard initialization was done and the solution was initialised all zones. The values of mass flow rate were varied and were 1.8kg/s and 2.1kg/s on both sides. The solution was converging in nearly 100 to 110 iterations for all cases.

VI. RESULTS

Simulations were carried out to calculate the effect of mass flow rate on the thermal properties of the heat exchanger, the mass flow rate of both the fluids was 1.95kg/s. Below is the temperature profile of the fluid at zone 1, which was of cold outlet and hot inlet. The value of the various parameters were can be found in Reports section in the setup menu.

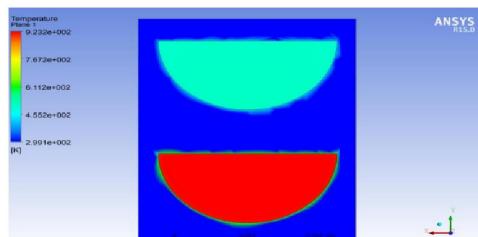
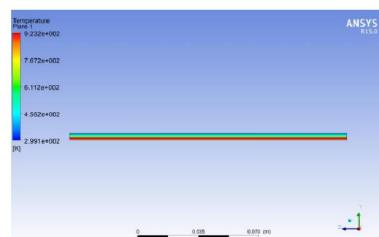

Figure 7: Temperature profile at zone 1

Figure 8: Temperature profile

Figure 9: Surface heat transfer coefficient

Figure 10: surface nusselt number

Effect of mass flow rate of 1.95kg/s on heat exchanger

After simulation, we have now known the outlet temperature of both fluids

Let Th_1 and Tc_1 be inlet temperature of both the fluids and Th_2 and Tc_2 be outlet temperature of both fluids.

The values came out to be:

$Th_2 = 483\text{C}$, $Tc_2 = 501\text{C}$ The total heat transfer rate can be calculated with the help of

$$Q = m_h \cdot C_{ph} \times (Th_1 - Th_2) = m_c \cdot C_{pc} \times (Tc_2 - Tc_1) = 1340\text{KW}$$

To calculate the effectiveness, we have

$$\epsilon = \frac{Q}{Q_{max}}$$

$Q_{max} = C_h \times (Th_1 - Tc_1) = C_c \times (Th_1 - Tc_1)$ whichever is lower among these two values

$$C_h = m_h \cdot C_{ph} = 3293\text{KW}$$

$$C_c = m_c \cdot C_{pc} = 2101\text{KW}$$

Therefore, effectiveness came out to be 63%

Effect of mass flow rate of 2.1kg/s

The outlet values were found to be

$$Th_2 = 472^{\circ}\text{C}, Tc_2 = 517^{\circ}\text{C}$$

Total heat transfer rate

$$Q = 1530\text{KW}$$

$$\epsilon = 72\%$$

Effect of mass flow rate of 1.8kg/s

$$Q = 1190\text{KW}$$

$$Th_2 = 489^{\circ}\text{C}, Tc_2 = 491^{\circ}\text{C}$$

$$Q = 56\%$$

VII. CONCLUSION

Isobutane have found to be among the other alternative than CO₂ against as a working fluid in thermal power plant which run supercritical cycle. The outlet conditions were calculated using CFD. Effects of mass flow rate on the thermal performance were also determined. It was found that the effectiveness increased with increase in mass flow rate. Heat transfer rate also increased with increase in mass flow rate

REFERENCES

- [1] Padrela, L.; Rodrigues, M.A.; Velaga, S.P.; Matos, H.A.; Azevedo, E.G. (2009). "Formation of indomethacin-saccharin cocrystals using supercritical fluid technology". European Journal of Pharmaceutical Sciences 38(1):9-12.
- [2] Malhotra, Ashok and Satyakam R, "Influence of climatic parameters on optimal design of supercritical power plants" IECEC, Energy Conversion Engineering Conference, pp. 1053–1058
- [3] Y.T.Ge; L. Li; X.Luo "Performance evaluation of a low-grade power generationsystem with CO₂ transcritical power cycles", Applied energy volume 227, 1 October2018, Pages 220-230.
- [4] Hall, W. B. (1971) Heat transfer near the critical points, Advances in HeatTransfer, Vol. 6, Academic Press, New York.
- [5] Span, Roland; Wagner, Wolfgang (1996). "A New Equation of State for Carbon Dioxide Covering the Fluid Region from the Triple-Point Temperature to 1100 K at Pressures up to 800 MPa". Journal of Physical and Chemical Reference Data. 25 (6):1509–1596.
- [6] <https://pubchem.ncbi.nlm.nih.gov/compound/isobutane>
- [7] Nobuyoshi Tsuzuki;YasuyoshiKato;TakaoIshiduka "High performance printedcircuit heat exchanger" Applied thermal engineering Volume 27, Issue 10, July 2007,Pages 1702-1707.
- [8] Yoon, S.-J.; Sabharwall, P.; Kim, E.-S. Numerical study on crossflow printed circuitheat exchanger for advanced small modular reactors. Int. J. Heat Mass Transf. 2014,70, 250–263.

- [9] Tsuzuki, N.; Kato, Y.; Ishiduka, T. High Performance Printed Circuit HeatExchanger. *Appl. Therm. Eng.* 2007, 27, 1702–1707.23.
- [10] Kim, I.H.; No, H.C. Thermal hydraulic performance analysis of a printed circuitheat exchanger using a helium–water test loop and numerical simulations. *Appl.Therm. Eng.* 2011, 31, 4064–4073.
- [11] Kim, I.H.; No, H.C.; Lee, J.I.; Jeon, B.G. Thermal hydraulic performance analysisof the printed circuit heat exchanger using a helium test facility and CFD simulations.*Nucl.Eng. Des.* 2009, 239, 2399–2408.
- [12] Kim, I.H.; No, H.C. Physical model development and optimal design of PCHE for intermediate heat exchangers in HTGRs. *Nucl. Eng. Des.* 2012, 243, 243–250.
- [13] Mylavarampu, S.K.; Sun, X.D.; Christensen, R.N.; Unocic, R.R.; Glosup, R.E;Patterson, M.W. Fabrication and design aspects of high-temperature compact diffusionbonded heat exchangers. *Nucl.Eng. Des.* 2012, 249,49–56.
- [14] Morteau, M.V.V.; Paiva, K.V.; Mantelli, M.B.H. Diffusion bonded cross-flow compact heat exchangers: Theoretical predictions and experiments. *Int. J. Therm. Sci.* 2016, 110, 285–298.
- [15] Hun, K.I.; Xiaoqin, Z.; Christensen, R.; Sun, X. Design study and cost assessment ofstraight, zigzag, S-shape, and OSF PCHEs for a FLiNaK-SCO₂ Secondary HeatExchanger in FHRs. *Ann. Nucl. Energy* 2016, 94,129-137.
- [16] Natesan, K.; Moisseytsev, A.; Majumdar, S. Preliminary issues associated withthe next generation nuclear plant intermediate heat exchanger design. *J. Nucl. Mater.* 2009, 392, 307–315.
- [17] Hosseini, S.B.; Khoshkhoo, R.H.; Malabad, S.M.J. Experimental and numericalinvestigation on particle deposition in a compact heat exchanger. *Appl. Therm. Eng.* 2017, 115, 406–417.
- [18] Starace, G.; Fiorentino, M.; Longo, M.P.; Carluccio, E. A hybrid method for the cross flow compact heat exchangers design. *Appl. Therm. Eng.* 2017, 111, 1129–1142.
- [19] Park, M.Y.; Song, M.S.; Kim, E.S. Development of tritium permeation model forPrinted Circuit Heat Exchanger. *Ann. Nucl. Energy* 2016, 98, 166–177.24.
- [20] Baek, S.; Kim, J.; Jeong, S.; Jung, J. Development of highly effective cryogenic printed circuit heat exchanger (PCHE) with low axial conduction. *Cryogenics* 2012,52, 366–374.
- [21] Kim, I.H.; No, H.C. Thermal–hydraulic physical models for a printed circuit heatexchanger covering he, he–CO₂ mixture, and water fluids using experimental data andfd. *Exp. Therm. Fluid Sci.* 2013, 48, 213–221.
- [22] Lee, S.-M.; Kim,W.Y. Comparative study on performance of a zigzag printedcircuit heat exchanger with various channel shapes and configurations. *Int. J. HeatMass Transf.* 2013, 49, 1021–1028.
- [23] Lee, S.-M.; Kim, W.Y. Multi-objective optimization of arc-shaped ribs in the channels of a printed circuit heat exchanger. *Int. J. Therm. Sci.* 2015, 94, 1–8.
- [24] MatteoMarchionni; Lei Chai; Giuseppe Bianchi; Savvas A. Tassou “Numerical modelling and transient analysis of a printed circuit heat exchanger used as recuperator for supercritical CO₂ heat to power conversion systems” *Applied thermal engineering* (2019).
- [25] Young-JinBaik ;SangwooJeon; Byeongil Kim; DaechanJeon; Chan Byon “Heat transfer performance of wavy-channeled PCHEs and the effects of waviness factors”, *IJHMT* June 2017.
- [26] Amjad Farah; Glenn Harvel; Igor Pioro. "Analysis of computational fluid dynamics code FLUENT capabilities for supercritical water heat transfer application in vertical bare tubes" *Journal for nuclear engineering and radiation science* (2016).
- [27] Muhammad Saeed; Man-Hoe Kim “Thermal-hydraulic analysis of sinusoidal fin based printed circuit heat exchangers for supercritical CO₂ Brayton cycle” *EnergyConversion and Management*, Volume 193, 1 August 2019, Pages 124-139.
- [28] Zhongchao Zhao; Kai Zhao; DandanJia; Pengpeng Jiang “Numerical Investigation on the Flow and Heat Transfer Characteristics of Supercritical Liquefied Natural Gasin an Airfoil Fin Printed Circuit Heat Exchanger” *Applied thermal engineering* Feb201925.

- [29] Zhongchao Zhao; Yimeng Zhou; Xiaolong Ma; Xudong Chen; Shilin Li and ShanYang “Numerical Study on Thermal Hydraulic Performance of Supercritical LNG inZigzag-Type Channel PCHEs” Applied Thermal Engineering Feb 2019.
- [30] JingzheXie; Hong bin; YanBengt; Sun dén; GongnanXie “A numerical prediction on heat transfer characteristics from a circular tube in supercritical fluid crossflow”. Applied Thermal Engineering Volume 153, 5 May 2019, Pages 692-703.
- [31] SangwooJeon; Young-JinBaik; Chan Byon; Woojin Kim “Thermal performanceof heterogeneous PCHE for supercritical CO₂ energy cycle” IJHMT: July 2016.

Review of Bacteria-Based Self-Healing Concrete

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Abstract: Concrete is one of the most widely used construction materials and has a high tendency to form cracks. These cracks lead to significant reduction in concrete service life and high replacement costs. Although it is not possible to prevent crack formation, various types of techniques are in place to heal the cracks. It has been shown that some of the current concrete treatment methods such as the application of chemicals and polymers are a source of health and environmental risks, and more importantly, they are effective only in the short term. Thus, treatment methods that are environmentally friendly and long-lasting are in high demand. A microbial self-healing approach is distinguished by its potential for long-lasting, rapid and active crack repair, while also being environmentally friendly. Furthermore, the microbial self-healing approach prevails the other treatment techniques due to the efficient bonding capacity and compatibility with concrete compositions. This study provides an overview of the microbial approaches to produce calcium carbonate (CaCO_3). Prospective challenges in microbial crack treatment are discussed, and recommendations are also given for areas of future research.

I. INTRODUCTION

Despite concrete's advantages, it has a high tendency to form cracks allowing aggressive chemicals to penetrate into the structure. Cracks are one of the main causes of concrete deterioration and decrease in durability. Cracks can be formed in both plastic and hardened states. Formwork movement, plastic settlement and plastic shrinkage due to rapid loss of water from the concrete surface result in crack formation during the plastic state, whereas weathering, drying shrinkage, the thermal stress, error in design and detailing, chemical reaction, constant overload and external load contribute to crack formation in hardened state. Moreover, concrete structures suffer from relatively low tensile strength and ductility. To address low tensile strength and ductility, concrete is usually reinforced with embedded steel bars. Reinforcement bars have positive effect on crack width restriction by controlling plastic shrink-age; however, they cannot prevent crack formation. Bio-concrete is proving to become a game-changer in the world of construction. By having the material essentially "heal itself" from cracks and breakage, builders will have an easier time completing projects and handling costly repairs. Bio-concrete will also play a critical role in structural integrity and durability by reducing the risk of a building collapsing.

As the most commonly used material in construction, concrete has been relied on for decades to provide durability, strength, and flexibility. Significant advancements have been made in the world of concrete manufacturing and usage over the years. Builders can now access concrete in multiple grades, compositions, and performance levels. But In 2017, a Dutch researcher (Hendrik Jonkers) developed one of the most innovative features that concrete could have. By slightly tweaking the composition of regular concrete, he infused a biological ingredient that made concrete have self-healing properties.

Bio-Concrete can help Construction Companies

Research surrounding self-healing concrete surfaced in 2015, sparking interest in builders, estimators, engineers, and other stakeholders as to how bio-concrete could be utilized to streamline daily construction activities. Does bio-concrete have the potential to become the future of construction? The numerous benefits of this material make it a front-runner for widespread adoption in years to come.

Bio-Concrete is useful and Applicable to Construction Companies in the following ways.**Sealing Small Cracks that could Eventually become Larger**

Perhaps one of the most powerful applications of bio-concrete is that it can be used to seal up small cracks within larger slabs of concrete. It is these small cracks that eventually expand to cause significant damage in buildings, bridges, and other infrastructure. Bio-concrete can seal cracks of up to 0.8mm in width, catching the problem in advance and preventing significant structural damage.

Applicable to Different Types of Infrastructure

Bio-concrete is also usable in many different contexts. The flexibility of bacillus bacteria makes it functional for bridges, buildings, tunnels, and other types of infrastructure. The wider use functions of this material can open up many new possibilities in engineering, microbiology, and construction. Not only can you save on costs during your future projects, but you can also explore new designs, enjoy more durable structures, and cut costs down the road.

An Environmentally Friendly Solution

The benefits of bio-concrete extend beyond economic applications. This material also reduces carbon emissions, making it possible for commercial and residential builders to lower their carbon footprints. By using less concrete to carry out maintenance and repairs, there will be fewer carbon emissions into the environment over time. Sustainable construction is the future of our industry and bio-concrete is at the forefront of promoting this revolution.

Active for Long Periods

Endurance tests were recently carried out on bio-concrete to assess its durability and strength. Results show that the material is expected to last for over 200 years within its proper composition. This also means that clay pellets in the biochemical mixture are durable even under multiple weather and physical conditions. The durability of bio-concrete is a game-changer that makes this material applicable in many different contexts.

Hendrik Jonkers, the Dutch researcher who produced bio-concrete, is also working on a new technique for encapsulating bacillus bacteria into concrete mixtures.

This will further reduce production costs and increase the use-value of this revolutionary material. The future of bio-concrete and sustainable construction is bright, and your business shouldn't be left behind in benefitting from this innovative building option.

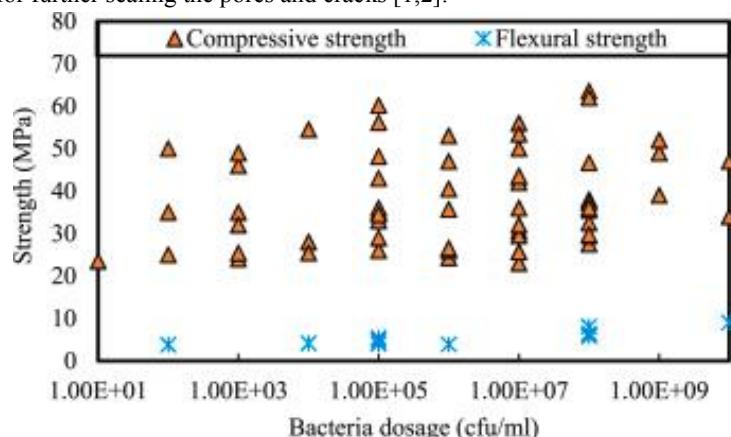
The construction industry isn't slowing down. Keep up with the digital transformation by trialling Cubit, an innovative natural estimating software to help save you time and money on your projects today.

II. COMPRESSIVE AND FLEXURAL STRENGTH

The basic micro-mechanism of strength restoration and crack healing in bacterial concrete is the transformation of soluble organic nutrients into inorganic CaCO₃ crystals that seal the cracks [1, 2]. Recent studies have shown that the strength restoration of cracks through CaCO₃ follows a multi-factor-criteria approach that can be divided into physical and chemical characteristics. In chemical characteristics, the type and concentration of bacteria [2], pH of the medium, and nucleation site for immobilization of bacteria [3] are the most effective factors on the strength development. Fig. 11 presents the results of 65 studies and their reported compressive and flexural strengths based on bacterial dosage. Based on this figure, the highest compressive strength range was achieved in the bacteria dosage range between 105 to 108 cfu/ml.

In addition, the type of bacteria can also play a significant role in strength values. As was reported by Rauf et al. [2], *Bacillus Sphaericus* exhibited a higher strength regain compared to *Bacillus Cohnii* and *Bacillus Subtilis* due to the higher calcite precipitation of *Bacillus Sphaericus*. Chen et al. [1] and Rauf et al. [2] studied the immobilization of bacteria using ceramsite sand and natural fibers as carrier compounds to stimulate microbial induced calcite precipitation, respectively. In their analysis, it was found that proper immobilization techniques can increase the flexural strength of the bacterial concrete by 56–72%.

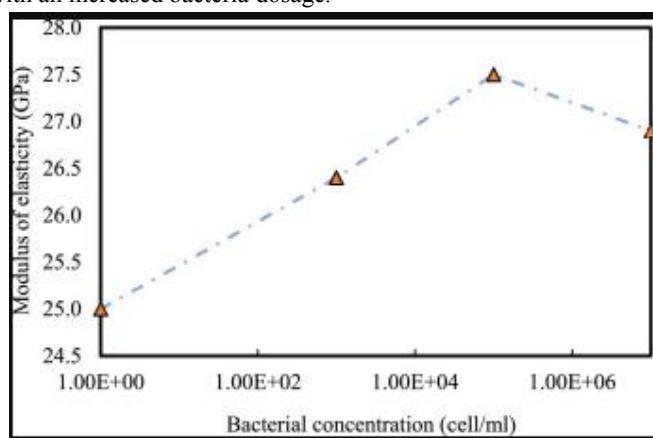
They also reported that natural fibers could further provide protection against the alkaline medium within the concrete mixture and increase the compressive strength by up to 42%. The strength increase can be attributed to the potential ability of carriers to protect and, at the same time, provide the already-included nutrients to bacteria to form CaCO_3 for further sealing the pores and cracks [1,2].



III. MODULUS OF ELASTICITY

Modulus of elasticity refers to the concrete ability to deform within the elastic stress-strain region without fracturing the elasticity of the concrete material generally depends on the type and size distribution of the aggregate, duration and type of curing and reinforcement. In bacterial concrete, despite the relatively higher impact of these factors, the bacteria content is found to significantly affect the elastic modulus.

Figure shows the variation of 28-day elastic modulus of bacterial concrete containing *Bacillus Sphaericus* bacteria with various bacteria dosages. As can be seen in the figure, an increase in the bacteria dosage up to a certain level caused an increase in the elastic modulus, which can be due to the increased compaction at the ITZ of the microstructure with an increased bacteria dosage.



IV. CONCLUSIONS AND SUMMARY

The crack healing process of bacterial concrete depends on the availability of nutrition and survival of the bacteria. This process, although have been done in numerous studies, requires adaptation of certain techniques to preserve the living organisms which poses a great challenge for large scale application of self-healing bio-concrete.

REFERENCES

- [1] H. Chen, C. Qian, H. Huang, Self-healing cementitious materials based on bacteria and nutrients immobilized respectivelyConstruct. Build. Mater., pp. 297-303, 10.1016/j.conbuildmat.2016.09.023.
- [2] M. Rauf, W. Khaliq, R.A. Khushnood, I. Ahmed, Comparative performance of different bacteria immobilized in natural fibers for self-healing in concrete construct. Build. Mater., 258 (2020), p. 119578, 10.1016/j.conbuildmat.2020.119578.
- [3] R. Siddique, N.K. Chahal, Effect of ureolytic bacteria on concrete properties construct. Build. Mater., 25 (10) (2011), pp. 331-3801, 10.1016/j.conbuildmat.2011.04.010.
- [4] Kunamineni Vijay Meena MurmuShirish V.Deo, Bacteria based self-healing concrete - A review-Construction and Building Materials, Volume 152, 15 October 2017, Pages 1008-1014.

A Study on IoT Based Real Time Flood Alert System for Dam

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Abstract: In the last few years we have seen floods in different parts of the world almost every year. Technological advancement in recent years has made it easier to find a solution to these natural disasters. One such technology that brings us closer to the Internet is the "Internet of Things". This paper contains Real Time Flood Alert System for Dam using IoT technology. The sensors in this case are used to measure water, humidity, and temperature and to send real-time data to the cloud and users can access the data via the mobile app. This model is widely used to scare people before there is a flood and appropriate safety measures are taken.

Keywords: NODEMCU, Ultrasonic Sensor, Buzzer, DHT11, etc.

I. INTRODUCTION

Floods are the foremost frequent style of disaster worldwide. It can strike anywhere and anytime. Although floods are often predicted, they often cause massive damage and destruction of property as most urban communities are located near water sources like coasts and rivers. Due to increased pollution and greenhouse gas emissions, natural disasters such as earthquakes, floods, tsunamis, etc. have increased significantly in many parts of the world. In some areas, such as USA, advanced technology has reduced casualties. But in countries that are technologically and economically backward, countries have not been able to do this. Therefore, this model solves the problem and supports at the lowest cost with limited computing power and high reliability. The uses the sensor network to help detect incoming floods. This is where IoT plays an important role as is the most efficient approach. It is actually a networked system of embedded electronics, software and sensors that send and receive data remotely over the Internet.

II. LITERATURE SURVEY

Flood warning systems in urban areas have improved lots in recent years. Arrival of GIS, Radar-Based Precipitation Estimation Using NEXRAD and Radar Systems Internet. the difficulty of flood warning and warning was delivered to the public's attention. After the recent Tropical Storm Allison Flood of June 2001. This flood was reported by NOAAAs the foremost damaging urban get American history, and definitely the foremost devastating event Further losses within the county affect Beau and Houston with over \$ 5 billion50,000 damaged structures. over \$ 1.5 billion in damages to Texas heart alone Informed with major influences from area people.

Conventional gauge-based ALERT Systems rely upon spatially independent rain gauges. While these systems can provide critical information, they can't provide dense coverage of information collection available with NEXRADRadar. With the arrival of NEXRAD radar and GIS data analysis systems, it's possible Real-time regional average rainfall over the basin, which may be compared to hydrologic models estimated peak flows in a very basin. One such system is since spring, 1998Houston, Texas area. Commissioned by Texas middle (TMC), focuses on the system Brings Bayou to Southwest Houston, and provides TMC with real-time information Flows forecast in Brays Bayou, with visual feedback as a real-time.

III. PROPOSED SYSTEM

An IoT Based Real Time Flood Alert System for Dam, the use of the Arduino is thus, a proposed technique to this problem. The gadget includes numerous sensors which might be temperature, humidity, water level, go with the float and ultrasonic sensors and additionally consists of an Arduino controller, a Wi-Fi module, an LCD, an IoT far off server-primarily based totally platform and an android utility with built person pleasant GUI relaying all of the crucial data worried within the image in a visible format. This version installation the NODEMCU board close to the dam and DHT11 sensor, float sensor and ultrasonic sensor, DHT11 sensor are related to it. DHT11 sensor offers the Humidity and Temperature within the air and Ultrasonic sensor offers the water level and Float sensors hits when water level is high also gives alarming signals. Based on this and a few different parameters we might also additionally determine if the flood goes to arise or not. We join them to the cloud from wherein we join this to the cellular utility and we will see the output in our Software too.

Following Fig.1 shows actual System architecture of this System, firstly the sensors connected to node MCU controller that will give humidity, temperature and Water level of the dam. So, code will collect all these data and upload it to cloud which we initialized before using Wi-Fi module and from there our data will be retrieved into the mobile application.

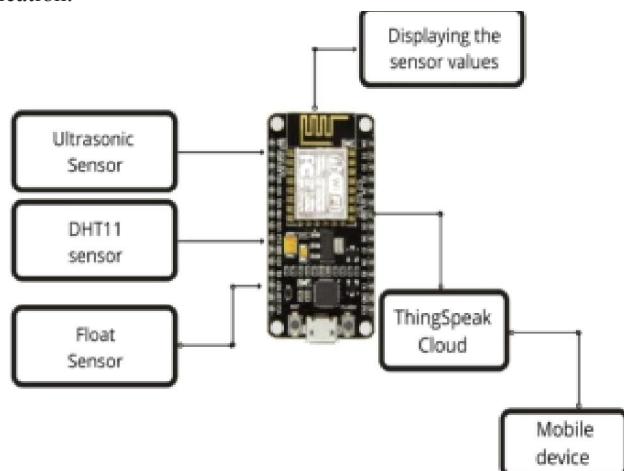


Fig 1: System Architecture

IV. CONCLUSION

This paper has tried to propose a possible and economic solution to the matter of floods. Floods can't be predicted easily, but we are attempting to develop a process which helps us to grasp the first Flood Detection and Intimates us to grasp the mandatory Precautions. The IoT based Real Time Flood alert system may persuade save the lives of individuals by reducing the human quick out during emergency situations. Development of a wireless sensor network has been successfully distributed, with considerations on area of deployment and efficiency. So far, we have built a micro-model through a prototype; the sensors utilized were fundamental in obtaining the specified data necessary for monitoring and detecting flood events, and a live feed has also been actualized for end users.

ACKNOWLEDGMENT

We have taken enormous efforts to complete the survey report of this subject. However, this might not be possible without the type support and assistance of the many individuals and organizations. we'd prefer to express our sincere because of all of them. We substantially enjoy presenting this report on "A Survey on Real Time Flood Alert System for Dam". I might prefer to express my heartfelt gratitude to Prof.M.S.Malkar, Head of Computer Engineering Department whose valuable guidance has helped us survey our project and we also thank the Principal of Pimpri Chinchwad Polytechnic, Dr.V.S.Byakod for valuable guidance. additionally, we might

wish to thank all the staff members of our department, my colleagues, who have convinced me and support during this project. With of these, i'd thank my team Members Mrs. P.S.Chavan and Mrs.P.S.Bhore.

REFERENCES

- [1] Karnik, "Performance of TCP congestion control with rate feedback: TCP/ABR and rate adaptive TCP/IP," M. Eng. thesis, Indian Institute of Science, Bangalore, India, Jan. 1999.
- [2] M. Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, "High resolution fiber distributed measurements with coherent OFDR," in Proc. ECOC'00, 2000, paper 11.3.4, p. 109.
- [3] S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low-temperature poly-Si TFT," IEEE Electron Device Lett., vol. 20, pp. 569–571, Nov. 1999.
- [4] J. Breckling, Ed., The Analysis of Directional Time Series: Applications to Wind Speed and Direction, ser. Lecture Notes in Statistics. Berlin, Germany: Springer, 1989, vol. 61.
- [5] Dr.C K Gomathy, Article: Supply Chain-Impact of importance and Technology in Software Release Management, International Journal of Scientific Research in Computer Science Engineering and Information Technology (IJSRCSEIT) Volume 3 | Issue 6 | ISSN: 2456-3307, P.No:1-4, July-2018.
- [6] J. Padhye, V. Firoiu, and D. Towsley, "A stochastic model of TCP Reno congestion avoidance and control," Univ. of Massachusetts, Amherst, MA, CMPSCI Tech. Rep. 99-02, 1999.
- [7] FLEXChip Signal Processor (MC68175/D), Motorola, 1996.
- [8] Flood Detection and Water Monitoring System Using IoT. Minakshi Roy, Prakar Pradhan, Jesson George,Nikhil Pradhan Assistant Professor of Dept of Computer Science and Engineering, SMIT, Sikkim, India,B-Tech student, Dept of Computer Science and Engineering, SMIT, Sikkim, India.
- [9] Lee, J.S., Lee, I.S., 2017. Automation Modelling of the Storm and Flood Hazard Risks for Insurance Premium Rate Map. Journal of the Korean Cadastre Information Association, 19(2), pp. 3-13.

Clustering of Customer Transaction Data

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Abstract: Clustering of customer transaction data and finding patterns using Apriori Algorithm is useful task in data mining to formulate market strategies and maximize profit. We apply an Apriori Algorithm for finding patterns. We use output of Customer Transaction Clustering Algorithm as an input to Apriori Algorithm. We have transaction tree which represents the customer's transaction records. Distance between transaction trees is calculated. A customer transaction clustering algorithm is used for clustering of transaction data of customers. The most frequent customers are selected as representatives of customer groups. Clustering is performed by assigning customer to the nearest neighborhood. Finally, the clustering results are forwarded to Apriori Algorithm for finding patterns.

Keywords: Customer Transaction Clustering Algorithm, Apriori Algorithm, Transaction Tree, Clustering, etc.

I. INTRODUCTION

Clustering is the method of arranging objects into groups. Objects with similar characteristics are placed into one group. These groups are known as clusters. Customer Segmentation is a technique in which the customers are clustered on the basis of certain characteristics. The main objective of this paper is to find the best number of clusters and these resultant clusters are used for finding patterns using Apriori Algorithm.

In clustering, we use large amount of raw and unorganized data as an input and determine similarities in input data. The clustering of transaction data of customers is essential phase to identify customer activities in retail and ecommerce firms [1]. As there is rapid growth in customer behavior data, scientists are now focusing on clustering of transaction data of customers [2].

Basically, the transaction data is the information of the daily transactions of customers. It contains information about, what type of product or set of products purchased by customers. There are three common problems of clustering the data. One is the how to show customer and customer transaction data. Second is how to calculate the distance between different customers, and third is how to divide a customer into a certain number of customer groups.

We apply Apriori algorithm for finding patterns. We use output of Customer Transaction Clustering Algorithm as an input to Apriori Algorithm. We have transaction tree which represents the customer's transaction records. Distance between transaction trees is calculated. A customer transaction clustering algorithm is used for clustering of transaction data of customers. The most frequent customers are selected as representatives of customer groups. Clustering is performed by assigning customer to the nearest neighborhood. Finally, the clustering results are forwarded to Apriori Algorithm for finding patterns. Apriori algorithm is used to identify patterns. The rules are derived from the association. These rules must satisfy the minimum support threshold and the minimum confidence threshold.

We use transaction tree distance to compare customers at all levels of the Item(Product)Tree. However, transaction data of customer are very big, even after data is compressed by transaction trees. So, the speed of Clustering of customer transaction data is very important. In real applications, it is very hard to use a hierarchical clustering method because of the high computational complexity. For complex product tree data, it is very difficult to apply the fast k-means algorithm. In this paper, we use clustering method called Customer

Transaction Clustering for clustering of large amount of transaction tree data and uses Apriori algorithm which further processes the output of Customer Transaction Clustering algorithm and discovers the patterns.

In Customer Transaction Clustering algorithm, we use a separate density for ranking a transactiontree as a representative tree. The most frequent customers are selected as representatives of customer groupsand clustering is performed by assigning each customer to the nearest neighborhood. Finally, clustering results are given as an input to Apriori Algorithm for finding patterns

The paper is organized in the following way.Literature Review is given in Section II. Proposed methodology is given in Section III. Result and discussion are given in section IV.Finally, we provide conclusion in section V.

II. LITERATURE REVIEW

Here we present the literature review of existing techniques:

In paper [1], transaction data of customers are compressed into set of purchase trees. Distance between two purchase trees is calculated. They implemented PurTreeClust clustering algorithm for performing clustering.

In this paper [2], they considered transaction data with high capacity and dimension. The author used heuristic approach to increase the ratio of width and height of cluster histogram. They developed fast and scalable algorithm named as CLOPE.

In order to predict the yearly sales of supermarket, SPPS tool and K-means clustering is used to create online and real time system for supermarket [3].

SWCC Subspace Weighted Co Clustering algorithm is developed by the author for high-dimensional expressiondata. To identify different clusters, Subspace weight matrices were presented [4]

In this paper [5], the author presents an automatic two-level variable weighting clustering algorithm for multi view data TW-k-means, which can compute the weight of view and individual variables simultaneously. The algorithm assigns view weights to each view in order to identify the compactness of the view, assigns variable weights to each variable in the view, then using the quantifiable two real data sets, examines the nature of the two types of weight in TW-K-mean, TW-K-mean it is possible to determine the weight of the view. The difference between the weight of the man and the weight of the individual variable weighting method was examined.

The author presents a robust tree edit distance algorithm – RTED [6]. The author introduces the class of LRH (Left-Right-Heavy) algorithms, which includes RTED and the fastest tree edit distance algorithms.

In this paper, data mining techniques are used to provide customer's purchasing patterns of food items. Author uses KMedoids clustering algorithm for clustering of food items. These outputs of clustering are given as an input to the association rule mining based Apriori algorithm and frequent patterns are discovered [7].

The aim of this paper [8] is to recommend the suitable items to the user. A better Rule extraction is needed to recommend the suitable items. Association Rule mining is applied for better rule extraction.The K-means clustering algorithm method is also applied here to cluster the data based on similar characteristics.

In this paper [9], frequent user access patterns are generated from web log entries. Combined efforts of clustering and association rule mining is used to apply pattern discovery.

III. PROPOSED APPROACH

A. Problem Statement

To develop a system that performs clustering of customer transaction data and processes resulting clusters to Apriori Algorithm for finding patterns.

B. Proposed System Overview

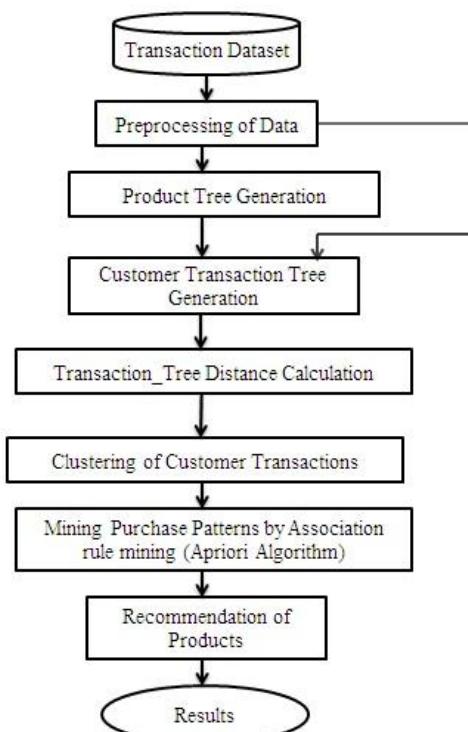


Figure 1:Proposed System Architecture

A detailed description of the proposed system is as follows:

1) Transaction Dataset:

The system uses customer transaction data. The transaction data include the products bought by customers.

2) Pre-processing of Data:

Pre-processing is done on transaction data of customers.

3) Product (Item) Tree Generation:

A Product or Item tree consists number nodes. A child node represents product or item. An internal node represents category of particular item.

4) Transaction Tree Generation:

A Transaction Tree consists of number of nodes. The child nodes represent items bought by customer and internal node represents the category of particular item.

5) Transaction Tree Distance:

Customers do not buy similar products, due to this between any two transaction trees the tree edit distance will produce high distance value. Within the tree edit distance it is very difficult to recover the cluster structure. To solve this issue, Transaction Tree distance metric is used. Transaction Tree distance compares customers from the entire levels of the product tree.

6) Transaction Tree Clustering:

Transaction Tree Clustering Algorithm is used for clustering of transaction tree data.

7) Mining Purchase patterns by association rule mining:

We use apriori algorithm for finding patterns.

8) Recommendation of products:

Finally, system recommends the product and gives fast and accurate results.

C. Algorithm

Algorithm1: Cust_Tran_Clustering

Clustering of customer transaction data consists of following steps

1. Generate the Item(product) tree.
2. Generate customer transaction tree for each customer.
3. Calculate the distance between two transaction trees.
4. Estimate the level density of transaction Tree with cover tree: $\text{denlCT}(p)$
5. Calculate the separate distance of object $p \in \text{CSI}$: $\text{sdislCT}(p)$
6. Calculate separate density of object $p \in \text{CSI}$: $\text{sdenlCT}(p)$
 $\text{sdenlCT}(p) = \text{denlCT}(p) * \text{sdislCT}(p)$
7. Select 'k' representative trees as 'k' trees having highest separate densities.
8. Perform clustering by assigning each customer to the nearest representative.

Algorithm 2: Apriori Algorithm

Following are the steps of Apriori Algorithm:

1. Initialize $s=1$
2. Generate frequent itemset of size '1'.
3. Generate candidate itemset of size ' $s+1$ ' from frequent itemset of size 's'.
4. Prune candidate itemsets containing subsets of size 's' that are infrequent.
5. Count the support of each candidate itemset.
6. Remove candidate that are infrequent keeping only those that are frequent.
7. Repeat steps 3 to 6 until no new frequent itemsets are identified.

IV. RESULT AND DISCUSSION

A. Expected Result

We used real life supermarket transactional dataset, initially we assumed 500 records. It shows that the Apriori algorithm with Clustering requires less time than Apriori algorithm without Clustering.

Table 1

Comparison of Apriori with Clustering and without Clustering		
Algorithm	Time Required (Seconds)	Accuracy (%)
Apriori algorithm with Clustering	10 Seconds	90%
Apriori algorithm without Clustering	15 Seconds	80%

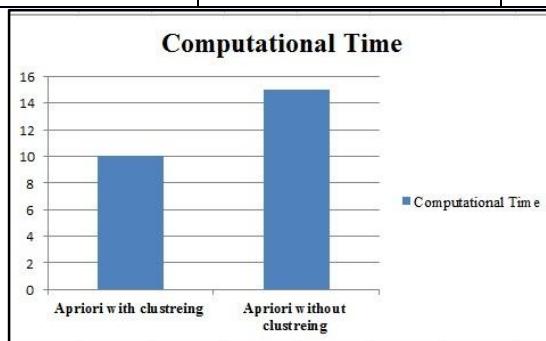


Figure 2: Comparison of Apriori with clustering and without clustering (Computational Time)

V. CONCLUSION AND FUTURE SCOPE

We use Apriori Algorithm for finding patterns. We use output of Customer Transaction Clustering Algorithm as an input to Apriori Algorithm. Apriori Algorithm is used for finding patterns. This is beneficial to increase product sale by identifying relations between combinations of customer's purchase pattern.

A customer transaction clustering algorithm is used for clustering of transaction data of customers. The most frequent customers are selected as representatives of customer groups. Clustering is performed by assigning customer to the nearest neighborhood. Finally, the clustering results are forwarded to Apriori Algorithm for finding patterns.

From the accuracy graph, we can conclude that Apriori algorithm with Customer Transaction Clustering is more accurate and efficient than Apriori Algorithm without Clustering. Resultant patterns are useful to formulate market strategies and maximize profit.

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REFERENCES

- [1] X. Chen, Y. Fang, M. Yang, F. Nie, Z. Zhao and J. Z. Huang, "PurTreeClust: A Clustering Algorithm for Customer Segmentation from Massive Customer Transaction Data," IEEE vol. 30, no. 3, March 2018.
- [2] Y. Yang,X. Guan,J. You, "CLOPE: A Fast and Effective Clustering Algorithm for Transaction Data" in Proceedings of 8th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining,ACM 2002.
- [3] Kishana R. Kashwan and C.M.Velu, "Customer Segmentation Using Clustering and Data Mining Techniques", IJCTE Vol. 5.No.6 December 2013.
- [4] Q. Wu, X. Chen,J. Z. Huang and M. Yang, "Subspace Weighting Co_clustering of Gene Expression Data", TCBB, 2017.
- [5] X. Chen, X. Xu,Y. Ye and J.Z. Huang, "TW-k-means: Automated two-level variable weighting clustering algorithm for multi-view data", IEEE, Vol.25 No.4 Apr. 2013.
- [6] M. Pawlik and N. Augsten, "RTED: A robust algorithm for the tree edit distance", Proc.VLDB Endowment,Vol.5,No.4,2011.
- [7] Kavita M. Gawande.Mr. Subhash K. Shinde, Mrs. Dipti Patil, "Frequent Pattern Mining Based on Clustering and Association Rule Algorithm", IJARCS,Vol.3,No.3,2012.
- [8] Jaimeel. M. Shah, Lokesh Sahu, Recommendation based on Clustering and Association Rules, IJARIIE-ISSN(O)-2395-4396, Vol-1 Issue-2 2015.

Blockchain: Study, Application and Future

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Abstract: Blockchain is the central technology which is used to create the cryptocurrencies, like bitcoin. From the invention of steam engine, electricity, and information technology, blockchain technology has been applied in many areas such as finance, judiciary, and commerce. The report is focused on its potential applications and explored how blockchain technology can be used to solve some problems. This report first introduced the feature, technologies and advantages of blockchain technology following by exploring some of the current block chain applications. Some innovative applications of using blockchain technology were proposed, and the benefits and challenges of using blockchain technology also discussed. This report explains the concept, need of Block chain. It attempts to highlights role of Blockchain in shaping the future of banking, financial institutions and in other sectors.

I. INTRODUCTION

The block chain is one of the genuine digital registers of economic transactions. This can be programmed to record not only the financial transactions but virtually everything of value. In order to use a blockchain, it is required to create a P2P network with all the nodes interested in making use of such a blockchain. Every node of the network receives two keys: a public key, which is used by the other users for encrypting the messages sent to a node, and a private key, which allows a node to read such messages. Therefore, two different keys are used, one for encrypting and another for decrypting.

1.1 Blockchain Architecture

A Blockchain is a chain of blocks which contain information. The data which is stored inside a block depends on the type of blockchain. For Example, A Bitcoin Block contains information about the Sender, Receiver, number of bitcoins to be transferred.

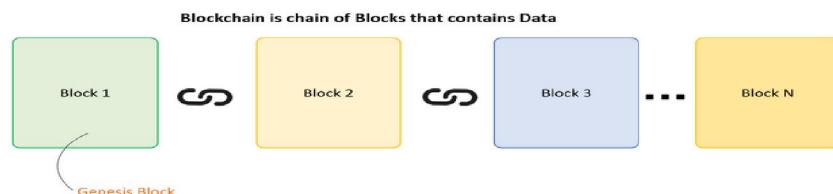


Figure 1:Blockchain Architecture

1.1.1 Block Chain Creation Structure

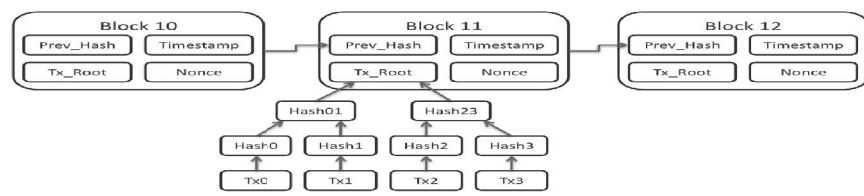
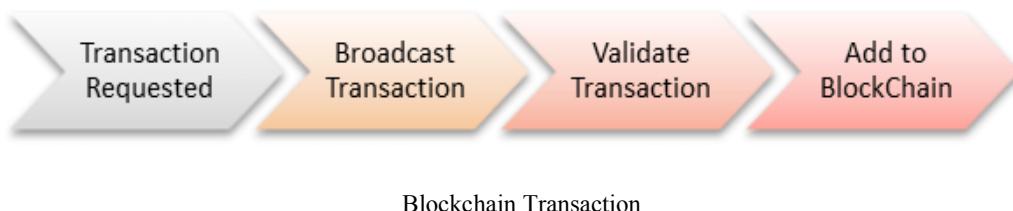


Figure 2:Blockchain Creation Structure

Blocks are data structures whose purpose is to bundle sets of transactions and be distributed to all nodes in the network. Blocks are created by miners. Blocks contain a block header, which is the metadata that helps verify the validity of a block.

1.2 Blockchain Transaction



Step 1) Some person requests a transaction. The transaction could be involved cryptocurrency, contracts, records or other information.

Step 2) the requested transaction is broadcasted to a P2P network with the help of nodes.

Step 3) The network of nodes validates the transaction and the user's status with the help of known algorithms.

Step 4) Once the transaction is complete the new block is then added to the existing blockchain. In such a way that is permanent and unalterable.

1.3 Types of Blockchain

1. Public Block chain

- a) A public blockchain as its name suggests is the blockchain of public, meaning a kind of blockchain which is 'for the people, by the people and of the people'.
- b) Example: Bitcoin, Lit coin etc.
- c) On Bitcoin and Lit coin block chain networks anyone can do the following things that make it truly public blockchain.
 - >anyone can run BTC/LTC full node and start mining.
 - >anyone can make transactions on BTC/LTC chain.
 - >anyone can review/audit the blockchain in a Blockchain explorer.

2. Private Blockchain

- a. Private blockchain as its name suggests is a private property of an individual or an organization.
- b. Unlike public blockchain here there is an in charge who looks after of important things such as read/write or whom to selectively give access to read or vice versa.
- c. Example: Bank chain
- d. In such types of blockchain:
 - >anyone can't run a full node and start mining.
 - >anyone can't make transactions on the chain.
 - >anyone can't review/audit the blockchain in a Blockchain explorer.

1.4 Blockchain Versions

- **Block chain 1.0: Currency**

The implementation of DLT (distributed ledger technology) led to its first and obvious application: cryptocurrencies. This allows financial transactions based on blockchain technology. It is used in currency and payments. Bitcoin is the most prominent example in this segment.

- Blockchain 2.0: Smart Contracts**

The new key concepts are Smart Contracts, small computer programs that "live" in the blockchain. They are free computer programs that execute automatically, and check conditions defined earlier like facilitation, verification or enforcement. It is used as a replacement for traditional contracts.

- Blockchain 3.0: DApps:**

DApps is an abbreviation of decentralized application. It has their backend code running on a decentralized peer-to-peer network. A DApp can have frontend code and user interfaces written in any language that can make a call to its backend, like a traditional App.

1.5 Blockchain Applications

1.5.1 Blockchain in Cryptocurrency

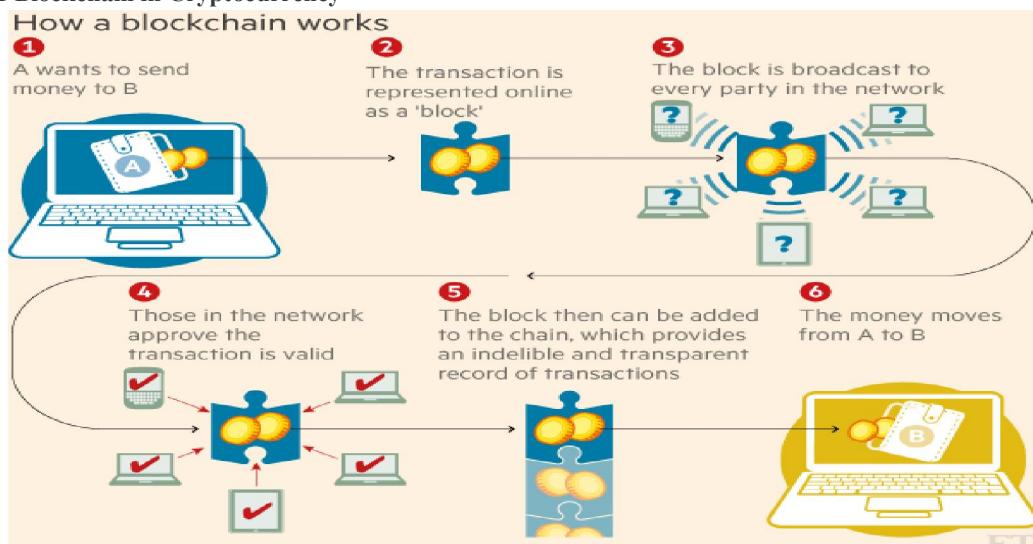


Figure: Blockchain in Cryptocurrency

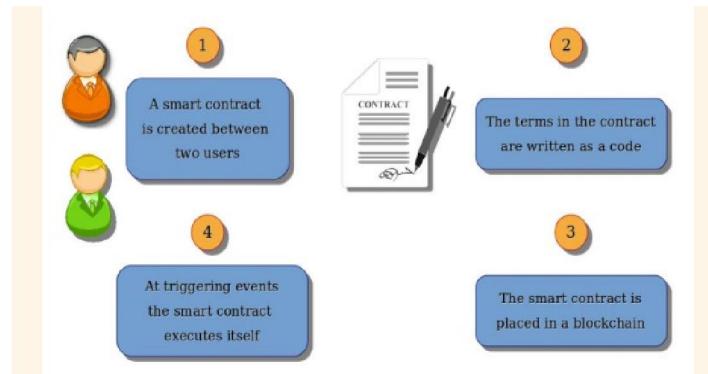
Every individual peer on the network has the complete ledger of all transactions every carried out on a particular blockchain. Transaction confirmation is the job of miners on the network. Once a transaction is confirmed, it cannot be modified or reversed. It is broadcast across all network nodes to form an immutable record.

Cryptocurrency Transaction are carried out using sets of private and public keys. These respectively encode and decode digital information to allow for the movement of digital assets from one user to another. Such transactions attract relatively low fees and allow for easy payment processing.

1.5.2 Blockchain in Voting

- Just like a bitcoin user carry out transactions by sending bitcoin or any other digital currency to the receiver's digital wallet, blockchain voting systems involves designing wallets for every candidate.
- All voters assigned a digital coin that represents a vote, which can be cast by sending their coin to the wallet of their preferred candidate.
- Like is bitcoin transactions, all the transactions are recorded on the blockchain, voters can see that there was really counted.
- A New York-based initiative is working on the project that will deliver fraud-proof, open-source, completely anonymous digital voting solutions based on the blockchain.

1.5.3 Blockchain in the Smart Contract



It typically works in the following way:

- A user requests a transaction. The transaction can involve contracts, records or cryptocurrency
- The request is broadcast to a P2P network consisting of computers, called nodes
- The transaction and the user's status are verified using known algorithm.
- On successful verification, the verified transaction is added to a block with other transaction
- The block is added to the blockchain.

1.5.4 Cross Border Payments

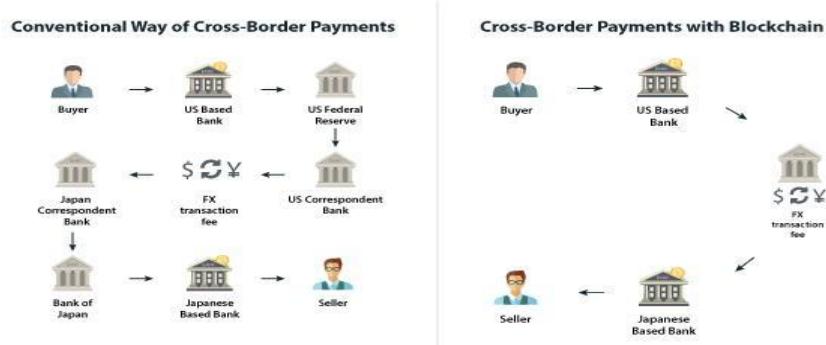


Figure: Cross Border Payment

Traditionally, the transfer of value has been both expensive and slow, and especially for payments taking place across international borders. One reason for this is that, when multiple currencies are involved, the transfer process typically requires multiple banks in multiple locations before the intended recipient can actually collect his or her money. There are existing services to help facilitate this process in a faster way, but these tend to be quite expensive.

Blockchain technology has the potential to provide a much faster and cheaper alternative to traditional cross-border payments methods. Indeed, while typical money remittance costs might be as high as 20% of the transfer amount, blockchain may allow for costs as low as 2%, as well as guaranteed and real-time transaction processing speeds. There are hurdles to be passed, including regulation of cryptocurrencies in different parts of the world and security concerns. Nonetheless, this is one of the most promising and talked about areas of block chain technology application.

II. FUTURE OF BLOCKCHAIN

2.1 Google will be working on its own Blockchain

- Google will come out with Enhanced version of blockchain.
- ShridharRamaswamy, Google advertising chief, looking at blockchain and said existing core technology can't handle a lot of transaction quickly.
- Technology like IBM corporation (IBM),Microsoft and Accenture are leading the pack of blockchain service providers.
- Facebook founder Mark Zuckerberg also expressing interest in virtual tokens encryption and other decentralized technology.

2.2 Block chain will help in changing the Government services

Recent media attention on blockchain has mostly focused on the technology's applications in the finance industry or on the numerous coins being generated on its platform. But the extent of its utility goes beyond immediate headlines. Blockchain's distributed ledger can be used to store, maintain and prosecute a wide variety of services.

Governments around the world have established pilot projects to integrate blockchain technology into their operations. In developed countries, blockchain will help streamline government functions to make them more efficient. In emerging economies, blockchain has the potential to help governments achieve policy goals by leapfrogging intermediate layers of technology. For example, it can help in social welfare objectives by eliminating the need for credit cards or bank accounts to disburse funds to those who are unbanked.

Example: Dubai Government is one of the most powerful Blockchain government

The online payment portal Dubai Pay will now use blockchain technology for real-time reconciliation and settlement of transactions. This is another step towards Dubai's goal of becoming the world's first blockchain-powered government by 2020.

Dubai's government is currently working on some use cases for blockchain technology to complement its existing operations. Dubai's government has strategic partnerships with IBM and Consensys as advisors to help them and Smart Dubai further their goals.

SmartDubai and its government arm Smart Dubai Government Establishment (SDG) aims to drive the city's success and global competitiveness via smart technology. SDG include the move to blockchain in their remit.

Mira Sultan Obaid Abdul Rahman, director of the smart services enablement department at SDG, it plans to increase government efficiency by moving all transactions to blockchain. The Dubai Department of Finance (DoF) works behind the scenes to enable the transactions on Dubai Pay and addresses any issues and disputes. The Dubai Pay portal handles transactions from 27 government entities and a further 14 non-government entities.

Dubai's Road and Transport Authority announced plans for a blockchain-based vehicle management system earlier in the year. The largest bank in Dubai, Emirates NBD launched a blockchain-based project to reduce cheque fraud in April 2018, and Dubai Tourism revealed plans in March 2018, to use blockchain and smart contract technology to overhaul its systems.

III. LITERATURE SURVEY

Paper 1: de la Rosa, JosepLluis, et al. "A survey of blockchain technologies for open innovation", 4rdAnnual World Open Innovation Conf. WOIC. 2017.

This paper explores the distributed nature of open innovation meets the distributed nature of the blockchain technology. This is especially true for the open innovation platforms, because They show limitations that demand reinvention on the basis of renewed confidence and Expectancies. With this perspective, their synergies with blockchain technological approaches are worth of being surveyed the BT, however, supports much more

than cryptocurrencies. With the launch of the ethereal platform and the related virtual currency Ether (ETH) in 2015, it is possible to build blockchain-based applications for use within practically any sector.

These are used to record any transaction of value through smart contracts, whether it is current “fiat” money, commodities such as gold or oil, energy, real estate contracts – or for that matter – intellectual property rights (IPR) that are central in OI.

Paper 2: Bayu Adhi Tama, Bruno Joachim Kweka, Youngho Park, Kyung-Hyune Rhee, A Critical Review of Blockchain and Its Current Applications, International Conference on Electrical Engineering and Computer Science (ICECOS) 2017.

This paper explores about Blockchain Technology. Blockchain is a type of distributed ledger (data structure) which contains information about transactions or events. It is replicated and shared among the participants in the network. The size of chain unceasingly increases since blocks are added and chained to the previous block using a hash function. A cryptographic hash function is used to produce a hash. For instance, Bitcoin uses SHA-256, whilst Lite coin and Prime coin use Script and Cunningham chain, respectively. In addition, it enables us to simply verify the input mapping to a given hash value. It would not be feasible for two different inputs having the same hash. Each node keeps a complete replica of the entire ledger.

Paper 3: Songara, Ankit, and Lokesh Chouhan. "Blockchain: A Decentralized Technique for Securing Internet of Things".

This paper discusses about the cryptocurrency, bitcoin and its advantages, security of a bitcoin transaction and the process behind it. This paper also talks about blockchain, its working and how it can be used in different areas like banking sectors, Internet of Things (IoT), etc. Also, this paper discusses the benefits and limitations of blockchain. Some major advantages of blockchain are security of the network, faster transactions, etc. Whereas, major drawbacks of using blockchain technology are scalability and high computation power.

Paper 4: Zheng, Zibin, et al. "An overview of blockchain technology: Architecture, consensus, and future trends." Big Data (BigData Congress), 2017 IEEE International Congress on IEEE, 2017.

This paper provides an overview of blockchain architecture firstly and compare some typical consensus algorithms used in different block chains. Furthermore, technical challenges and recent advances are briefly listed. We also lay out possible future trends for blockchain.

Blockchain has shown its potential for transforming traditional industry with its key characteristics: decentralization, persistency, anonymity and auditability. In this paper, we present a comprehensive overview on blockchain. We first give an overview of blockchain technologies including blockchain architecture and key characteristics of blockchain. We then discuss the typical consensus algorithms used in blockchain. We analyzed and compared these protocols in different respects.

Furthermore, we listed some challenges and problems that would hinder blockchain development and summarized some existing approaches for solving these problems. Some possible future directions are also proposed. Nowadays blockchain-based applications are springing up and we plan to conduct in-depth investigations on blockchain-based applications in the future.

In this paper we have seen what bitcoin is, its advantages and how its decentralized nature can play an important role in various sectors. Process behind securing the bitcoin transactions.

IV. CONCLUSION

The application of the Block chain concept and technology has grown beyond its use for bitcoin generation and transaction. The properties of its security, privacy, traceability, inherent data provenance and time stamping have seen its adoption beyond its initial application areas. Thus, the invention of the block chain can be seen to be vital and much needed additional component of the internet that was lacking in security and trust before.

REFERENCES

- [1] De la Rosa, JosepLluis, et al. "A survey of blockchain technologies for open innovation." 4rdAnnual World Open Innovation Conf. WOIC. 2017.
- [2] BayuAdhiTama, Bruno Joachim Kweka, Youngho Park, Kyung-HyuneRhee" A Critical Review of Blockchain and Its Current Applications" International Conference on Electrical Engineering and Computer Science (ICECOS) 2017.
- [3] Zheng, Zibin, et al. "An overview of blockchain technology: Architecture, consensus, and future trends." Big Data (BigData Congress), 2017 IEEE International Congress on. IEEE, 2017.
- [4] Songara, Ankit, and LokeshChouhan. "Blockchain: A Decentralized Technique for Securing Internet of Things."
- [5] Chen, Guang, et al. "Exploring blockchain technology and its potential applications for education." Smart Learning Environments 5.1 (2018)
- [6] <https://blockchain.ieee.org/images/files/pdf/ieee-future-directions-blockchain-white-paper.pdf>
- [7] How Consensus Algorithm solve issue with bitcoin's proof of work, <http://www.coindesk.com/stellar-ripple-hyperledger-rivals-bitcoinproofwork/>
- [8] Sun, J., Yan, J., & Zhang, K. Z. (2016). Blockchain-basedsharing services: What blockchaintechnology can contribute to smart cities. Financial Innovation, 2(1), 26.

Bitcoin -Digital Currency Wallet

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Abstract: *Crypto currencies have imitative as important financial software systems. They depend on a secure distributed, public, digital ledger that records all the transactions. Mining is a most essential part of systems. Mining keeps number of records of past transactions to the distributed ledger known as Blockchain. Using the Blockchain technology customers have to make secure, robust consensus for each transaction. Mining also introduces capital in the form of new units of currency. Crypto currencies do not have a central Management to handle transactions because they were designed as peer to-peer systems. They rely on miners to validate transactions. Bitcoin became the first decentralized cryptocurrency come into the market in 2009 these use a decentralized control which is related to the use of bitcoin's transaction database. Bitcoin generation and transactions are based on hashes and asymmetric encryption algorithms.*

Keywords: Cryptocurrency, Blockchain, Bitcoin, Ledger, etc.

I. INTRODUCTION

A Cryptocurrency is a peer-to-peer digital exchange system. In the digital exchange system cryptography technique is used to generate and distribute currency units. This process requires distributed verification of transactions without an administration or central authority. Transaction verification confirms transaction amounts, and check whether the customer have it owns the currency, or they are trying to spend while ensuring that currency units are not spent twice. This verification process is called mining. Cryptocurrencies use a variety of mining technologies, according to their particular requirements.

Cryptocurrency is a digital currency in which cryptography techniques are used to control the creation of units of currency and verify the transfer of funds. Cryptocurrency system is Decentralized i.e., operates independent of any central authority or individuals. In the cryptocurrency transaction the supply of money is regulated by software and the agreement of users of the system. The cryptocurrency transaction is based on peer-to-peer transaction.

Table 1: Difference between Conventional currency and cryptocurrency

	Conventional Currency	Cryptocurrency
Type	Real	Virtual
Intermediates	Yes	No(peer to peer)
Portability	Yes(except heavy cash)	Highly portable
Durable	Moderate	Highly durable
Acceptance	National	Global(throughout the internet)
Secure	Moderate	High
Sovereign (Government issued)	Yes	No
Decentralized	No(Central bank control)	Yes

Table2: Evolution of cryptocurrency

Year	Name	Description
2009	Bitcoin	First cryptocurrency and used SHA-256 as hashing function.
April 2011	Namecoin	Decentralized DNS
Oct 2011	Litecoin	First successful Scrypt cryptocurrency
2012	Peercoin	First use of POW and POS function
Early 2014	Monero	Uses cryptoNote protocol.2G of cryptocurrency.
2015	Capricoin	Improved and more user friendly

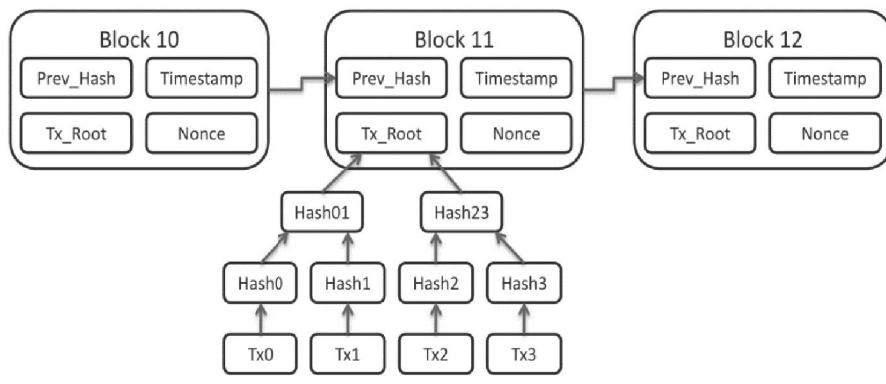
1.1 Bitcoin

Bitcoin is virtual cryptocurrency. Bitcoin used in all over the world as a payment system. It is the first decentralized digital currency, because this system works without a central bank or single administrator. The network is peer-to-peer and transactions take place between users directly, without an intermediary. These transactions are verified by network nodes through the use of cryptography and recorded in a public distributed ledger called a blockchain. Bitcoin was invented by an unknown person or group of people under the name Satoshi Nakamoto and released as open-source software in 2009.

The technology used to summarize the Bitcoin is as follows:

1. Blockchain
2. Bitcoin mining process
3. Bitcoin Transaction process

1) Blockchain: A blockchain is a continuously growing list of records, called blocks. Blocks are linked and secured using cryptography. Each block typically contains a cryptographic hash of the previous block, a timestamp and transaction data. The modification of the data is possible in a blockchain. It is "an open, distributed ledger that can record transactions between two customers efficiently and in a verifiable and permanent way". For use as a distributed ledger, a blockchain is typically managed by a peer-to-peer network for inter-node communication and validating new blocks. Once recorded, the data in any given block cannot be altered posterior without the alteration of all subsequent blocks.


Figure 1: Blockchain Creation Structure

Blocks are data structures whose purpose is to bundle sets of transactions and be distributed to all nodes in the network. Blocks are created by miners. Blocks contain a block header, which is the metadata that helps verify the validity of a block.

Typical block metadata contains:

- previous block header hash - the reference this block's parent block
- merkle root hash - a cryptographic hash of all of the transactions included in this block
- time - the time that this block was created
- nonce ("number used once") - a random value that the creator of a block is allowed to manipulate however they so choose.

Hash Function

SHA-256 is a cryptographic hash functions designed by the NSA (National Security Agency). SHA stands for Secure Hash Algorithm. Cryptographic hash functions are mathematical operations run on digital data; by comparing the computed "hash" (the output from execution of the algorithm) to a known and expected hash value, a person can determine the data's integrity.

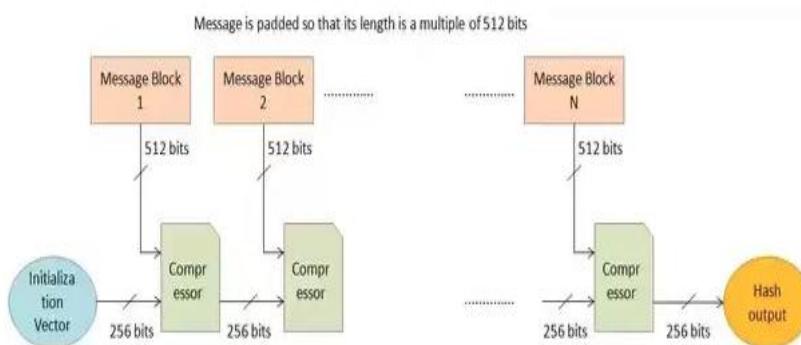


Figure 2: Workings of SHA-256 Hash Function

- a. The SHA-256 function takes an input message of any size and produces a fixed size output – 256 bits.
- b. The message is broken into blocks of 512 bits each and it is also padded to make sure the overall message size is a multiple of 512 bits.
- c. An initialization vector, as defined by SHA-256, is passed as input to the first compressor.
- d. Each compressor will use binary operations such as AND, XOR etc. to compress the input message into 256 bits.

Hash Pointer

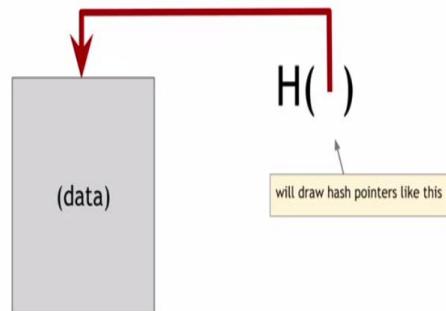


Figure 3: Hash Pointer

- a. A Hash Pointer is a type of data structure which stores both the address and hash of a data.
- b. So given a Hash Pointer, you can access the data stored in that address, compute its hash and verify the computed hash against the hash present in the Hash Pointer.

Merkle Root

binary tree with hash pointers = “Merkle tree”

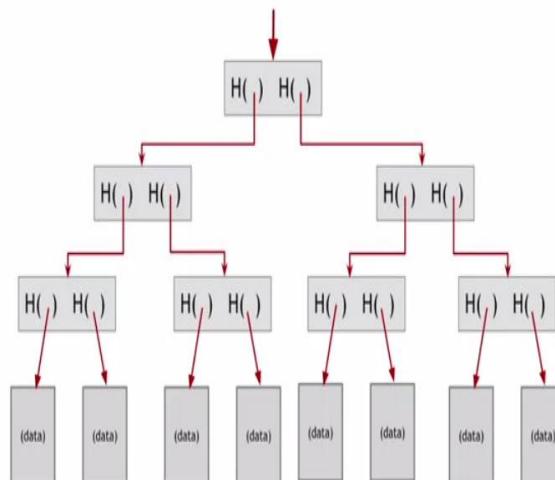


Figure 4: Merkle Tree

Another useful data structure using hash pointers is a binary tree. We can build a binary tree with hash pointers. Suppose we have a bunch of data blocks which we'll draw across the bottom down. We have to take consecutive pairs of these data blocks and for these two data blocks we're going to build a data structure here that has two hash pointers, one to each of these blocks, and similarly all the way across. Then go another level up and this block will contain a hash pointer of these two children down. And so on, all the way back up to the root of the tree.

Bitcoin Mining

Bitcoin mining is the process of verifying Bitcoin transactions and recording them on Bitcoin's public ledger or blockchain. This ledger of past transactions is called the block chain as it is a chain of blocks. The block chain serves to confirm transactions to the rest of the network as having taken place.

Mining Bitcoin in Six easy steps

1. Join the network, listen for transaction
 - a. Validate all proposed transaction.
2. Listen for new blocks, maintain the blockchain
 - a. Validate it, when a new block is proposed.
3. Collect a new valid block.
4. Find the nonce to make your block valid.
5. Hope everybody accepts your new block.
6. Profit.

Validation of Block

First join the network, and becoming a Bitcoin node. After that listen for all of the transactions that people are broadcasting. Then we have to validate them, you listen for new blocks that people have found, you maintain a view of the current block chain. The other miners accept your block, that they validate it and start mining on the top of it, and that they don't accept some competitor's block instead. And if all that happens in step 6 you finally get to profit, Miners perform this validation step.

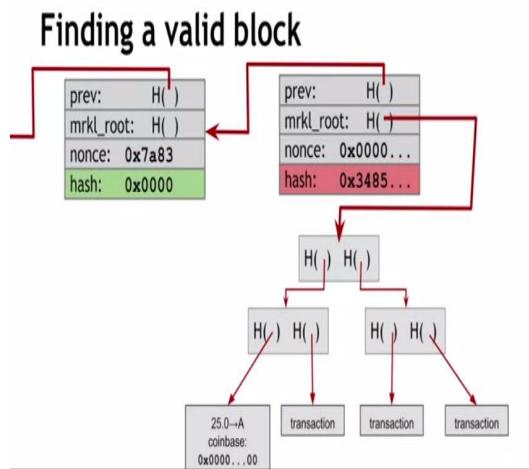


Figure 5: Validation of Block

Bitcoin Transaction

The following diagram gives a streamlined view of how transactions are signed and linked together. Consider the middle transaction, moving bitcoins from address B to address C. The contents of the transaction (including the hash of the previous transaction) are hashed and signed with B's private key. In addition, B's public key is included in the transaction. By performing several steps, anyone can validate that the transaction is authorized by B. First, B's public key must correspond to B's address in the previous transaction, proving the public key is valid.

Next, B's signature of the transaction can be verified using the B's public key in the transaction. These steps ensure that the transaction is valid and authorized by B. One unexpected part of Bitcoin is that B's public key isn't made public until it is used in a transaction.

With this system, bitcoins are passed from address to address through a chain of transactions. Each step in the chain can be verified to ensure that bitcoins are being spent validly. Note that transactions can have multiple inputs and outputs in general, so the chain branches out into a tree.

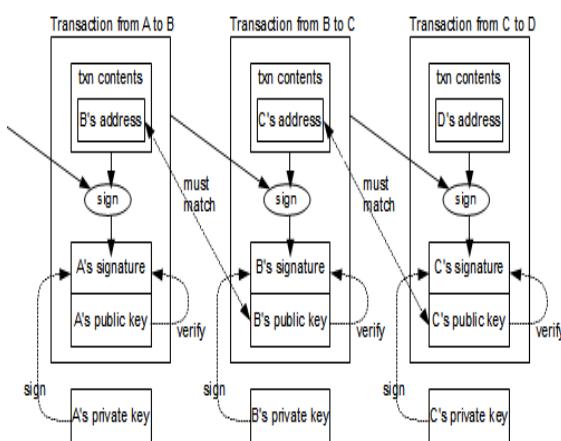


Figure 6: Bitcoin Transaction

II. LITURATURE SURVEY

Paper 1: Mukhopadhyay, Ujan, et al. "A brief survey of cryptocurrency systems." Privacy, Security and Trust (PST), 2016 14th Annual Conference on. IEEE, 2016.

This paper explores the brief survey of cryptocurrency like Bitcoin, Litecoin, Peercoin, Ethereum, Ripple, Namecoin, Auroracoin, Blackcoin, Dash, Decred, and Permacoin. These Cryptocurrencies are the most interesting, widely used, and with the greatest capital and transaction rates. This paper discusses about the Hash function.

SHA 256: SHA 2 is a set of Secure Hash Functions that has six algorithms, which produce digests (results) that are of different bit lengths. SHA 256, produces a digest of 256 bits. SHA 256 satisfies the requirement of unidirectional hashes. Also, the same input will always produce the same digest. SHA 256 pads input to convert its length to a multiple of 512 bits. Then, it divides the input into blocks of 512 bits each. The compression function permutes and compresses the input block answer is a combination of bitwise logical operators, such as AND, OR, XOR, Complement, etc. In Figure Ch and Ma are the block wise logical operators using XOR functions.

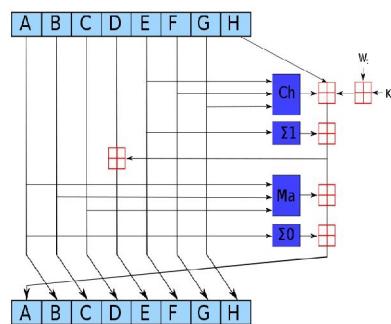


Figure 7: Round function of SHA-256

Paper 2: Bayu Adhi Tama, Bruno Joachim Kweka, Youngho Park, Kyung-Hyune Rhee, "A Critical Review of Blockchain and Its Current Applications" International Conference on Electrical Engineering and Computer Science (ICECOS) 2017.

This paper explores about Blockchain Technology.

Blockchain is a type of distributed ledger (data structure) which contains information about transactions or events. It is replicated and shared among the participants in the network.

The size of chain increases since blocks are added to the previous block using a hash function. A cryptographic hash function is used to produce a hash. For instance, Bitcoin uses SHA-256, whilst Litecoin and Primecoin use Scrypt and Cunningham chain, respectively. In addition, it enables us to simply verify the input mapping to a given hash value. It would not be feasible for two different inputs having the same hash. Each node keeps a complete replica of the entire ledger.

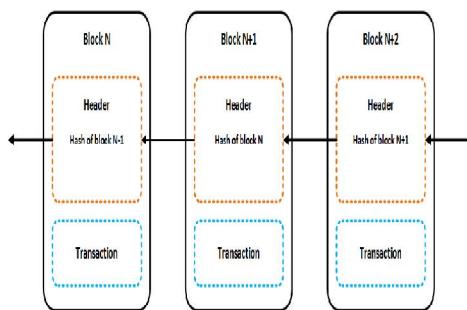


Figure 8: A chain of blocks-blockchain in Bitcoin

Paper 3: Satoshi Nakamoto “Bitcoin:A peer-to-peer Electronics Cash System”.

This paper discusses about the transaction of bitcoin. This paper explores about the transaction of the bitcoin. They proposed a system for electronic transaction without relying on trust. They started with usual framework of coins made from digital signature, which provides a strong control of ownership.

It also explores about the Timestamp server.

A timestamp server works by taking a hash of block of items to be time stamped and widely publishing the hash. The timestamp proves that the data must have existed at a time in order to get into the hash. Each timestamp includes the previous timestamp in its hash forming a chain with each additional timestamp reinforcing the ones before it.

III. CONCLUSION

Thus, I have studied the Bitcoin as a cryptocurrency. As per the study I have observed that Bitcoin is a revolutionary currency system which can work in parallel or even replace the existing forms of currencies in the future. Bitcoin can be used as a reliable alternative for fast cashless payments. Bitcoin joins a number of cryptocurrencies in presenting an alternative to banking-mediated online commerce. A cryptocurrency is a money-exchange protocol that uses cryptography to ensure transaction security, privacy, and the creation of units of exchange. The ideal cryptocurrency is secure, anonymous, and free from duplication, portable and two-way, and divisible. Indeed, the most pressing concern of a digital currency is to protect transactions from hackers who could steal or modify information, and also ensuring that each transaction has its source and destination authenticated.

REFERENCES

- [1] Mukhopadhyay, Ujan, et al. “A brief survey of cryptocurrency systems.” Privacy, Security and Trust (PST), 2016 14th Annual Conference on. IEEE, 2016.
- [2] Bayu Adhi Tama, Bruno Joachim Kweka, Youngho Park, Kyung-Hyune Rhee, “A Critical Review of Blockchain and Its Current Applications” International Conference on Electrical Engineering and Computer Science (ICECOS) 2017.
- [3] Satoshi Nakamoto “Bitcoin:A peer-to-peer Electronics Cash System”.
- [4] www.slideshare.net/CoinDesk/state-of-bitcoin-and-blockchain-2016-57577869/118-Source_Bitcoin_and_Blockchain_Thought
- [5] <https://www.coursera.org/learn/cryptocurrency/lecture/0htpQ/the-task-of-bitcoin-miners>
- [6] Matthew D. Sleiman, Adrian P. Lauf, Roman Yampolskiy, “Bitcoin Message Data Insertion on a Proof-of-Work”.
- [7] Matthew D. Sleiman, Adrian P. Lauf, Roman Yampolskiy, “Bitcoin Message: Cryptocurrency System” 2015 International Conference on Cyberworlds.

Object Detection using Tensor Flow API

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Abstract: This paper is based on object detection using Tensor flow. Due to object detection's close relationship with video analysis and image understanding, it has attracted much research attention in recent years. The ubiquitous and wide applications like scene understanding, video surveillance, robotics, and self-driving systems triggered vast research in the domain of computer vision in the most recent decade. Being the core of all these applications, visual recognition systems which encompasses image classification, localization and detection have achieved great research momentum. Due to significant development in neural networks especially deep learning, these visual recognition systems have attained remarkable performance. Object detection is one of these domains witnessing great success in computer vision. This paper demystifies the role of deep learning-based object detection frameworks and its representative tool, namely Convolution Neural Network (CNN). So, by studying these we decided to train a model for Mask detection and also for object detection using Single Shot Detector (SSD). After the breakout of the worldwide pandemic COVID-19, there arises a severe need of protection mechanisms, face mask being the primary one. The basic aim of the project is to detect the presence of a face mask on human faces on live streaming video as well as on images. We have used deep learning to develop our face detector model. The architecture used for the object detection purpose is Single Shot Detector (SSD) because of its good performance accuracy and high speed. Alongside this, we have used basic concepts of transfer learning in neural networks to finally output presence or absence of a face mask in an image.

Keywords: Tensor Flow, Convolution Neural Network, Single Shot Detector, Object Detection, Deep Learning, etc.

I. INTRODUCTION

Object detection's close relationship with video analysis and image understanding, it has attracted much research attention in recent years. So, our report gives a brief introduction on the deep learning and its representative tool, namely Convolutional Neural Network (CNN). Frameworks and Services of Object Detection is done with the help of Tensor Flow. The Tensor Flow Object Detection API is an open-source framework built on top of Tensor Flow that makes it easy to construct, train and deploy object detection models. There are already pre-trained models in their framework.

There are already pre-trained models in their framework. includes a collection of pre-trained models trained on various its datasets such as the –

- COCO (Common Objects in Context) dataset,
- the KITTI dataset, and
- the Open Images Dataset.

Tensor Flow bundles together Machine Learning and Deep Learning models and algorithms. It uses Python as a convenient front-end and runs it efficiently in optimized C++. Tensor Flow is at present the most popular software library. There are several real-world applications of deep learning that makes Tensor Flow popular.

Being an Open-Source library for deep learning and machine learning, Tensor Flow finds a role to play in text-based applications, image recognition, voice search, and many more.

Deep Face, Facebook's image recognition system, uses Tensor Flow for image recognition. So, the paper clarifies the role of deep learning-based object detection frameworks and its representative tool, namely CNN. So, by studying these we decided to train a model for Mask detection and also for object detection using Single Shot Detector (SSD).

A. Methodology

Tensor Flow Object Detection API- The Tensor Flow object detection API is a software framework used for object detection tasks. Object Detection is the process of finding real-world object instances like car, bike, TV, flowers, and humans in still images or Videos. It allows for the recognition, localization, and detection of multiple objects within an image which provides us with a much better understanding of an image as a whole. It is commonly used in applications such as image retrieval, security, surveillance, and advanced driver assistance systems (ADAS).

Tensor Flow Object Detection API and other similar APIs (Keras, RCNN, YOLO) uses pre trained CNNs inside the frameworks for predictions. Most of those pretrained models are trained using, the COCO dataset, and the Open Images Dataset. These models are trained to detect some fixed type of categories of objects such as, persons, cars, dog, tooth brush and etc. If you want to detect custom objects you can retrain those models using your own datasets.

B. Convolution

CNN stands for Convolution Neural Network. CNNs have revolutionized Pattern Recognition in last decades. As a result, CNNs are currently used for various applications such as Object Detection and Image Recognition. This process of Object Detection is carried out in four layers by CNN Models.

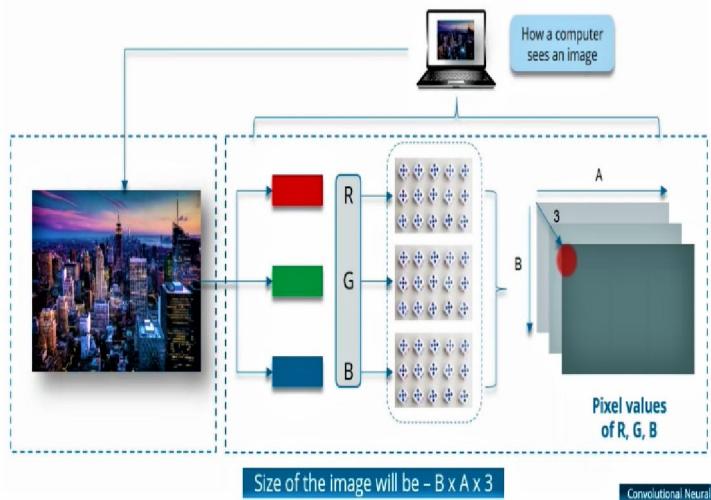


Figure 1: Convolution Neural Network pattern recognition

So firstly, let us understand how exactly a computer reads an Image. In the figure 1.0 we can see the image of Dog and when we look at this image, the first thing we notice, is a Dog and a Puppy, Different Colours, and other stuffs like that, but how a computer read this image? So basically, there will be three channels- known as RGB Channel. Now each of this channel will have their own respective Pixel Values as shown in the Figure. So, when I say image size is- $B \times A \times 3$ pixels it means that there are B Rows, A Columns and 3 Channels. And this is how a computer sees an image and understands through its pixel values. So, this is for coloured images for Black n White there are two channels. Now here the role of CNN is very important, it gives this pixel values for particular image or Object. And this is done by CNN Models.

C. CNN models used in TensorFlow Object Detection API-

There are different types of CNN models as shown here. Basically, these CNN Models have pre-trained images i.e. It contains 100+ images trained with their pixel values. In a simple way, suppose we have to identify this dog's picture. So, CNN Model already contains a trained image of Dog with its pixel value and it compares this original pixel value with the pixel value we extracted from the image we have to identify, if it matches or comes near to the original pixel value it identifies the picture as dog. So as there are different CNN models, each model has different speed and Accuracy of object detection.

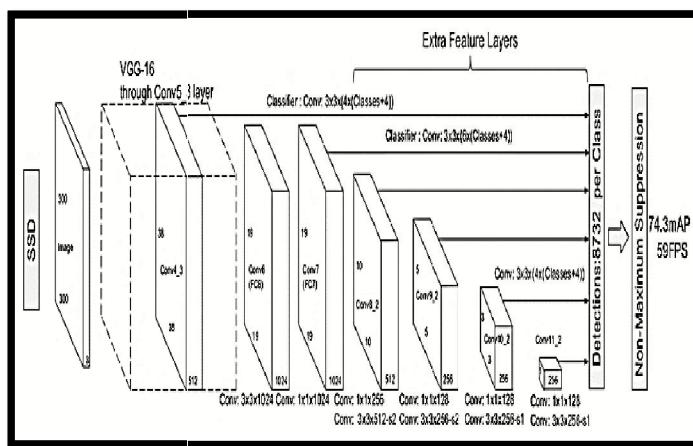
Model name	Speed	COCO mAP	Outputs
ssd_mobilenet_v1_coco	fast	21	Boxes
ssd_inception_v2_coco	fast	24	Boxes
rfcn_resnet101_coco	medium	30	Boxes
faster_rcnn_resnet101_coco	medium	32	Boxes
faster_rcnn_inception_resnet_v2_atrous_coco	slow	37	Boxes

Figure 1.1: Convolution Neural Network Models

D. mAP (mean Average Precision)-

The accuracy is measured in mAP means mean average precision; it is popular metric in measuring accuracy of object detection. We can see here that faster the speed of object detection less the accuracy and slower the speed of detection better the accuracy. Average precision computes the average precision value for recall value over 0 to 1.

E. SSD Mobile Net:



In order to extract feature maps, we usually use the predefined trained techniques which are used for high quality classification problems. We call this part of the model a base model. For the SSD, we have VGG-16 network as our base model. At the training time, the bounding boxes evaluated are compared with the ground truth boxes and in the back propagation, the trainable parameters are altered as per requirement. We truncate the VGG-16 model just before the classification layer and add feature layers which keep on decreasing in size. At each feature space, we use a kernel to produce outcomes which depicts corresponding scores for each pixel whether there exists any object or not and the corresponding dimensions of the resulting bounding box.

VGG-16 is a very dense network having 16 layers of convolution which are useful in extracting features to classify and detect objects. The reason for the selection is because the architecture consists of stacks of convolutions with 3x3 kernel size which thoroughly extract numerous feature information along with max-pooling and ReLU to pass the information flow in the model and adding non linearity respectively from the given image. For additional nonlinearity, it uses 1x1 convolution blocks which does not change the spatial dimension of the input. Due to the small size filters striding over the image, there are many weight parameters which end up giving an improved performance.

At the input end, we can see the VGG-16 being used as the base model. Some additional feature layers are added at the end of the base model to take care of offsets and confidence scores of different bounding boxes. At end part of the figure, we can see the layers being flattened to make predictions for different bounding boxes. At the end, non-maximum suppression is used whose purpose is to remove duplicate or quite similar bounding boxes around same objects. There may be situations where the neighbouring pixel also predicts a bounding box for an object with a bit less confidence which is finally rejected.

The problem can be solved in two parts: first detecting the presence of several faces in a given image or stream of video and then in the second part, detect the presence or absence of face mask on face. In order to detect the face, we have used the OpenCV library. The latest OpenCV includes a Deep Neural Network (DNN) module, which comes with a pre-trained face detection convolutional neural network (CNN). The new model enhances the face detection performance compared to the traditional models. Whenever a new test image is given, it is first converted into BLOBS (Binary Large Object refers to a group of connected pixels in a binary image) and then sent into the pretrained model which outputs the number of detected faces. Every face detected comes out with a level of confidence which is then compared with a threshold value to filter out the irrelevant detections. After we have the faces, we need to evaluate the bounding box around it and send it to the second part of the model to check if the face has a mask or not.

The second part of the model is trained by us using a dataset consisting of images with mask and without mask. We have used Keras along with TensorFlow to train our model. First part of the training includes storing all labels of the images in a NumPy array and the corresponding images are also reshaped (224, 244, 3) for the base model. Image augmentation is a very useful technique because it increases our dataset with images with a whole new perspective. The base model that we have used here is MobileNetV2 with the given ‘ImageNet’ weights. ImageNet is an image database that has been trained on hundreds of thousands of images hence it helps a lot in Image classification. CNN process is carried out in 4 layers which means it extracts the pixel values of the Input image to compare with original pixel value which is already stored in Model. So, the four layers are Convolution Layer, ReLU Layer, Pooling Layer and finally Fully Connected Layer.

- **In Convolution Layer**, the image is Converted into number of pixels, then adding those pixels and dividing them into total no. of pixel is done here.
- **In ReLU Layer**, after getting those pixel values if any input pixel value is negative or zero, then the output is given as Zero.
- **Pooling Layer**, in this layer we shrink the image stack into smaller size. For Example: Four pixels image input are converted into one single pixel by giving them the value of highest pixel.
- **Fully Connected Layer**, stacking up the layer, means all of the above layer’s process is done again by taking out filtered and shrunked images and putting them into single list.

Thus, Output is given as detected category of the bounding object and also their bounding rectangles parameter as (x-min, x-max) (y-min, y-max).

F. How Object Detection is Done?

1. Generates the small segments in the input image as shown in figure 3.0. So, it generates small segments in the input image as we seen in Convolution layer.

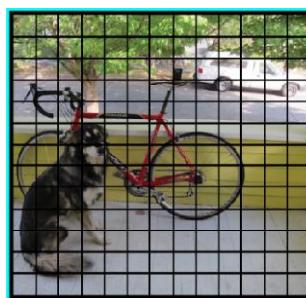


Figure 1.3: Small segments of a picture

2. Feature extraction is carried out for each segmented rectangular area to predict whether the rectangle contains a valid object as shown in the figure 3.2. Which means Extraction of Pixel values of the input image is done and Compared with the original pixel values with the trained image stored in the Model.

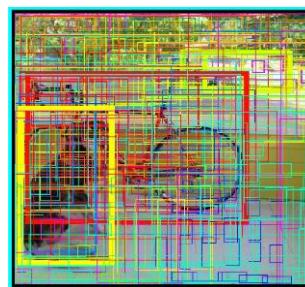


Figure 1.4: Extraction for each segment

3. Overlapping boxes are combined into a single bounding rectangle (Non-Maximum Suppression) - Thus, we get the output identified with bounding rectangle as in figure.

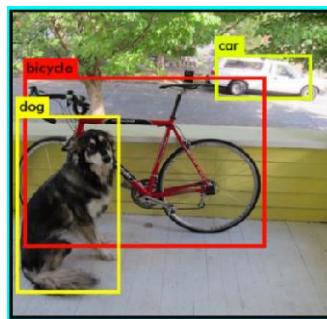


Figure 1.4: Object is identified

II. CONCLUSION

As today's era is moving towards being digitalized and automated with a great speed, the youth want everything very easily and smart. Not only the youth but the people of all generation are finding it very easy to be smart effort. So, we thought of using this model. We have modelled a face mask detector using SSD architecture and transfer learning methods in neural networks. To train, validate and test the model, we used the dataset that consisted of 1916 masked faces images and 1919 unmasked faces images. These images were taken from various resources like Kaggle and RMFD datasets. The model was inferred on images and live video streams.

REFERENCES

- [1] Haddad, J., 2020. How I Built A Face Mask Detector For COVID-19 Using Pytorch Lightning, <https://towardsdatascience.com/how-i-built-a-face-mask-detector-for-covid-19-usingpytorch-lightning-67eb3752fd61>.
- [2] Hussain Mujtaba, Jul 24, 2020 Real-Time Object detection using TensorFlow, www.mygreatlearning.com/blog/object-detection-using-tensorflow/
- [3] Mustamo P. (2018)- “Object detection in sports: TensorFlow Object Detection API case study”. He has developed and studied the TensorFlow Object Detection case deeply for making it applicable in sports region. The aim of his study was to explore the modern open source-based solutions for object detection in sports, in this case for detecting football players.
- [4] <http://jultika.oulu.fi/files/nbnfioulu-201802081173.pdf> G.Eason,B Noble and I.N.Sneddon, “on certain integrals of Lipschitz Hankel type involving products of Bessel functions,” Phil.Trans Roy Soc.London,Vol A247,pp.529-551,April 1995.
- [5] Zhong-Qiu Zhao, Peng Zheng and Shou-Tao Xu are with the College of Computer Science and Information Engineering, Hefei University of Technology, China. Xindong Wu is with the School of Computing and Informatics, University of Louisiana at Lafayette, USA. (2017) - Here authors explained how actually object is identified and more about object detection and Deep Learning. <https://ieeexplore.ieee.org/abstract/document/8627998/authors#authors>.

Change in Composite Material Behaviour Under Thermal Loading: An Investigation

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Abstract: Natural fibres are a new generation of reinforcements and supplements for polymer-based products that are made from renewable resources. Due to rising environmental concern, the development of natural fibre composite materials or ecologically friendly composites has become a popular topic recently. Natural fibres are a type of material that can be utilised to substitute synthetic materials and products in order to reduce weight and conserve the environment. Natural fibre reinforced polymer composites and natural-based resins are being widely used to replace conventional synthetic polymer or glass fibre reinforced materials. For its interior components, the automotive and aerospace industries have been actively creating various types of natural fibres, primarily hemp, flax, and sisal, as well as bio resins systems. Natural fibre composites are appealing for a variety of applications due to their high specific characteristics and affordable pricing. The goal of this research is to figure out how thermal loading affects natural fibre reinforced composites. This report is based on a study of composite behaviour at various temperatures.

Keywords: Natural Fibers, Composites, Thermal Loading, Tensile Test, Bending Test, etc.

I. INTRODUCTION

Composite materials are gaining popularity due to their increased specific strength, stiffness, and fatigue resistance. Composite materials are made up of two or more constituents and contain two or more physical phases that can be separated. Composites are made up of reinforcement, which has a high load bearing ability, and matrix, which has a lower load carrying capacity. It provides desired strength for structural load reinforcement. The matrix or binder (organic or inorganic) maintains its position by reinforcement. Individual constituents have their own properties, but when combined, they produce greater and improved traits.

Natural fibre composites are not new to us; Egyptians were known to use natural fibres in a variety of purposes. Due to their non-conductive nature, wood cotton fibre composites were a hot issue in the twentieth century for electrical applications. These are now employed in automotive and aviation applications where moisture is a secondary consideration. Flax fibre reinforced polyolefin, for example, is widely employed in the automotive industry today, but it is primarily used as a filler material in frames and other non-structural parts. Natural fibres can be employed in structural applications; however, there are some constraints in terms of the environment. Jute, sisal, pineapple, abaca, and bamboo have all been investigated as reinforcement and fillers in composites. Bamboo stalks have a circular cross section and are hollow on the inside.

The pulp is contained in the outer layer. The green layer has the same hardness as hardwood and has a waxy gloss. Stem is capable of extracting fibres. It's able to withstand tremors. Because of its high aspect ratio and robust mechanical qualities, bamboo fibres can be employed as reinforcement in polymer matrix. Bamboo fibres are becoming increasingly popular as a result of this. Natural fibre composites are becoming more popular by the day. Jute fibres, which were obtained from the local market, were also used as reinforcement in this study. The main focus of this paper is on tensile and bending tests of a hybrid composite at different temperatures. As a result, the study's primary goal is to

- a. Investigate the behaviour of composite materials when subjected to separate loads
- b. Study the behaviour of composite material under thermal loading

Excavator bucket teeth are typically made of alloy steel, and hard facing of some wear resistant materials can be placed to the material of the bucket tooth to extend its life against abrasive wear.

II. LITERATURE REVIEW

C M. Meenakshi [3] has fabricated three types of composite laminates with Glass, Kenaf and Aloe Vera fibers in Epoxy Resins and studied their mechanical and thermal properties. It is found that by adding natural fiber thermal stability increased.

Hua Hu [7] has studied moisture absorption and microstructure evolution of uncoated and coated short jute fibre reinforced He suggest that reliable measures of isolation from moisture must be taken when such composites are exposed in hygrothermal environment.

Paresh V [2] has investigated the mechanical properties of banana fiber epoxy composites in X and Y direction During hygrothermal aging the tensile strength of banana fiber epoxy composites subjected to reduce by average 13.3217%. The change was depending on how the environment was changing.

Yan Yu [13] focused mainly on has tested 11 bamboo fiber and two wood fiber for mechanical properties and he concluded that bamboo fibers show excellent mechanical properties.

Deepa. A [3] observed that with increase in %weight gain, micro hardness of specimen decrease. %Age area fraction decremented with time has also been studied.

Komorowski [5] concluded that environmental condition affects the noncritical design condition of no defect. Results of tests on samples exposed either on the ground or taken from structures that were in actual service for several years, show little degradation due to environmental exposure. However, most of these samples were only lightly loaded.

Manjunath Shettar [6] has talked about aging effect on GFRP. Thermal and moisture gradient have great influence in hygrothermal aging. It has been observed that aging for long duration has bad effect on strength as well as thermal stability.

Zulkafli [7] studied tensile, flexural and quasi-static indentations of hybrid banana / glass fibers in different stacking sequences were investigated. Based on the results, the hybrid banana / glass fibers showed better mechanical properties with the incorporation of glass fibers, especially in flexural properties.

Amir Hossein [9] concluded that natural fibers have outstanding mechanical and physical properties such as high strength-to-weight; high stiffness-to-weight, low density, good thermal insulation, and biodegradability. But composites have some limitations regarding mainly moisture absorption, variability, and dimensional stability.

Huang [1] successfully used resin transfer molding to fabricate continuous unidirectional bamboo fiber reinforced epoxy composites. On the other hand, the tensile strength and modulus of bamboo fibers decrease after alkaline treatment. The mechanically extracted BF has the better strength compared to other methods.

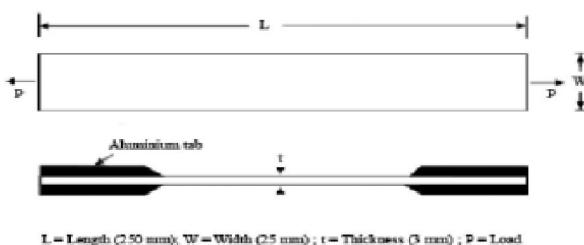
Natural fibre reinforced composites will be very important in the future, according to a literature review. However, their behaviour under numerous shifting environmental situations is of primary significance. When composites are exposed to humid conditions for an extended period of time, their tensile strength and durability diminish. Because natural fibres were incorporated, the tensile properties of the developed composites improved. There has been very little research into the effect of thermal loading on hybrid composites

III. MATERIALS AND SPECIMEN

Bamboo fibre and jute fibre reinforced epoxy hybrid composites were used as the materials. The binder is epoxy resin, and the hardener is K-59. The ASTM D3039 standard was used to create the specimen.

Specimen Specification Used for Testing (ASTMD3039)

Sr.No	Specification of the Specimen	For tensile testing (mm)	For bending Test (mm)
1	Length	250	250
2	Width	25	25
3	Thickness	3	3



Dimensions of the Tensile Test Specimen (ASTMD3039)

IV. EXPERIMENTAL SETUP AND METHODOLOGY

Oven system has been utilised for various temperature conditions. The test was conducted at a temperature of 28°C and a relative humidity of 65 percent. The test specimens were placed in the chamber once it reached the requisite temperature of 28°C and RH of 65 percent. After the treatment test specimen is taken from the chamber and wiped to remove excess moisture on its surface, the amount of moisture absorbed is calculated using an electronic balance (adjusted to two decimal places) [7]. After that, the specimens were wrapped in aluminium foil to prevent moisture loss or pickup. The percent moisture uptake was calculated using the formula below:

$$w_e(t) = 100 \times (w_t - w_0) / w_0,$$

Where, w_e is water absorption percentage, w_t is weight after time t , and w_0 is the initial weight of the sample

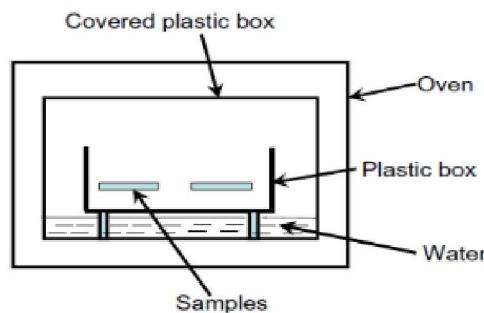
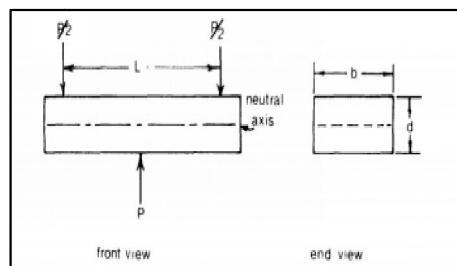


Figure 2: Thermal Treatment Setup

To get the result for large range of temperatures, finite element analysis has been performed on test specimen in ANSYS 19.

V. PREDICTION OF BEHAVIOUR UNDER THERMAL LOADING



ANSYS 19 was used to simulate tensile testing. The test speed for ASTM D3039 can be determined based on the material. 2 mm/min (0.05 in/min) is a common test speed for standard test specimens.

Extensometers and strain gauges can be used to determine elongation. The rules of mixture are used to calculate the Young's modulus.

$$E_c = E_f V_f + E_m V_m$$

Where,

E_f is the Young's modulus of the fiber, E_c is the Young's modulus of the composite along the fiber direction, E_m is the Young's modulus of the matrix, V_m is matrix volume fraction and V_f is fiber volume fraction. The above fig 3 shows the behavior of composite under tensile loading at various temperatures.

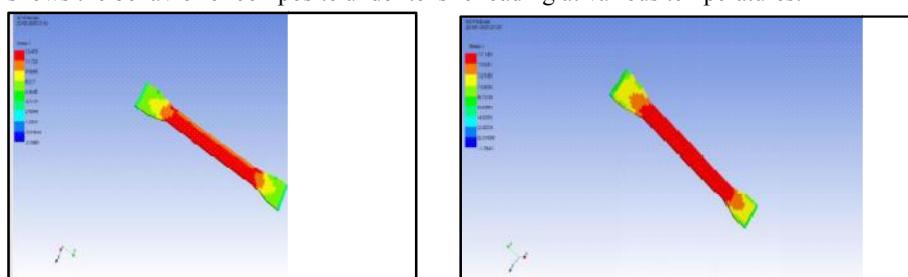


Figure 3: Tensile Test Performed

A bend test is used to determine a material's ductility, bend strength, and fracture resistance. The qualities listed above can be used to predict how a material will behave when subjected to a heavy load for construction purposes. If a material fails to function in a bending test, it is assumed that it will fail catastrophically in real-world applications under similar conditions. Flexural strength is measured using three-point bending tests.

The flexural stress Q_f can be calculated by

$$Q_f = \frac{3FL}{2bh^2}$$

Where,

Q_f is the flexural stress, (MPa);

Q_f is the flexural stress, (MPa);

F is the load in newton's (N);

L is the span, in millimeters (mm);

h is the thickness of the specimen, (mm);

b is the width of the specimen, in millimeter (mm).

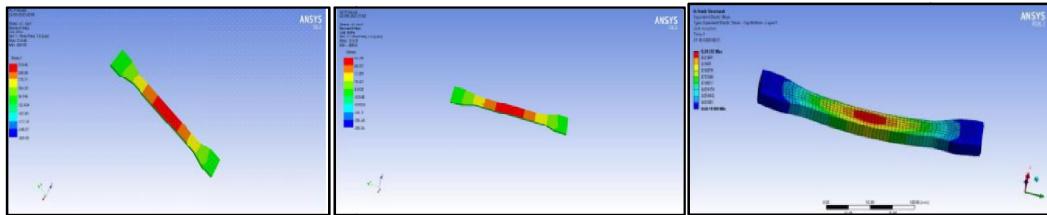


Figure 5: Bend Test Performed

The above figures depict the behaviour of the composite under bending conditions, as well as its deformation pattern.

VI. RESULTS

From the result it has been observed that by adding the natural fiber, tensile properties of neat epoxy-based composite have been improved.

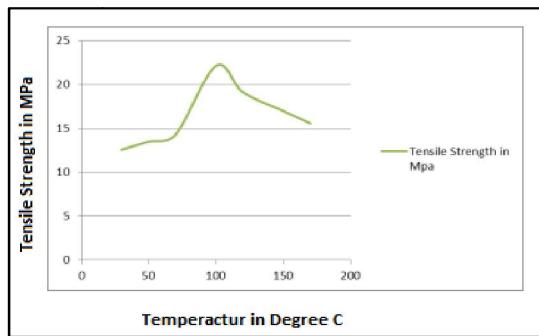


Figure 7: Behaviour of Hybrid Composite during Tensile Test

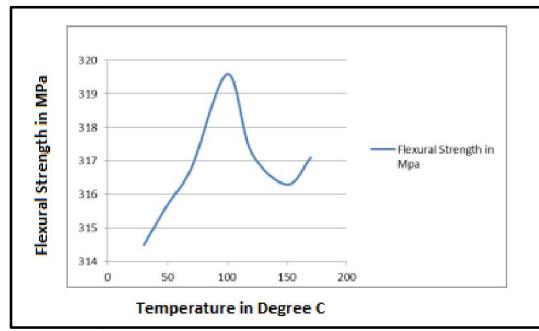


Figure 8: Behavior of Hybrid Composite

The flexural strength of the produced composites increased with increasing temperature until it reached 100°C , after which it decreased. Above this temperature, the matrix material softens, and the tensile strength decreases. In Figure 8, the flexural strength of the produced composites shows a rise in flexural strength with increasing temperature up to 100°C , then declines with increasing temperature. When compared to the jute fibre composite shown in Figure 9, the hybrid composites had a greater thermal performance. In comparison to jute fibre reinforced composite, hybrid composite has better flexural properties.

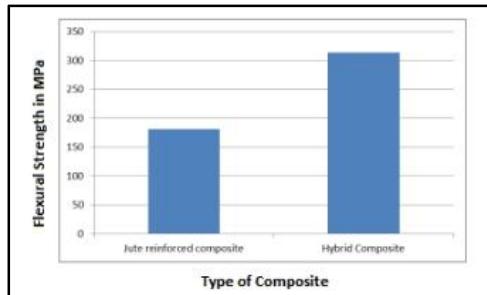


Figure 9: Comparison of Flexural Strength

VII. CONCLUSION

The goal of this research was to anticipate the behaviour of natural fibre composites under combined thermal, tensile, and bending stress. It has been discovered that the advantages of composite materials over conventional materials are mostly due to their higher specific strength, stiffness, and fatigue properties, which boost the usage of natural fibres in structural applications.

Because natural fibres were included into the polymer and bamboo fibre qualities were added, the flexural properties of the hybrid composites improved. The best strength of composites is reached at 100°C, but flexural strength plummets beyond 1000°C. In comparison to a jute fibre reinforced polymer composite, the hybrid composite has better flexural characteristics

REFERENCES

- [1] Huang J-K, Young W-B, The mechanical, hygral, and interfacial strength of continuous bamboo fiber reinforced epoxy composites, Composites Part B, doi: <https://doi.org/10.1016/j.compositesb.2018.12.013>.
- [2] Paresh V. Sawai, Abhijit R. Deshpande, and Kiran S. WangikarEffect of Hygrothermal Environment on the Tensile Properties of Banana Fiber Epoxy Composites International Engineering Research Journal Page No 1620-1625.
- [3] Deepa.A, Padmanabhan.K, Raghunadh.G," Effect of Hygrothermal Loading on LaminateComposites", Proceedings of the 2nd International Conference on Design, Analysis, Manufacturing and Simulation (ICDAMS-2016), April 07&08, 2016.
- [4] C.M. Meenakshi, Jeeva Bharathi, S Karthikeyan, "Experimental Work on the Effect of Hygrothermal Environment on the Mechanical Behaviour of Natural Fiber Reinforced Epoxy Composites", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-8, Issue-6S2, August 2019.
- [5] J. P. Komorowski. "Hygrother Mal Effects in Cont1Nuous FibreReinforCedcomposites" National Aeronautical Establishment Scientific and Technical Publications.
- [6] Manjunath Shettar, AakarshitaChaudhary, Zaid Hussain1, U. AchuthaKini and Sathyashankara Sharma, Hygrothermal Studies on GFRP Composites: A Review MATEC Web of Conferences 144, 02026 (2018) RiMES2017, <https://doi.org/10.1051/matecconf/201814402026>
- [7] NorizzatiZulkafli, SivakumarDhar Maligam, SitiHajar Sheikh Md Fadzullah, Zaleha Mustafa, KamarulAriffin Zakaria1 &SivaraoSubramonian, Mechanical Properties Of Cross-Ply Banana-Glass Fibre Reinforced Polypropylene Composites Defence S and T Technical Bulletin · March 2019 Research Gate.
- [8] Rui-Hua Hu a,b, Min-young Sun c, Jae-Kyoo Lim a,* Moisture absorption, tensile strength and microstructure evolution of short jute fiber/polylactide composite in hygrothermal environment Materials and Design 31 (2010) 3167–3173 Elsevier Ltd. All rights reserved.
- [9] Amirhossein Lotfi, Huaizhong Li, Dzung Viet Dao and Gangadhara Prusty, Natural fiber-reinforced composites: A review on material, manufacturing, and machinability Journal of Thermoplastic Composite Materials 1–47.

- [10] Yan Yu Hankun, Wang Fang Lu, Genlin Tian, Jinguo Lin, Bamboo fibers for composite applications: a mechanical and morphological investigation J Mater Sci (2014) 49:2559–2566 Springer DOI 10.1007/s10853-013-7951-z
- [11] O. A. Khondker, U. S. Ishiaku, A. Nakai and H. Hamada Tensile, flexural and impact properties of jute fibre-based thermosetting composites ISSN: 1465-8011 (Print) 1743-2898 (Online) Journal homepage: <http://www.tandfonline.com/loi/yprc20>
- [12] R Yahaya, SM Sapuan, M Jawaid, Z Leman and ES Zainudin, Mechanical performance of woven kenaf-Kevlar hybrid composites Journal of Reinforced Plastics and Composites published online 7 November 2014
- [13] Jai InderPreet Singh, Sehijpal Singh & Vikas Dhawan, Effect of Curing Temperature on Mechanical Properties of Natural Fiber Reinforced Polymer Composites, ISSN: 1544-0478 (Print) 1544-046X (Online) Journal homepage: <http://www.tandfonline.com/loi/wjnf20>
- [14] Yan Yu Hankun Wang Fang Lu Genlin Tian, Jinguo Lin Bamboo fibers for composite applications: a mechanical and morphological 10 Books.
- [15] JORG MUSSIG, Industrial Applications of Natural Fibers, A John Wiley and Sons, Ltd., Publication.

Gesture Translator for Hard to Hearing and Tongue-Tied People

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Abstract: *Vocalize and Language is that the main obstacle for human to speak with the whole world. Thanks to hearing ability we are able to perceive thoughts of every different. Even today we are able to offer commands victimization voice recognition. However, what if one fully cannot hear something and eventually cannot speak. So, The Sign Language is that the main human action tool for hearing impaired and mute folks, associate degree additionally to make sure a freelance life for them, the automated interpretation of linguistic communication is an in-depth analysis space. With the utilization of image process and artificial intelligence, several techniques and algorithms have been developed during this space. Each linguistic communication recognition system is trained for recognizing the signs and changing them into needed pattern. The projected system aims to produce speech to unarticulated, during this paper the double two-handed Indian linguistic communication is captured as a series of pictures and it's processed with the assistance of Python so it's born-again to speech and text.*

Keywords: Machine Learning, Convolutional Neural Networks (CNN), Sign Language, Communication, etc.

I. INTRODUCTION

Gesture languages square measure authentic on wide and world level. There square measure multiple sign languages in world that square measure regular in use that square measure ASL (American Sign Language) ISL (Indian Sign Language), BSL (Bangla Sign Language), MSL (Malaysian Sign Language). These languages square measure engineered and developed with innumerable work and sensible testing with intention of practicability to the deaf and dumb persons. Any language is made with its word and it's that means. Sign Language is made as 'Sign' and 'Action of That Sign'. Because here we tend to don't seem to be ready to create them perceive that means of sign by writing word. As they're deaf and might not listen from birth therefore we are able to not teach them words.

In linguistic terms, sign languages square measure as made and complicated as any voice communication, despite the common idea that they're not "real languages". Skilled linguists have studied several sign languages and located that they exhibit the elemental properties that exist altogether languages. American language is natural and complete language as it uses hands movements and facial expression for communication purpose. Mainly North American people who are having difficulties for communication due to their hard of hearing fact used this language.

All the more for the most part, both sign and communicated in dialects share the qualities that etymologists have found in all characteristic human dialects, for example, temporariness, semanticist, assertion, profitability, and social transmission. and non-manual articulation. All the more for the most part, both sign and communicated in dialects share the qualities that etymologists have found in all characteristic human dialects, for example, temporariness, semanticist, assertion, profitability, and social transmission.

II. LITERATURE SURVEY

Here we present the literature review of existing techniques:

In Paper [1], Sign language is physical communiqué for contributing the meaning instead of the use of voice to demonstrate communicator's opinion. This paper introduces a simple and green set of rules for function extraction to recognize American Sign Language alphabets from both static and dynamic gestures. The proposed algorithm contains of 4 special techniques: Number of white pixels at the threshold of the picture (NwE), peculiarities. For example, the head margin in Finger period from the centroid point (Fcen), Angles between fingers (AngF) and Differences of angles among hands of the first and remaining frame (delAng). After extracting capabilities from video images, an Artificial Neural Network (ANN) is used to classify the signs.

In paper [2], This paper proposes a novel sign language learning method which employs region of interest (ROI) segmentation pre-processing of input data through an object detection network. As the input, 2D image frames are sampled and concatenated into a wide image. From the image, ROI is segmented by detecting and extracting the area of hands, crucial information in sign language. The hand area detection process is implemented with a well-known object detection network, you only look once (YOLO) and the sign language learning is implemented with a convolutional neural network (CNN). 12 sign gestures are tested through a 2D camera.

In paper [3], Sign language is a type of language that uses manual communication to convey meaningful messages to other people. They proposed a system called Dynamic tool for American Sign Language (ASL) finger spelling interpreter which can consistently classify the letters a-z. The dataset consists of a set of American Sign Language videos.

In paper [4], author introduce a hand sign language recognition framework is proposed for various Bangla alphabets using Artificial Neural Network (ANN). For that, initially the input image is normalized and the skin area is extracted on the basis of the YCb Cr values corresponding to human skin color. The extracted area i.e., hand sign area is converted into a binary image and the gaps in the binary hand sign area are filled through the morphological operations. After that, the boundary edge of the hand sign area is extracted through the canny edge detector and extracts the hand sign region of interest (ROI). Finally, features are extracted from the hand sign ROI using Freeman Chain Code (FCC). The ANN is used for training and classifies the hand sign images. The proposed method is tested using various hand sign images and results are presented to demonstrate the efficiency and effectiveness.

In paper [5], Any hand gesture can be represented by sets of feature vectors that change over time. Recurrent Neural (RNNs) are suited to analyse this type of sets thanks to their ability to model the long-term contextual information of temporal sequences. In this paper, RNN is trained by using as features the angles formed by the finger bones of the human hands. The selected features, acquired by a Leap Motion Controller (LMC) sensor, are chosen because the majority of human hand gestures produce joint movements that generate truly characteristic corners. The proposed method, including the effectiveness of the selected angles, was initially tested by creating a very challenging dataset composed by a large number of gestures defined by the American Sign Language (ASL).

In paper [6], author has shown 38 Bangla Sign detection using SIFT and CNN, and used classification techniques like SVM/ANN. They have taken all training and testing images in fixed illumination, but cannot detect two handed gestures.

In paper [7], author proposed accuracy of optimum distance of Kinect Sensor to recognize the Thai finger-spelling and there are 16 gestures were done. This system is strong and small amount of calculation to detect the signer's hand in the complex background.

In paper [8], they searched for the edge detection pre-processing and Skin detection pre-processing. And Edge detection gives more accuracy than skin detection.

In paper [9], author proposed a sentence-based sign language recognition system based on motion data. System uses KNN solution and HMMs.

In paper [10], author proposed a tool which will provide communication opportunity for common people to

understand mode of communication. They used CNN classifier and proposed a tool that will capture the ASL gestures made by deaf and dumb people in real time and classify those gestures into text and voice.

III. PROPOSED METHODOLOGY

We are offering a gadget with a view to use gadget learning set of rules i.e., CNN Convolutional Neural Network. Our planned version can be educated with round 100-500 snap shots of and with growing epoch as a way to increase accuracy. The reason we are the use of CNN is it has a couple of layers as a result it will help into schooling model with smooth manner. We will use Open Computer Vis ion Technology concurrently to interact with digicam, to take stay input from camera. We will set and dene different symptoms with photos and those pictures could be trained with set of rules. Person can have to carry out register in front of camera. After taking live enter from camera the sign might be recognized. Recognized sign will supply textual content output and it will be translated to audio sound. So, system will work as Sign to Speech.

A random man or woman if visited to deaf person and if deaf character is in problem and looking to explain it then it's far very difficult to recognize what exactly he is trying to say. Delay in detecting his Sign language can turn into big critical trouble for that deaf character. This kind of people can't spend everyday life. They face communication issues at every point. Also, they get limitations and limitations to their desires and expert aims. Hence, they get demotivated and Inferiority Complex. This machine will definitely can grow to be step into innovation of this global degree hassle solution.

Our device can be prototype and proof of concept for global stage solution. This machine can be used by Deaf and Dumb persons and also regular person can have this machine with them and deaf character can carry out register the front of camera and signal can be transformed to txt or speech. Objective is to provide them capability to be expressive in thoughts and thoughts. They can get helped in increasing their motivation and condense and it will help them to suppose definitely and to overcome that bodily disability. To develop gadget with the usage of trendy technologies and tools we're keeping objective to conquer from this worldwide level trouble.

A. Architecture

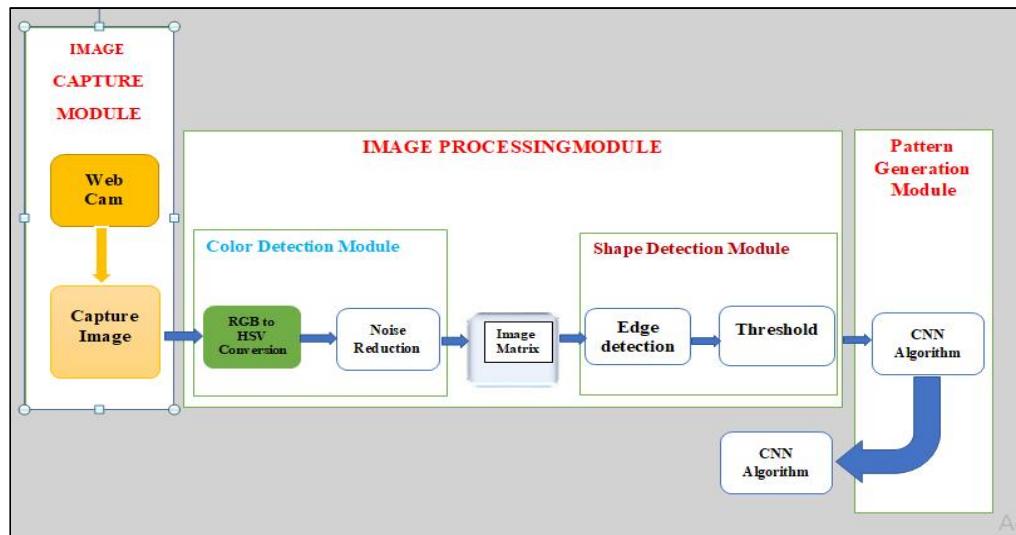
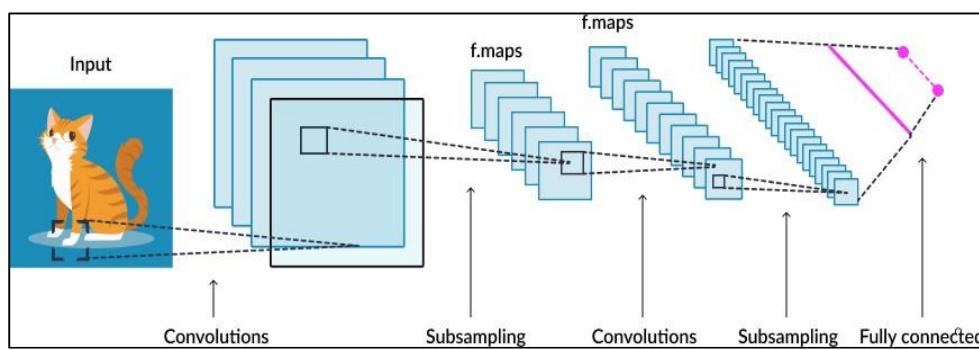


Figure 1: Proposed Architecture

B. Algorithms


Figure 2: CNN Model

Therefore, applying features from a specific layer only to classification seems to be a process that does not utilize learned CNN's potential discriminative power to its full extent. This inherent property leads to the need for fusion of features from multiple layers. To address this information to predict an image correctly. In some cases, features from the lower layer carry more discriminative power than those problem, we propose a method of combining features from multiple layers in given CNN models.

Moreover, already learned CNN models with from the top layer of the CNN are utilized for classification; however, those features may not contain enough useful training images are reused to extract features from multiple layers. Convolutional neural networks (CNN) have been widely used in automatic image classification systems. In most cases, features the proposed fusion method is evaluated according to image classification benchmark data sets, CIFAR-10, NORB, and SVHN. In all cases, we show that the proposed method improves the reported performances of the existing models by 0.38, 3.22 and 0.13, respectively.

Proposed System Algorithm having following steps –

1. To create image data set, sign images are captured in threshold form to get exact sign shape.
2. 2000 images per sign hence 10,000 images for 5 signs.
3. Threshold converts image RGB to black and white color only.
4. Then we get exact shape of hand.
5. Then we define CNN model and add layers in it.
6. Split data into testing as 20% images and training 80% images, then train model.
7. Trained model is then saved.
8. The model loaded and through webcam we send input to model and model predicts it's sign on camera screen.
9. To hear the predicted text, we "C" button.
10. On pressing "C" we can hear the sign text.

IV. RESULT AND DISCUSSIONS

Table 1: Comparison of Accuracy

Comparison of Convolutional Neural Network Algorithm with Artificial Neural Network algorithm for Accuracy	
Algorithm	Accuracy
Convolutional Neural Network algorithm (CNN)	98%
Artificial Neural Network algorithm (ANN)	88%

V. CONCLUSIONS AND FUTURE SCOPE

The proposed device intention to offer speech to speechless, on this paper the double surpassed Indian Sign Language is captured as a series of pictures and it is processed with the help of Python and then it is converted to speech and text. With the help of photo processing and Artificial Intelligence, many techniques and algorithms were developed in this area. Every sign language recognition device is skilled for spotting the signs and converting them into required pattern.

This proposed device is only able to detect hand gesture and not whole-body gesture. There are many improvements to be made into this device. Currently it can't be able to detect whole body gesture so in future we can extend this project. Already CNN algorithm is popular algorithm in image processing system and it will definitely make huge impact on Indian Sign Language.

REFERENCES

- [1] "A Novel Feature Extraction for American Sign Language Recognition" Ariya Thongtawee, Onamon Pinsanoh, Yuttana Kitjaidure 2018 Bio medical Engineering International Conference (BMEiCON-2018).
- [2] "An effective sign language learning with object classification using ROI" Sun mok Kim, Yangho Ji, and Ki-Baek Lee 2018 Second IEEE International Conference on Robotic Computing.
- [3] "Dynamic Tool for A merican Sign Language" Prateek SG Jagadeesh J International Conference on Advances in Co mputing, Co mmun ication Control and Networking (ICACCCN2018).
- [4] "Hand Sign Language Recognition for Bangla A lphabet Based and ANN" Proceedings of the 2017 4th International Conference on Advances in Electrical Engineering 28-30 September, 2017, Dhaka, Bangladesh Mohammad Mahadi Hasan, Md. Khaliluzzaman, Shabiba Akhtar Himel and Rukhsat Tasneem Chowdhury.
- [5] Exploiting Recurrent Neural Networks and Leap Motion Controller for the Recognition of Sign Language and Semaphoric Hand Gestures" Danilo Avola, Member, IEEE, Marco Bernardi, Student Member, IEEE, Luigi Cinque, Senior Member, IEEE, Gian Luca Foresti, Senior Member, IEEE, and Cristiano Massaroni, Student Member, IEEE, 2018.
- [6] Bangla Sign Detection using SIFT and CNN", Shirin Shanta, Saif Taifur Anwar, Md. Rayhanul Kabir, IEEE, 9th ICCCNT 2018.
- [7] Reliability and Accuracy of Thai Sign Language Recognition with Kinect Sensor", Chana Chansri, Jakkree Srinonchat 2016 IEEE.
- [8] The Comparison of Some Hidden Markov Models for Sign Language Recognition" Suharjito, Herman Gunawan, Narada Thiracitta, Gunawan Witjaksono, The 1st 2018 INAPR International Conference.
- [9] "User-dependent Sign Language Recognition Using Motion Detection", Mohamed Hassan, Khaled Assaleh, Tamer Shanableh, 2016 International Conference on Computational Science and Computational Intelligence.
- [10] Dynamic Toll for American Sign Language Finger Spelling Interpreter, Prateek S G, Siddarth R, P. G. Sunitha Hiremath, Jagdeesh J, Smitha Y, Neha Tarannum, International Conference on Advances in Computing, Communication Control and Networking (ICACCCN2018), 2018 IEEE.

Battery Technology of an Electric Vehicles

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Abstract: Rising prices of fuel and dependency on exportation is big challenge to India. Electric vehicles not only reduce the dependency on fossil fuel but also diminish the impact of ozone depleting substances and promote large scale renewable deployment. India has potential to sell electric vehicles in large number to curb the menaces of degrading air quality index. Electric vehicles are becoming popular due to less movable parts, eco-friendly and ease of maintenance. The paper provides an overview of the studies of battery of Electric Vehicle, state of health and battery safety.

Keywords: Electric Vehicle, Battery Management System, Electric Motors, Li-ion Battery, SOC, DOD SOH DOE, HEV, BEV, etc.

I. INTRODUCTION

Technology facilitates humans, improves productivity and leads to a better quality of life. Electrification is the most viable way to achieve clean and efficient transportation that is crucial to the sustainable development of the whole world. In the near future, electric vehicles (EVs) including hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), and pure battery electric vehicles (BEVs) will dominate the clean vehicle market EV batteries are quite different from those used in consumer electronic devices such as laptops and cell phones. They are required to handle high power (up to a hundred kW) and high energy capacity (up to tens of kWh) within a limited space and weight and at an affordable price.

Extensive research efforts and investments have been given to the advanced battery technologies that are suitable for EVs all over the world. The U.S. government has been strongly supporting its R&D activities in advanced batteries through the Department of Energy (DOE): about \$2 billion grants to accelerate the manufacturing and development of the next generation of U.S. batteries and EVs.

European Commission and governmental organizations in Europe and Japanese Ministry of Economy, Trade and Industry (METI) have also been continuously supporting the R&D activities in advanced batteries. BYD, Lishen, and Chunlan have obtained strong subsidy supports from the Chinese government for its research and manufacturing of advanced batteries and electric vehicles.

II. HISTORY OF EV

In the early years of 1900s, there was a golden period of EVs. At that time, the number of EVs was almost double that of gasoline power cars. However, EVs almost disappeared and gave the whole market to internal combustion engine (ICE) cars by 1920 due to the limitations of heavy weight, short trip range, long charging time, and poor durability of batteries at that time.

EV batteries are quite different from those used in consumer electronic devices such as laptops and cell phones. They are required to handle high power (up to a hundred kW) and high energy capacity (up to tens of kWh) within a limited space and weight and at an affordable price the current two major battery technologies used in EVs are nickel metal hydride (NiMH) and lithium ion (Li-ion).

Nearly all HEVs available in the market today use NiMH batteries because of its mature technology. Due to the potential of obtaining higher specific energy and energy density, the adoption of Li-ion batteries is expected to grow fast in EVs, particularly in PHEVs and BEVs. It should be noted that there are several types of Li-ion batteries based on similar but certainly different chemistry.

III. BASIC TERMS OF BATTERY PERFORMANCE AND CHARACTERIZATION

Table 2.1 Batteries used in electric vehicles of selected car manufacturers.

Company	Country	Vehicle model	Battery technology
GM	USA	Chevy-Volt	Li-ion
		Saturn Vue Hybrid	NiMH
Ford	USA	Escape, Fusion, MKZ HEV	NiMH
		Escape PHEV	Li-ion
Toyota	Japan	Prius, Lexus	NiMH
Honda	Japan	Civic, Insight	NiMH
Hyundai	South Korea	Sonata	Lithium polymer
Chrysler	USA	Chrysler 200C EV	Li-ion
BMW	Germany	X6	NiMH
		Mini E (2012)	Li-ion
BYD	China	E6	Li-ion
Daimler Benz	Germany	ML450, S400	NiMH
		Smart EV (2010)	Li-ion
Mitsubishi	Japan	iMiEV (2010)	Li-ion
Nissan	Japan	Altima	NiMH
		Leaf EV (2010)	Li-ion
Tesla	USA	Roadster (2009)	Li-ion
Think	Norway	Think EV	Li-ion, Sodium/Metal Chloride

Various terms have been defined for batteries to characterize their performance. Commonly used terms are summarized in the following as a quick reference. Cell, Module, and Pack. A single cell is a complete battery with two current leads and separate compartment holding electrodes, separator, and electrolyte. A module is composed of a few cells either by physical attachment or by welding in between cells.

A pack of batteries is composed of modules and placed in a single containing for thermal management. An EV may have more than one pack of battery situated in a different location in the car. Ampere-hour Capacity. Ampere-hour (Ah) capacity is the total charge that can be discharged from a fully charged battery under specified conditions. The Rated Ah capacity is the nominal capacity of a fully charged new battery under the conditions predefined by the manufacturer. A nominal condition, for example, can be defined as 20_C and discharging at 1/20 C-rate. People also use Wh (or kWh) capacity to represent a battery capacity. The rated Wh capacity is defined as Rated Wh Capacity = Rated Ah Capacity X Rated Battery.

Voltage: State of Charge (SOC). SOC is defined as the remaining capacity of a battery and it is affected by its operating conditions such as load current and temperature. SOC $\frac{1}{4}$ Remaining Capacity Rated Capacity: Depth of Discharge (DOD). DOD is used to indicate the percentage of the total battery capacity that has been discharged. For deep-cycle batteries, they can be discharged to 80% or higher of DOD. DOD= 1- SOC: State of Health (SOH). SOH can be defined as the ratio of the maximum charge capacity of an aged battery to the maximum charge capacity when the battery was new [7]. SOH is an important parameter for indicating the degree of performance degradation of a battery and for estimating the battery remaining lifetime. SOH = Aged Energy Capacity / Rated Energy Capacity.

IV. LITERATURE REVIEW

The focus of the paper is to cover for the art of batteries to be able to handle random charging due to regenerative braking., the braking power of regenerative braking can be at the level of hundred kilowatts. Safety limitation has to be applied to guarantee the safe operation of batteries. Mechanical braking is usually used to aid regenerative braking in EVs as a supplementary and safe measure. This paper contributes to the current state-of-the-art by providing a holistic review of EV charging system Most of the recent papers address these issues separately and they focus on technological innovations.

Therefore, this paper tries to gather the conceptual frameworks with the practical aspects by illustrating the main architecture concepts and compiling the outcomes of some of the latest research about Battery technologies, including their applications, advantages and limitations. The success of EVs will be highly dependent on whether charging stations can be built for easy access. This is also critical for the potential grid supports that EVs can

provide. The first place considered for charging stations should be homes and workplaces. Other potential locations with high populations include gas stations, shopping centers, restaurants, entertaining places, highway rest areas, municipal facilities, and schools.

Table 4.1: Standards related to electric vehicle charging

Standard	Title/description
SAE J2293	Energy Transfer System for Electric Vehicles
SAE J2836	Recommended Practice for Communication between Plug-in Vehicles and Utility Grid
SAE J1772	Electric Vehicle Conductive Charge Coupler
SAE J1773	Electric Vehicle Inductively Coupled Charging
IEEE 1547.3	Interconnecting Distributed Resources with Electric Power Systems

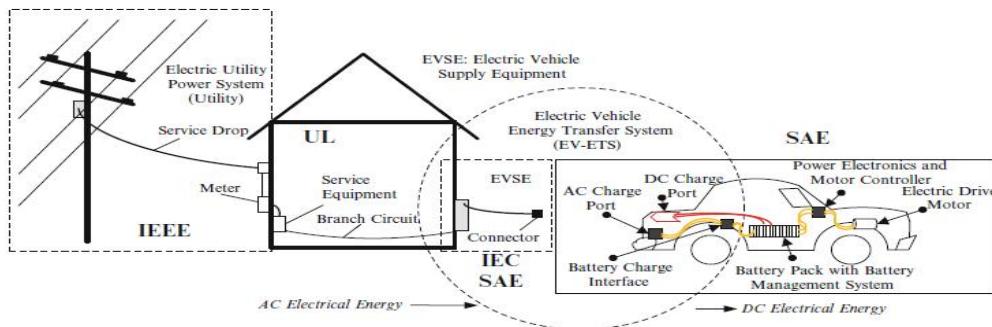


Figure 4.1: Electric vehicle energy transfer system applicable standards. Modified from

V. CONCLUSION AND RESEARCH DIRECTIONS

Extensive research has been carried out on battery modeling and a variety of models have been developed from different aspects and for different purposes. It would be desirable to have a comprehensive, unified electrical model that is developed based on physical properties of battery cells. The model should have the capability to estimate SOC and SOH accurately. A conceptual, unified model with Main circuit, thermodynamic, SOC, and SOH sub-models.

REFERENCES

- [1] Howell D (2010) Annual progress report for energy storage R&D, Vehicle Technologies Program, Energy Efficiency and Renewable Energy. U.S. Department of Energy, Washington, DC.
- [2] Boulanger AG, Chu AC, Maxx S, Waltz DL (2011) Vehicle electrification: status and issues. Proc IEEE 99(6):1116–1138.
- [3] Xu X, Wang C, Liao G, Yeh CP, Stark W (2009) Development of a plug-in hybrid electric vehicle educational demonstration unit. In: Proceedings of 2009 North American power symposium, Starkville, MS, USA, 4–6 Oct 2009.
- [4] Corrigan D, Masias A (2011) Batteries for electric and hybrid vehicles. In: Reddy TB (ed) Linden's handbook of batteries, 4th edn. McGraw Hill, New York.
- [5] Ehsani M, Gao Y, Emadi A (2010) Modern electric, hybrid electric, and fuel cell vehicles: fundamentals, theory and design, 2nd edn. CRC, London.
- [6] USABC (1996) Electric vehicle battery test procedures manual. http://avt.inl.gov/battery/pdf/usabc_manual_rev2.pdf
- [7] Coleman M, Hurley WG, Lee CK (2008) An improved battery characterization method using a two-pulse

- load test. IEEE Trans EC 23(2):708–713.
- [8] Dhameja S (2002) Electric vehicle battery systems. Newnes, Boston
 - [9] Pokrzywa J (2010) SAE Taipei: SAE ground vehicle standards SmartGrid. <http://sae-taipei.org.tw/image/1283265726.pdf>
 - [10] Rocky Mountain Institute (2008) Smart garage Charrette pre-read v2.0. <http://move.rmi.org/files/smартgarage/Theory 2021, 107, 102210>.

Predictive Algorithms for Equity Market

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Abstract: The stock markets all over world have many uncertainties which contain a large amount of data with jumps, noises, and movements leading to the highly non-stationary time series. Here, we introduce real-time financial signal representation and trading techniques as RDNN (Recurrent Deep Neural Network) for the environment sensing and recurrent decision making for the online financial asset trading. In which the RDNN have two parts, first one is DNN (Deep neural network) function of this DNN is feature learning and the second one is RNN (Recurrent Neural Networks) to predict rapidly changing market condition. This proposed model based on two biological related learning concepts such as Reinforcement Learning (RL) and Deep Learning and DL (Deep Learning) is used to represent financial signals and self-taught reinforcement trading. Here, RL is used to interact with deep representations and makes trading decisions to accumulate the ultimate rewards in an unknown environment. It improves the robustness of market summarization using fuzzy learning concepts it reduces the uncertainty of input data. Here, used K-Means for making data static and labeled data, so it makes easy for the MLP to predict the result. Fuzzy MLP will be used to provide the prediction of stock market.

Keywords: Deep Neural Network, Direct reinforcement Learning, Fuzzy logic, Multilayer Perceptron Model, Equity Market.

I. INTRODUCTION

Real-time health data collection is very common nowadays. This data is processed by various signal processing and machine learning algorithms. The procedure of mining and reasoning are similar in different applications. Researchers and engineers working with real-time signals perform similar preprocessing and processing steps prior to derivation. The collected data can be used to get real-time offline multiple results of the condition of the patient [2]. However, the use of health parameters is very limited, due to the processing of the network requirements of the infrastructure. The real health app requires real-time analysis of high-resolution sensor data, data from other sources as well as data from many users at the same time and local processing of all the data on a single computer can be achieved by calculation constraints, reliability, recovery scalability, fault/power supply problems, etc. which is not practical.

Recently, there has been a great interest in optimizing algorithms and increasing the efficiency of the system through system implementation [3]. But these methods only suggest a solution to a particular problem. They include design decisions that are difficult to generalize due to certain assumptions in the problem. The application of these challenges requires the implementation of a dependent machining platform efficient enough to work under real-world hardware and software constraints. This work and the construction of this problem will solve the intelligent distribution of the computational load.

The analysis of health data generally involves comparing pre-defined basis with extracted parameters. Symptoms can be detected when the readings are higher or lower than the threshold. Early detection of symptoms of heart failure can support the prediction of heart failure stroke and so they can be avoided. Therefore, the most important task is to define the "Accurate" threshold. The accuracy of the analysis depends strongly on the accuracy of the threshold used.

The cardiologist defines and updates the thresholds based on the measurements of the patient and the conducted interview with the patient [4]. In fact, cardiologists confirm that the values of the thresholds are not the same for all patients and can vary even for the same patients. As a result, there are 2 goals for this work. Firstly, propose a

monitoring approach to remotely extract health parameters from patients suffering from heart failure will then define an analytical approach to automatically calculate and update the health threshold at the run time.

A smart home monitoring system for tracks vital signs in patients with CHF. The system collects vital signs (SpO₂, Electro Cardio Graph (ECG), Blood Pressure (BP), and Body Weight) and sends them to a hospital information system that is evaluated by a physician. The aim of this system is to reduce the number of face-to-face visits of each patient with help of CHF.

In this paper study about the Literature Review done, in section II, the Proposed Approach Modules Description, Mathematical Modeling, Algorithm and Experimental setup in section III .Finally we provide a conclusion in section IV.

II. LITERATURE REVIEW

Portfolio management is the process of making decisions about the constant redistribution of the Fund amount in a number of different financial investment products in order to maximize profits while limiting risk. Traditional methods of portfolio management can be divided into four categories: “follow the winner”, “follow the loser”, “pattern matching” and “meta-learning” [1]. The first two categories are based on previously built financial models, although some machine learning techniques for parameter determination may also help. The effectiveness of these methods depends on the reliability of the models in different markets. The Pattern- Matching algorithms predict the next market distribution based on a sample of historical data and explicitly optimize the portfolio based on a sample distribution. The last class, the method of “meta-learning”, combines several strategies of other categories to achieve more consistent work [2].

There are deep machine learning approaches to trading financial markets. However, many of them try to predict price movements or trends [3]. A history of prices the neural network can output the predicted vector of asset prices from all assets as input data for the next period. Then the sales agent can act on this forecast. This idea easy to implement because it is supervised learning, or more specifically regression problem. However, the performance of these algorithms is based on price forecasting, strongly depends on the degree of accuracy of the forecast, but it turns out that the future market prices are difficult to predict. In addition, price forecasts are not market actions, converting them into actions requires an additional layer of logic. If this layer is a manual code, then the whole approach is not fully machine learning, and thus not very open and adapted. For example, for a network-based prediction, it is difficult to consider the transaction value as a risk factor.

Previous successful attempts in Model-free and complete machine learning schemes for algorithmic trading problems without predicting future prices include this recent deep use by Moody and Sachel, denpster and Rayman, caming, and RL Deng et al. (2017). These RL algorithms output a separate trading signal to the asset. Limited to single asset trade, they do not apply to the general problem of portfolio management; where distributors manage multiple assets.

In this paper study about the Literature Review done, in section II, the Proposed Approach Modules Description, Mathematical Modeling, Algorithm and Experimental setup in section III .and at final we provide a Conclusion in section

III. PROPOSED APPROACH

Propose recurrent deep neural learning techniques for the real- time financial signal representation and trading and this technique based on the two biological related learning concepts Deep Learning (DL) and Reinforcement Learning (RL) it automatically senses dynamic marketing condition and provides a prediction for the market conditions.

3.1 Proposed System Overview

In this present techniques RDNN (Recurrent Deep Neural Network) Structure for the environment sensing and recurrent decision making for the online financial assert trading. In which the RDNN using a two parts DNN (Deep neural network) it is used for the feature learning and the second one is RNN (Recurrent Neural Networks)

for the RL (Reinforce Learning). Improve the robustness of market summarization using fuzzy learning concepts it reduces the uncertainty of input data.

The DDR trading system is using data of the real financial market for future contracts trading. In detail, we accumulate the historic prices of both the stock-index future (IF) and commodity futures. These real market data will be directly used for performance verifications. The deep RL system will be compared with other trading systems under diverse testing conditions. The comparisons show that the DDR system and its fuzzy extension are much robust to different market conditions and could make reliable profits on various future markets.

A. Read Dataset:

In this module, it read financial data. In this, we are used real word financial data such as stock index and commodity futures contracts.

B. Fuzzy Extensions:

In this module for data, uncertainty problem is considered. Financial sequences contain the high amount of unpredictable uncertainty due to the random gambling behind trading. Besides, a number of other factors, e.g., global economic atmosphere and some company rumors may also affect the direction of the financial signal in real time. Therefore, reducing the uncertainties in raw data is an important approach to increase the robustness for financial signal mining.

Membership functions of fuzzy sets are never unique. Different individuals might define various F A ' S for the same fuzzy set. For example, the membership function of a fuzzy TALL defined by an American for Americans would probably be different from that defined by an Oriental for Orientals.

Measures of fuzziness estimate the average ambiguity in fuzzy sets in some well-defined sense. We begin by considering properties that seem plausible for such a measure.

The fuzziness of a crisp set using any measure should be zero, as there is no ambiguity about whether an element belongs to the set or not. If a set is maximally ambiguous

($p \sim (z = 0.5 \vee x)$, then its fuzziness should be maximum. $H_E(A, P)$ is a measure associated with fuzzy set A and When a membership value approaches either 0 or 1, the ambiguity about belongingness of the argument in the fuzzy set decreases.

Extensions to Membership Functions on Real Intervals of the multiplicative and additive classes are easily extended to fuzzy sets on any real interval. Let A be a fuzzy subset of $X \subset R$. Then we define a measure of fuzziness (under the multiplicative class) for A as: $H(A) = K \int g(\mu_A(x))dx$

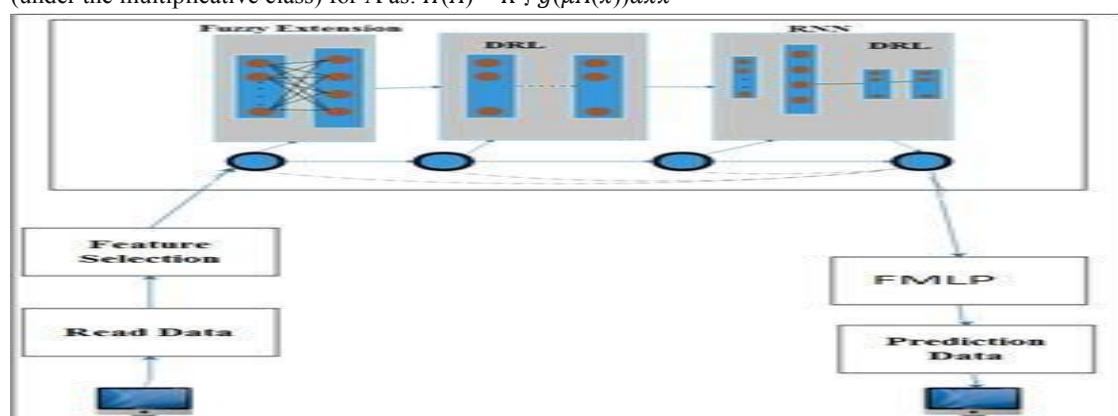


Figure 1. Proposed System Architecture

Where $K \in R^+$ is a constant and g is a continuous function whose form is defined in. H , reduces to H , at whenever X is discrete.

For the reducing uncertainty of data, we are using a mostly used artificial intelligent techniques fuzzy learning. In which is used input as linguist values. In it compare a real word data with the number of fuzzy-rough sets and then deriving corresponding fuzzy membership degrees. Fuzzy-rough sets are naturally defining according to basic

movements of stock price. Fuzzy sets are defined by increasing decreasing and no trend groups. The parameters in fuzzy membership function are predefined.

C. Direct Reinforcement Learning (DRL)

DRL (Direct Reinforcement Learning) is the review of the Moodys DRL frameworks and typical DRL is the one-layer RNN. In this we consider the P1, P2... Pn is the sequences released from exchange center. The return at time point t is determined by the $Z = Pt - Pt-1$ his value is based on the current market condition real-time trading decision policy.

The profit R_t made by the trading model is obtained by:

$$R_t = \delta t - Zt - C|\delta t - \delta t-1|$$

D. Recurrent Deep Neural Network (RDNN):

In this module, we are using practical learning strategy to train the DNN using two steps of system initialization and fine-tuning. For the learning of the DNN use three learning parts, First one is fuzzy representation part is it the easy process of initialization. In this only parameter are specified in the fuzzy center. Here K-means algorithms are applied for clustering and creating k classes of input data.

The parameter k is fixed as 3, because each input node is connected with three membership functions.

Algorithm

Algorithm 1: RNN Algorithm

Data: A set of sequence with their corresponding context Output: RNN optimized for generation

Initialize RNN at random and set NXENT , NXE+R and Δ ;

For s =T, 1, and $-\Delta$ do;

If s==T then;

Train RNN for NXENT epochs using XENT only;

Else;

Train RNN for NXE+R epochs;

Use XENT loss in the first s steps; and REINFORCE (Sampling from the model) in the remaining T –s steps;

End;

End;

Algorithm 2: K-Means Algorithm

Input the initial set of k cluster Centers C Set the threshold THmin

while k is not stable generate a new set of cluster centers $C\Theta$ by k-means or every cluster centers $C\Theta\lambda$

get the minimum relevance score: $\min(S_i)$

$Set \leftarrow Zp, D \rightarrow D$;

if the $\min(S_i) < THmin$

add a new cluster center: $k = k + 1$

go to while until k is steady.

Algorithm 3: Fuzzy Multi-Layer perceptron Model:

In Fuzzy MLP Algorithm, The concept of fuzziness is inherited from FRNN algorithm. In this algorithm it uses fuzzy logic to handle uncertainties. Clustering stock data into 3 clusters like Losser, Gainer, and Neutral. So it makes easy for MLP to handle data to recall error back propagation (EBP) training

If a submitted pattern provides an output far from desired value, the weights and thresholds are adjusted s.t. the current mean square classification error is reduced. The training is continued/repeated for all patterns until the training set provides an acceptable overall error. Usually the mapping error is computed over the full training set. EBP training is working in two stages:

1. The trained network operates feed-forward to obtain output of the network

2. The weight adjustment propagates backward from output layer through hidden layer toward input layer.
3. Error Back-Propagation Training Algorithm
4. Initialization of k means algorithm.
5. Use Fuzzy membership function to calculate Values of each record in dataset.
6. Given P training pairs { Z1,D1,Z2,D2,...,ZP,DP} where Zi is I*I, Di is K*I
7. The lth component of each Zi is of the value -1 since input vector are augmented.
8. Size J-1 of the hidden layer having output y is selected.
 - a. Jth component of y is -1, since hidden layer have also been augmented.
 - b. Y is (J * 1) and o is (k * 1)
 - c. In the following, q is training step and p is step counter within training cycle.
 - d. Choose $\eta > 0$, $E_{max} > 0$
 - e. Initialized weight at small random values, W is (k*j), V is (j*l),
 - f. Initialize counters and error: $q \leftarrow 1$, $p \leftarrow 1$, $E \leftarrow 0$
9. Find Error
10. Error signal vectors of both layers are computed.
11. Update weight

$$wkj \leftarrow wkj + \eta \delta ok yi ,$$

$$k = 1, \dots, k, j = 1, \dots, j$$

$$Vij \leftarrow Vij \eta \delta yj zj$$

$$jk = 1, \dots, j, i = 1, \dots, l$$

Go to step III, otherwise, go to step VIII

If $E < E_{max}$ the training is terminated, otherwise $E \leftarrow 0$, $p \leftarrow 1$

go to step iv for new training cycle.

Mathematical Model

Let S be system such that

S = Let s be the system such that

S = {I, P, O, Sc, Fc}

Where;

I = Input of system

P = Process in system O = Output of System

Sc = Success case of output of system

Fc = Failure case of output of system

I = {I1, I2...In};

Where;

I = Finance dataset

Process:

1. $P1 = \{I1\}$ // Read dataset

2. $P2 = \{P1\};$

Auto encoder:

$$\phi = X \rightarrow F$$

$$\Psi = X \rightarrow F$$

$$X = |(\phi, \Psi)X|^2$$

3. $P3 = \{P2\};$

Direct reinforcement learning:

$$\Pi: S \times A \rightarrow [0,1]$$

$$\Pi(a|s) = P(at = a \mid st)S$$

4. $P_4 = \{P_3\}$;

Recurrent neural Networks: n

$$T_i, Y_i = -Y_i + \sum_{j=1} w_{ij} \sigma(Y_j - \theta_j) + I_i(t)$$

5. $P_5 = \{P_4\}$;

Use fuzzy membership function

6. $P_6 = \{P_3, P_4, P_5\}$;

Prediction of finance data

$S_c = \{\text{When successfully prediction is given}\}$ $F_c = \{\text{When Prediction is Fails}\}$

IV. RESULTS AND DISCUSSION

4.1 Experimental Setup

Hardware and software of proposed system given below:

A. Software Technology

- a. Technology: Core Java
- b. Tools: JDK 1.8, Netbeans 8.0.2
- c. Operating System: Windows 7

B. Hardware Technology

- 1. Processor: 1.0 GHz
- 2. RAM: 1 GB
- 3. Hard Disk: 730 GB

4.2 Dataset

Here we use online dataset such as Yahoo finance historical database of S&P BSE SENSEX (BSESN). Time period: Last 5 years.

4.3 Expected Result

Table 1 shows that memory comparison between existing system RNN algorithm and proposed system MLP algorithm. Proposed algorithm required 20 bytes memory and existing system required 30 byte memory.

Algorithm	Memory in byte
RNN	30
MLP	20

Table 1: Memory Comparison of RNN and MLP Algorithm

Figure 2 shows that graph of memory comparison between existing system RNN algorithm and proposed system MLP algorithm. Result graph shows that the proposed system required less memory than the existing system.

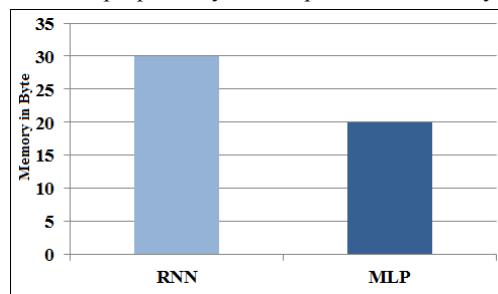


Fig 2: Memory Comparison Graph of RNN and MLP Algorithm

Table 2 shows that time comparison between existing system RNN algorithm and proposed system MLP algorithm. Proposed algorithm required less time as compared to existing system.

Algorithm	Time in ms
RNN	1800
MLP	1400

Table 2: Time Comparison of RNN and MLP Algorithm

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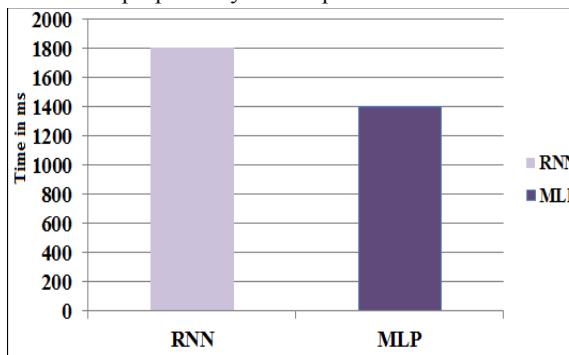


Fig 3: Time Comparison Graph of RNN and MLP Algorithm

Table 3 shows that comparison between existing system RNN algorithm and proposed system MLP algorithm. A proposed technique is more accurate than the existing techniques.

Algorithm	Accuracy in %
RNN	97
MLP	99

Table 3: Accuracy Comparison of RNN and MLP Algorithm

Figure 2 shows that graph of accuracy comparison between existing system RNN algorithm and proposed system MLP algorithm. Result graph shows that the proposed system is more accurate than the existing system

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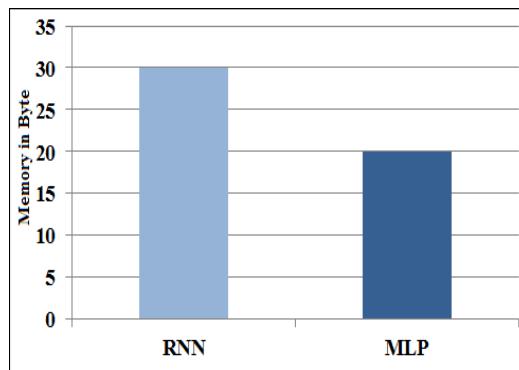


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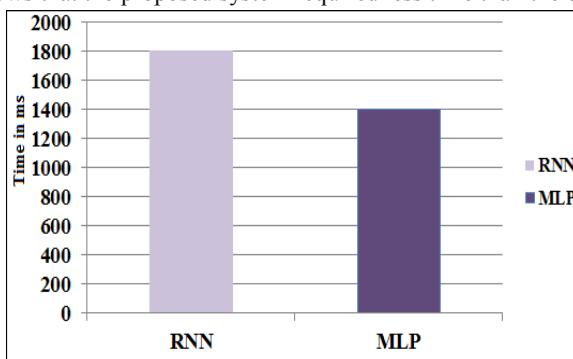


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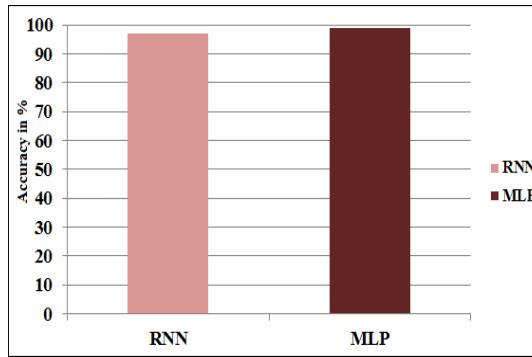


Fig 3: Accuracy Comparison Graph of RNN and MLP Algorithm

V. CONCLUSION AND FUTURE SCOPE

Here, we introduce RDNN techniques for the recurrent decision making for the online financial asset trading and environment sensing. This technique is made up two parts DNN and second one is RNN. It improves the robustness of market summarization by the use of fuzzy learning concepts, and it reduces the uncertainty of input data. The deep RL system will be compared with other trading systems under diverse testing conditions. The comparisons show that the DDR system and its fuzzy extension are much robust to different market conditions and could make reliable profits on various future markets. K-Means algorithm is used for the making data statics and labeled data, so it makes easy for the MLP to the predicted result. Fuzzy MLP is will be using to the predicted result. FRNN has some limitations like it takes long computation time because of complex calculations. So FRNN also provides lower accuracy while handling Uncertainties. FMLP overcomes both limitation of FRNN in computation time and accuracy of stock market prediction.

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REFERENCES

- [1]. D. Wierstra, J. Hunt and D. Silver “Continuous Control with Deep Reinforcement Learning”, arXiv-1509.02971v5, [2016].
- [2]. David Lu, “Agent Inspired Trading Using Recurrent Reinforcement Learning and LSTM Neural Networks”, arXiv: 1707.07338 [2016].
- [3]. James Cumming, “An investigation into the use of reinforcement learning technique within the algorithmic trading domain”; Knowledge Information System, Master’s thesis, Imperial College London, United Kingdom, [2015].
- [4]. Dongbin Zhao and Yuanheng Zhu, “MEC: A near-optimal online reinforcement learning algorithm for continuous deterministic systems”, IEEE Transaction on Neural Networks and Learning Sys., Vol-26, no-2, [2015].
- [5]. Volodymyr Mnih, Daan Wierstra and Shane Legg, “Human Level Control through Deep Reinforcement Learning”; Macmillan Publishers Limited, Vol- 5 1 8; Nature, [2015].
- [6]. Yue Deng, Risheng Liu, and Sanqing Hu, "Low-rank structure learning via nonconvex heuristic recovery"; IEEE Transaction on Neural Network and Learning System, Vol-24, no.-3, [2013].
- [7]. Alex Graves, Geoffrey Hinton and Abdel-rahman Mohamed, “Speech Recognition with Deep Recurrent Neural Network”; IEEE International Conference on Acoustics, Speech and Signal Processing, [2013].
- [8]. Yue Deng, Zengke Zhang, and Qionghai Dai, "Noisy depth map fusion for multiview stereo via matrix completion"; IEEE Journal of Selected Topics in Signal Processing, Vol-6, no.-5, [2012].
- [9]. George Dahl, Li Deng, and Dong Yu, “Context-dependent pre-trained deep neural networks for large-vocabulary speech recognition”; IEEE Transaction on Audio Speech and Language Processing, Vol:20, no.:1, [2012].

Survey on IOT Security and Privacy

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Abstract: This paper introduces Internet of Things (IoTs), which offers capabilities to identify and connect worldwide physical objects into a unified system. As a part of IoTs, serious concerns are raised over access of personal information pertaining to device and individual privacy. This survey summarizes the security threats and privacy concerns of IoT. This survey also tell us about the applications of IOT and what are the network system used in IOT and the intelligent system used in IOT.

Keywords: Internet of IOT Threats, Security, Privacy.

I. INTRODUCTION

With the rapid development of Internet technology and communications technology, our lives are gradually led into an imaginary space of virtual world. People can chat, work, shopping, keeps pets and plants in the virtual world provided by the network. However, human beings live in a real world, human activities cannot be fully implemented through the services in the imaginary space. It is the limitation of imaginary space that restricts the development of Internet to provide better services. To remove these constraints, a new technology is required to integrate imaginary space and real-world on a same platform which is called as Internet of Things (IoTs). Based on a large number of low-cost sensors and wireless communication, the sensor network technology puts forward new demands to the Internet technology. It will bring huge changes to the future society, change our way of life and business models.

Apart from benefits of IoTs, there are several security and privacy concerns at different layers viz; *Front end, Back end and Network*. In this paper, the survey is in several security and privacy concerns related to Internet of Things (IoTs) by defining some open challenges. Then, discussion on some applications of IoTs in real world.

Rest of the paper is organized as follows: Section 2 gives an overview, background and real life applications of IoTs. Security and privacy concerns in IoTs are discussed in Section 3. Section 4 concludes survey study with references at the end.

1.1 What is the Internet of Things?

As shown in Fig. 1, the IoTs allow people and things to be connected anytime, anywhere, with anything and anyone, ideally using any path/network and any service [1]. They are “Material objects connected to material objects in the Internet”.

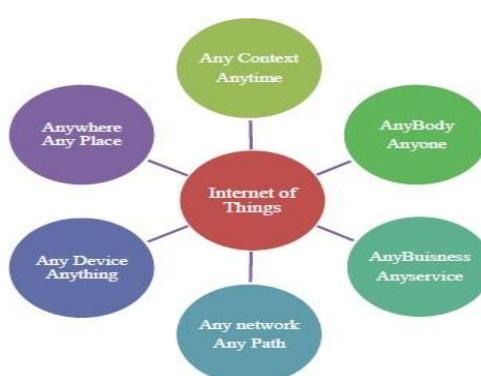


Fig 1.Defination of IOT

For example, through RFID, laser scanners, global writing system, infrared sensors and other information sensing devices are connected to any object for communication services and data exchange. At last, to reach the smart devices to be tracked, located, and monitored and to handle the network functions, to make the IT infrastructure and physical infrastructure consolidation IoT is the most needed one.

II. EVOLUTION

Before the investigation of the IoTs in depth, it is worthwhile to look at the evolution of the Internet. As shown in Fig. 2, in the late 1960s, communication between two computers was made possible through a computer network. In the early 1980s, the TCP/IP stack was introduced. Then, commercial use of the Internet started in the late 1980s. Later, the World Wide Web (WWW) became available in 1991 which made the Internet more popular and stimulate the rapid growth. Then, mobile devices connected to the Internet and formed the mobile-Internet. With the emergence of social networking, users started to become connected together over the Internet. The next step in the IoTs is where objects around us will be able to connect to each other (e.g. machine to machine) and communicate via internet.

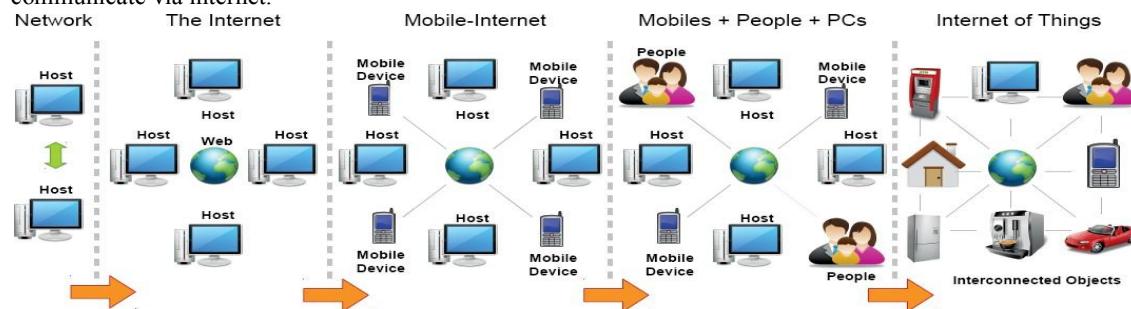


Fig 2. Evolution of Internet

III. ARCHITECTURE AND PROTOCOL STACK OF IOTS

IoTs can be divided into three important layers Viz; Perception, Network and Application. As shown in Fig.3, perception layer (also called as recognition layer) gathers data/information and identifies the physical world. Network layer is the middle one (also called as wireless sensor networks), which accountable for the initial processing of data, broadcasting of data, assortment and polymerization. The topmost application layer offers these overhauls for all industries. Among these layers, the middle one network layer is also a "Central Nervous System" that takes care of global services in the IoTs, since it acts the part of aggregating with upward application layer and makes the link downward of perceptual layer.

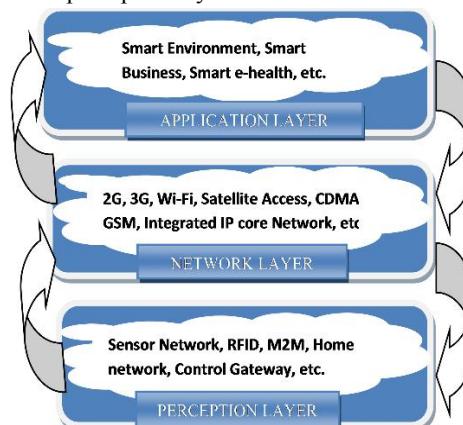


Fig 3 Architecture of IOT

3.1 IOT Protocol Stack

From a networking perspective, the introduction of the IETF 6LoWPAN protocol family has been instrumental in connecting the low power radios to the Internet and the work of IETF ROLL allowed suitable routing protocols to achieve universal connectivity. From the transport layer and an application perspective, the introduction of the IETF CoAP protocol family has been instrumental in ensuring that application layers and applications themselves do not need to be re-engineered to run over low-power embedded networks.

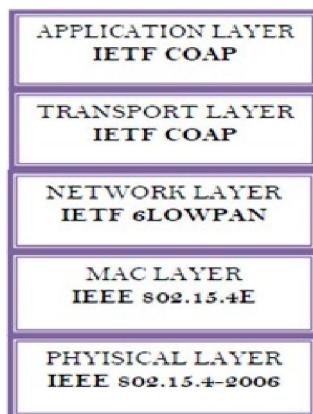


Fig 4.IoT Protocol stack

IV. APPLICATIONS OF IOT

A survey done by the IoT-I project in 2010 [4] identified IoTs application scenarios which are grouped in 14 domains viz; Transportation, Smart Home, Smart City, Lifestyle, Retail, Agriculture, Smart Factory, Supply chain, Emergency, Health care, User interaction, Culture and tourism, Environment and Energy.

4.1 IoTs in Medical Application

Due to population growth, rural urbanization, declining birthrate, population aging, economic growth and social unbalanced resource utilization, some social problems have become increasingly apparent in the healthcare field.

- The health management level and the incapability of responding to emergency is a pressing social problem.
- There is a serious shortage in medical staffs, institutional facilities especially in rural areas, lack of medical facilities, low level of treatment, inadequate healthcare system
- The imperfect diseases prevention system cannot meet the national strategy requirements to safeguard the health of the citizen becoming heavy burden on economy, individuals, families and state.
- Inadequate disease prevention and early detection capability.

To address these issues, Remote Monitoring and Management Platform of Healthcare information (RMMP-HI) [5] can provide monitoring and management of these lifestyle diseases so as to reach the purpose of prevention and early detection.

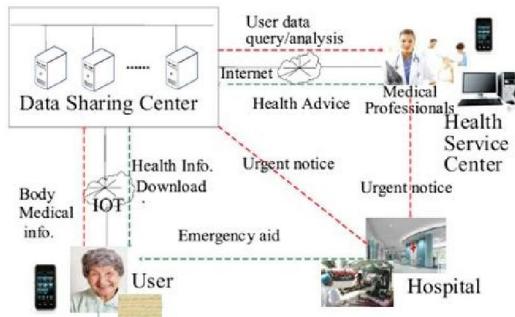


Fig 5 The framework of healthcare service

4.2 IoT in Smart Home

Now a days, smart homes are becoming more and more cost- effective and intellectualized with continued progress and cost reduction in communication technology, information technology, and electronics, which connects the Internet with everyday devices and sensors for connecting virtual and physical objects through the data capture and communication capabilities development.



Fig 6 IOT in Smart Home

In addition, by virtue of smart home systems, windows, home ventilation, doors, lighting, air conditioning etc., can be controlled by remotely. Each electronics devices such as refrigerator, washing machine, oven etc., can be manipulated by remote platforms or programs. Entertainment equipment's like radios and televisions can be connected to common channels which are in remote. In addition, home security and healthcare are also important aspects of smart homes. For instance, health aid devices can help an elder individual to send request or alarm to a family member or a professional medical center.

V. SECURITY AND PRIVACY CONCERNNSIN IOT

5.1 Security Concerns in IoTs

Internet of Things virtually is a network of real world systems with real-time interactions. The development of the initial stage of IoT, is M2M (Machine to Machine), having unique characteristics, deployment contexts and subscription. Unattended operation without human intervention is possible for long periods of time by the wireless area network (WAN) or WLAN.

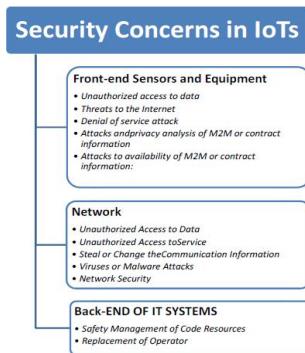


Fig 7 Security Threats in IOT

Network plays an important role providing a more comprehensive interconnection capability, effectualness and thriftiness of connection, as well as authentic quality of service in IoTs. Back-end IT systems form the gateway, middleware, which has high security requirements, and gathering, examining sensor data in real time or pseudo real-time to increase business intelligence.

5.2 Privacy Concerns in IOT

The Internet security glossary [9] defines privacy as "the right of an entity (normally a person), acting in its own behalf, to determine the degree to which it will interact with its environment, including the degree to which the

entity is willing to share information about itself with others". Privacy should be protected in the device, in storage during communication and at processing which helps to disclose the sensitive information.

5.3 Privacy in Device

The sensitive information may be leaked out in case of unauthorized manipulation or handling of hardware and software in these devices. For example, an intruder can "re-programme" a surveillance camera could such that it sends data not only to the legitimate server, but also to the intruder. Thus, for devices that gather sensitive data robustness and tamper-resistance are especially important.

5.4 Privacy during Communication

To assure data confidentiality during the transmission of the data, the most common approach is encryption. Encryption on certain occasions adds data to packets which provides a way for tracing, e.g. sequence number, IPsec-SecurityParameterIndex, etc. These data may be victimized for linking packets to the analysis of same flow traffic.

5.5 Privacy in Storage

For protecting privacy of information storage, following principals should be considered.

- Only the least possible amount of information should be stored that is needed.
- In case of mandatory then only personal information retained.
- Information is brought out on the basis of "need-to-know".

5.6 Privacy at Processing

It is mainly of two folds. Firstly, personal data must be treated in a way that it should be simpatico with the intended purpose. Secondly, without explicit acceptance and the knowledge of the data owner, their personal data should not be disclosed or retained to third parties. By considering the above two points, Digital Rights Management (DRM) systems [15] is most suitable which controls the consumption of commercial media and defends against re-distribution illegally.

VI. CONCLUSION

The IoT technology draws huge changes in everyone's everyday life. In the IoTs era, the short-range mobile transceivers will be implanted in variety of daily requirements. The connections between people and communications of people will grow and between objects to objects at anytime, in any location. The efficiency of information management and communications will arise to a new high level. The dynamic environment of IoTs introduces unseen opportunities for communication, which are going to change the perception of computing and networking. The privacy and security implications of such an evolution should be carefully considered to the promising technology. The protection of data and privacy of users has been identified as one of the key challenges in the IoT.

REFERENCES

- [1]. S. M. Metev and V. P. Veiko, *Laser Assisted Microtechnology*, 2nd ed., R. M. Osgood, Jr., Ed. Berlin, Germany: Springer-Verlag, 1998.
- [2]. J. Breckling, Ed., *The Analysis of Directional Time Series: Applications to Wind Speed and Direction*, ser. Lecture Notes in Statistics. Berlin, Germany: Springer, 1989, vol. 61.
- [3]. S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low-temperature poly-Si TFT," *IEEE Electron Device Lett.*, vol. 20, pp. 569–571, Nov. 1999.
- [4]. M. Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, "High resolution fiber distributed measurements with coherent OFDR," in Proc. ECOC'00, 2000, paper 11.3.4, p. 109.
- [5]. R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.

- [6]. (2002) The IEEE website. [Online]. Available: <http://www.ieee.org/>
- [7]. M. Shell. (2002) IEEETran homepage on CTAN. [Online]. Available: <http://www.ctan.org/tex-archive/macros/latex/contrib/supported/IEEETran/>
- [8]. FLEXChip Signal Processor (MC68175/D), Motorola, 1996.
- [9]. “PDCA12-70 data sheet,” Opto Speed SA, Mezzovico, Switzerland.
- [10]. A. Karnik, “Performance of TCP congestion control with rate feedback: TCP/ABR and rate adaptive TCP/IP,” M. Eng. thesis, Indian Institute of Science, Bangalore, India, Jan. 1999.
- [11]. J. Padhye, V. Firoiu, and D. Towsley, “A stochastic model of TCP Reno congestion avoidance and control,” Univ. of Massachusetts, Amherst, MA, CMPSCI Tech. Rep. 99-02, 1999.
- [12]. Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification, IEEE Std. 802.11, 1997

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