



Project Innovations in Distributed Computing and Intelligent Technology

Proceedings of 12th Project Innovation Contest 2023
(A sister concern event of 19th ICDCIT 2023)
Bhubaneswar, India, January 18-22, 2023

Bindu Agarwalla
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Biswajit Sahoo

**PROJECT INNOVATIONS IN DISTRIBUTED
COMPUTING AND INTELLIGENT TECHNOLOGY**
Proceedings of 12th PIC 2023 (A sister concern activity of 19th ICDCIT
2023) Bhubaneswar, India, January 18-22, 2023

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Kalinga Institute of Industrial Technology, Bhubaneswar, India

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MESSAGE

Date: 6th January 2023

It is a matter of extreme happiness that the School of Computer Engineering, KIIT Deemed to be University, is bringing out a publication with the proceedings of 12th Project Innovations Contest (PIC-2023), a satellite event of the 19th International Conference on Distributed Computing and Intelligent Technology (ICDCIT-2023), in the form of a book. Of course the Project Innovations Contest, which was started in the year 2012, is an admirable effort to motivate young engineers, particularly the undergraduate scholar community to develop projects with ingenious ideas.

It is gratifying to know that a total of -43- innovative projects, spread across different spectrum of computer knowledge domain like IoT, data analytics, machine learning, robotics, website design, circuit design, mobile app development and many more, have been presented in this book. It gives me a sense of satisfaction & confidence that these young scholars are all set to solve many real-life problems through their projects. I congratulate all the contributing authors for sharing their innovative ideas, and theories that will enrich the different domains of Computer Engineering.

I also laud the efforts of the school, organizing committee members, reviewers, and other stakeholders of this important academic event for their sincere endeavor.



(Achyuta Samanta)
Founder, KIIT & KISS



MESSAGE



It gives me immense pleasure to learn that School of Computer Engineering is coming out with the 12th edition of the prestigious Project Innovation Contest (PIC-2023), in conjunction with 19th International Conference on Distributed Computing and Intelligent Technology (ICDCIT-2023), a flagship event of Kalinga Institute of Industrial Technology Deemed to be University, Bhubaneswar from 18th - 22nd January 2023.

Project Innovation Contest, since its inception in 2012, has truly reflected the commitment of KIIT towards academic and research excellence. It has provided a crucial platform to the young budding talents to showcase their potential and to give some riveting solutions for the problems that the modern human race is facing.

I applaud the painstaking work of the organizing committee and offer my warm wishes to the scientific fraternity for participating in the conference. I hope the outcomes will enrich the intellectual horizon to cherish and extend my best wishes for the grand success of this event.

A handwritten signature in blue ink, appearing to read 'Sasmita'.

Prof. Sasmita Samanta
Vice-Chancellor



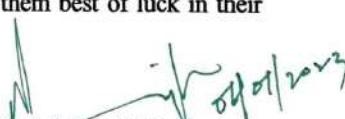
Prof. (Dr.) Saranjit Singh
Pro Vice Chancellor

MESSAGE

I am immensely pleased to know that 12th Project Innovation Contest (PIC-2023) is being organized by School of Computer Engineering, Kalinga Institute of Industrial Technology, Deemed to be University, Bhubaneswar, in conjunction with 19th International Conference on Distributed Computing and Intelligent Technology (ICDCIT-2023) from 18th-22nd January 2023.

While, ICDCIT has become a pioneer in its field, PIC has also strengthened its position in the academic world through its pathbreaking project ideas. It has become a hotbed for budding young researchers, who come out with several ingenious solutions to some of the real-life challenging problems. I am overjoyed to learn that 12th edition of PIC has attracted a total of 117 projects from several parts of the country, out of which only 43 projects could find a place in its proceedings. This itself speaks about the scintillating success of this event.

I congratulate all the participating authors, and extend my best wishes to them for a thrilling experience in this exhibition. I also applaud the tireless effort put by the organizing chairs, and the student volunteers, and wish them best of luck in their exemplary endeavor.



04/01/2023

Prof. (Dr.) Saranjit Singh
Pro Vice Chancellor



Dr. Jnyana Ranjan Mohanty
Registrar
KIIT Deemed to be University

MESSAGE

I am thrilled to learn that the School of Computer Engineering, KIIT Deemed to be University, Bhubaneswar, will host the 12th Project Innovation Contest (PIC- 2023), in conjunction with the 19th edition of ICDCIT-2023.

PIC's sole goal since its inception has been to provide a perfect platform to the young scholars to demonstrate their talent in solving real life problems and to develop projects with innovative ideas. Kalinga Institute of Industrial Technology (KIIT) University has always played an important role as a promoter of events that provide highly intellectual collaborations to its research community.

I joyfully welcome all the participants to this event and wish them the best of luck in their endeavor. I also congratulate the entire organizing team of 12th PIC 2023 and extend my best wishes for the success of their event.

A handwritten signature in black ink, appearing to read 'Jnyana Ranjan Mohanty'.

Dr. Jnyana Ranjan Mohanty
Registrar



Prof. Biswajit Sahoo

Director General,

School of Computer Engineering KIIT Deemed to be University

MESSAGE

It gives me immense happiness to know that School of Computer Engineering, Kalinga Institute of Industrial Technology, Deemed to be University, Bhubaneswar, is organizing 12th Project Innovation Contest, PIC-2023, as an event in the 19th International Conference on Distributed Computing and Intelligent Technology, ICDCIT 2023.

Project Innovation Contest (PIC) has become a fitting ground for the young researchers to advertise their potential in turning path breaking ideas into reality that solves many real-life challenges. I feel proud to know that PIC has scaled new heights with every passing edition and this edition has gone one step higher where only 43 projects, out of 117, could find a place in the final exhibition.

I feel highly honored to congratulate the participating students, committee members, and organizers for making this wonderful event into reality. My best wishes for the grand success of the event.



Walt

Prof. Biswajit Sahoo
Director General



Prof. Samaresh Mishra
Director - Student Affairs
KIIT Deemed to be University

MESSAGE

I am very much delighted to know that School of Computer Engineering, Kalinga Institute of Industrial Technology, Deemed to be University, Bhubaneswar, is bringing out the proceedings of 12th Project Innovation Contest, PIC-2023, a satellite event of 19th International Conference on Distributed Computing and Intelligent Technology, ICDCIT2023. The journey of Project Innovation Contest started in 2012 with an aim to provide a platform to young research talents to exhibit their potential in developing innovative projects. I feel truly honored to say that after a decade, PIC has become a hub for these young scientists to advertise their potential in turning path breaking ideas into reality that where they not only try to solve real-life challenges, but they also come out with some inventive ideas.

I am extremely honored to know that PIC has scaled new heights in this edition by attracting more than hundred projects from different part of the country and after rigorous evaluation process only 43 projects could make the final cut. I am overjoyed to congratulate all the participating authors, organizers and the student volunteers of this event for making this wonderful event into reality. My best wishes for the grand success of the event.

Prof. Samaresh Mishra
Director - Student Affairs



About KIIT

KIIT is a multi-disciplinary University respected worldwide due to its rich educational culture of excellence. The growth from a non-descript Industrial Training Institute to a multi-disciplinary world class University spreading over 25 sq. kms. of prime land in 23 lush green sprawling campuses having 13 million squarefeet built-up area in the shortest span of time speaks about KIIT's phenomenal growth, excellence and a tremendous will power, determination of its visionary founder Dr. Achyuta Samanta.

In the Globalized academic atmosphere, KIIT continues to make its presence felt in the international arena through its collaboration with more than 167 Universities across the world. There are 28 constituent schools accredited by the NAAC and other International Accreditation bodies. The Ministry of Human Resource Development, Govt. of India has issued Letter of Intent (LoI) for remand by Institution of Engineering and Technology (IET), U.K. Academic excellence, innovative research impressive infrastructures are not the sole reasons for the distinct identity of KIIT. It is perhaps the only University that synergizes academic and human values the need for which has only been realized now in Madrid and Stockholm conventions on Higher Education while the same has been practiced in KIIT since its inception.

KIIT commenced its silver jubilee celebration, with the tagline "Soil to Silver", with the launching ceremony held on 16th November 2022 attended by around 1 lakh students, faculty & staff. The ceremony was graced by Dr. Achyuta Samanta, Honorable Founder KIIT & KISS. Dr. Samanta expressed his deep gratitude to all stakeholders of the institute and inspired them to keep the good work going. Since, then KIIT has organized several events like international conferences, Grand parents meet, and mega alumni meet as a part of its silver jubilee celebrations.

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About KISS

The humane face of KIIT is best illustrated through its protégé Kalinga Institute of Social Sciences (KISS) which has been transforming the lives of thousands of poor, voiceless indigenous children by giving them their legitimate space through education. Empowerment, eradication of poverty and sustainable development no longer remain as mere slogans, for KISS has shown the way how it takes care of 25,000 poorest of the poor tribal children through provisions of food, accommodation, health care and education from KG to PG free of charge without any substantial help from any quarter. The United Nations has granted the Special Consultative Status to KISS. It is also associated with the United Nations Department of Public Information (UNDP). Kalinga Institute of Social Sciences (KISS), Bhubaneswar has been placed amongst the best 223 NGOs of the world and has created three Guinness World Records (GWR) i.e. the Largest Human Sentence (We Urge for World Peace), the Longest Human Chain (High-Fives) and the largest Laughter Yoga Class.

Untiring saga of struggle, sacrifice, determination and dedication of just one person Achyuta Samanta, inspires everyone to bring KIIT and KISS, where these are now. It is indeed a testimony to his never ending spirit to achieve the unachievable and to reach the unreached.

Kalinga Institute of Social Sciences (KISS) has been declared a Deemed University (U/S 3 of UGC Act, 1956) by the Ministry of HRD, Govt. Of India on August 25, 2017. With this, it has become the first tribal university in India and in the entire world.

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About Art of Giving

Art of Giving is all about creating an unconditional and sustainable abundance of love, peace and happiness and contentment for others through gestures of kindness and generosity. It was founded by Shri Achyuta Samanta on 17 May 2013. The key to peace and happiness lies in unlocking the Art of Giving in each individual. It is a not-for-profit initiative for spreading, supporting and promoting the practice of the art of giving around the world.

VISION: To bring together the sense of peace and happiness among people of all ages, especially children and youth through genuine acts of giving back to the society by the practice of empathy and compassion to the distressed without any discrimination.

MISSION: To make people aware and spread the philosophy of the Art of Giving across all sections of human society worldwide through activities of sharing love, care, compassion, wisdom, knowledge, skills and talents.

MAN BEHIND THE PHILOSOPHY

Shri Achyuta Samanta, A noted educationist, and philanthropist is the founder of two world-class institutions. Kalinga Institute of Industrial Technology KIIT that provides technical education to 27000 students across India and overseas and Kalinga Institute of Social Sciences KISS, which is a home to 37000 poor indigenous tribal children who are provided with free education from kindergarten to post graduation besides free lodging, boarding, healthcare, vocational and life skill empowerment.

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About **School of Computer Engineering**

The School of Computer Engineering aims to impart cutting-edge skills through research and development, industrial consultancy, in frontier areas of Computer and Information Technology and teaching. The state-of-the-art facilities of the School include adequate number of air conditioned classrooms, laboratories, conference hall, reading rooms and round the clock Library with Journals, e-resources and around 15000 books. The well qualified faculty members of the School endeavor to impart understanding of fundamental concepts, with a view to laying a strong foundation to help assimilate continual changes in the dynamic field; train in current technologies to be employable in the industry; train to connect theory with application; develop analytical; problem solving and product design skills; motivate to take up careers in research and development as well as in academics and develop entrepreneurship abilities with a view to becoming self-reliant.

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PREFACE

12th Project Innovation Contest 2023 (PIC-2023), a sister concern event of 19th International Conference on Distributed Computing and Intelligent Technology (ICDCIT-2023), is to be held on 18-22 January 2023 at Kalinga Institute of Industrial Technology, Deemed to be University, Bhubaneswar, Odisha, India. Since 2004, ICDCIT conference series results and innovative ideas on the foundations of distributed computing, internet technologies, and societal applications.

Project Innovation Contest, started as a satellite event to ICDCIT conference series with the first edition in 2012 inaugurated by Prof. R. K. Shyamasunder, TIFR. This year the 12th Project Innovation Contest 2023 will be publishing the work of student researchers in its 5th proceedings titled Project Innovations in Distributed Computing and Intelligent Technology in the form of a book.

The call for submissions for the 12th Project Innovations Contest included the major areas of innovations in Internet of Things, Software Models, Embedded System, Android Apps, VLSI, High Performance Computing, Web

Applications, Networking, Image Processing, Information Security, Cloud Computing, BigData Analytics and Power Management.

This proceeding focuses on innovative research projects in the field of Distributed Computing and Intelligent Technology presented during the 12th Project Innovation Contest-2023. The selected research projects enrolled in this book are relevant to the current trends of distributed computing and its application to real-world problems. Undergraduate and postgraduate students have demonstrated the working of their proposed technique using models/prototypes. The projects presented would have an effective way to connect the academia and the industry with practical problems and their realistic solutions. This book will be helpful for the researchers, students, and developers who computing and its applications.

In response to the call for submission to the 12th Project Innovation Contest, a total of 117 projects were received from several parts of India. A total of 43 projects was selected after going through a double-blind review process and has been included in the proceeding. On behalf of the editorial team, we would like to thank all the program committee members and student coordinators who served in various aspects for the 12th Project Innovation Contest-2023. Special gratitude to the authorities of Kalinga Institute of Industrial Technology, Deemed to be University for their continuous support and encouragement.

Editorial Team

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CUISINYUMM-A Multi -Cuisine Recipe Forum

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Abstract- In the prevailing generation everything that is occurring across the world is obtainable to us through our phones, laptops, and lots of more. But the one major aspect that concerns the common man is how to make each day life increasingly easy. This project depicts the design and improvement of a social media recipe website that'll make the life of various food enthusiasts easy. This project will allow people to discover various traditional recipes from different cuisines across the world with detailed calorie count and nutritional value. The objective of our website is to provide users with a unified platform for multi-cuisine recipes to try at home. It will also help different aspiring food connoisseurs, food bloggers, chefs, homemakers, and many other food lovers try out different fancy dishes from all around the world. Our main objective is to make cooking for anyone easy and delicious by providing them with a search of any cuisine based on their region and type. The project will bring together all the food lovers and provide them with exciting content on a unified platform. The addition of the website makes our website a commercial project as it has a probability of monetary success in the long term. Our project is unique as it not only provides users with exquisite content on food but also allows them to interact with other users by following their favorite content creators. Our project is cost effective as it doesn't require any special hardware or software requirements. The technology adopted by our project is MERN full stack web development which makes our project fit for the upcoming era of new and easier software and technologies, applying this the original data is reduced to its smaller form called code. This code can then be decoded to reconstruct the original data. The model is applied on medical images and the performance is compared to standard compression techniques to demonstrate its effectiveness.

Index Terms- Image compression, Autoencoders, RGB image, Grayscale, Telemedicine

I. INTRODUCTION

A standardized recipe produces a specific quality and quantity of food for a specific restaurant. That recipe is unique to the restaurant and the creative ideas of the person who created the dish. Once that standardized recipe is created it will become one of the most powerful documents in a foodservice operation.

Our website will offer users recipes from various cuisines and ease cooking sessions because users will be able to implement and try out new and authentic dishes from various cultures around the world [7]. People who enjoy cooking and are constantly tempted to try new recipes but hesitate out of fear that they might make a mistake and waste their time and effort make up most of our target audience [6] [8]. The privilege of posting comments and recipes will also be extended to our website's visitors. Additionally, we'll be adding recipes for inexpensive meals and dishes with a high protein value for fitness enthusiasts. We will compile recipes from different nations around the world and classify them according to the cuisine. We will host recipes from many different cultures that have persisted throughout the ages, including Mughlai, Turkish, English, Chinese, Korean, and Indian [9-10]. However, there will be even more subcategories for Indian food for easier scrolling. Additionally, this will allow us to highlight the rich food culture that exists in our country. Famous dishes from Indian cuisine are categorized by the state in which they originated as well as into North Indian and South Indian subgroups. The website will include more than just recipes; it will also list the number of calories in each dish, interesting trivia about the ingredients used, and recommendations for what would go best with that particular dish. A community forum page will be available on the website, where logged-in individuals can post their recipes for other visitors to the site to see. The posts will also have an interactive component because other users will be able to like, comment on, and share the recipe post. A report tool is crucial in social media forums because spam will inevitably be there. In addition, a system will be in place to remove these spams.

II. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED

In this section, we have presented the summary of the background work that was conducted to kick start this project. The summary is presented in Table 1 as below.

Table 1: Literature Survey

Sl. No.	Website Name	Description	Pros	Cons
1	All Recipes [1]	Taking the top position is All Recipes, a top-tier recipe website that is estimated to have over 25 million visitors each month.	1. Gives you access to an extensive recipe database.	Recipes' load-speeds are slow since they contain loads of information.
2	The Food Network [2]	The Food network boasts a religious following since it reaches its followers via several mediums, including the website, television, radio, magazines, and podcasts.	1. has the backing of experienced and talented gourmet experts. 2. Incorporates classic and	1. Loading speeds can be slower due to the tons of information on this website. Some complain that the site doesn't update their content regularly.

			modern recipes	
3	Yummly [3]	Yummly is a great resource for finding top-notch recipes. With a user-friendly interface and a variety of filters, this platform makes it simple to browse the database's over 2 million recipes.	1.Features outstanding videos 2.Boasts a plethora of different filter options 3.Clean, fun and easy to use website	1.You need to sign up to share recipes. 2.Filters are only visible once you sign up.
4	Epicurious [4]	Primarily focused on videos, Tasty is one website that you ought to visit if you enjoy visually appealing recipes.	1.Allows users to upload their recipes. 2.Emphasizes on quality rather than quantity.	1.Fewer recipes when compared to other famous recipe websites
5	Tasty [5]	Primarily focused on videos, Tasty is one website that you ought to visit if you enjoy visually appealing recipes.	1.Provides cleverly created recipe videos 2.Clean and fast performing website	1. It doesn't feature in-depth content on topics that relate to food.

III. PROPOSED MODEL / TOOL

We have divided our project into several smaller segments and classified them in an order we intend to execute. For the Front-end Web Design, we plan to use Figma to design the appearance of our site, and for the development, we are inclined towards the implementation of HTML-5, CSS-3, JavaScript, and its framework React.js to add certain functionality to our website.

For the Back end we shall use Node.js to configure our runtime environment, and for the database, we will use a non-relational database, MongoDB. Our Database will store certain information from the user when they Sign-up on our website. The sign-up/login feature would be easily accessible on the navbar. Whenever a user clicks on that, he or she will be redirected to a login/signup form. If a user wants to sign-up on our website, then the login form will ask them for their email ID and a password, which they can use as their login credentials on our site later. We will also store their name, age, geographical location, their taste preferences, and allergies and use these sets of information to configure the recommendations a registered user gets on our website.

This feature will give them a personalized experience of surfing on our website.

1. The Search:

The search algorithm implemented on our website will try to match what the user types with relevant usernames (of creators), food names, food items and other such relevant keywords. Also using an API will give the website the flexibility of having more content to display.

2. Chatbot Section:

We will be implementing a Chatbot on the homepage of the website which will be purely text based. A user will be able to get necessary information on calorie count in a particular recipe, nutritional value of a food item and much more using the chatbot. We will be using AIML to build this text-based chatbot. The website will have a community forum page, where signed in users will be able to share their recipes with other users on the website. The posts will also be an interactive element, as other users will be able to like, comment and share the recipe post. An integral part of a social media forum is having a report feature as there will be spams. There will also be a system to filter this spam out. Our website will be responsive, have minimal animations, and smooth page loading to give the user a hassle-free surfing experience on our website. The website will also have a dynamic recommendation system. The functional and non-functional requirements of the proposed system is discussed as below:

Functional Requirements:

1. **Read top recipes:** The user will see a list of all recipes in this section, along with information about the ingredients, preparation process, cooking time, ratings, and nutritional value.
2. **Sign up:** In this section, the user will have to fill up a survey form which will ask them for their name, age, occupation, and region they live in; their email and a password so that they can later log in to the website with the given email and password.
3. **Log in:** Here, the user will be able to log in to the website after filling up the survey form in the sign-up section to enjoy all the features of the website.
4. **Search Recipes:** In this section, the user will be able to search for recipes based on various cuisines and regions. They will be provided with a search bar that will take their input and display the appropriate recipe.
5. **Post Recipes:** In this section, the user will be able to create their own recipes and post them on our website.
6. **Delete the posted recipes:** The user can also delete their once posted recipes.
7. **Chat-bot:** The user can also chat with a chat-bot implemented in our project to get relevant information about recipes, calories, nut

Non-functional requirements:

- Good network connection all day,
- Fast server loading, and a
- Enough server storage.

Development Software Requirements:

- Languages Used in The Front-End: HTML-5, CSS-3, React
- Resources Used in the Back end: Node.js 18, Express.js 4.18.1, mongo DB 6.0, Redux

- IDE: VS code, ATOM
- Processor: Intel(R) Core (TM) i5-10300H CPU @ 2.50GHz 2.50 GHz
- RAM: 8.00 GB (recommended)
- GPU: NVIDIA GeForce GTX 1650

Database: MongoDB is a non-relational document database that provides support for JSON-like storage. The MongoDB database has a flexible data model that enables you to store unstructured data, and it provides full indexing support, and replication with rich and intuitive APIs.

IV. IMPLEMENTATION AND RESULTS

System Designs:

The Use case diagram and activity diagram of the proposed system has been depicted in Figure 1 and Figure 2, respectively.

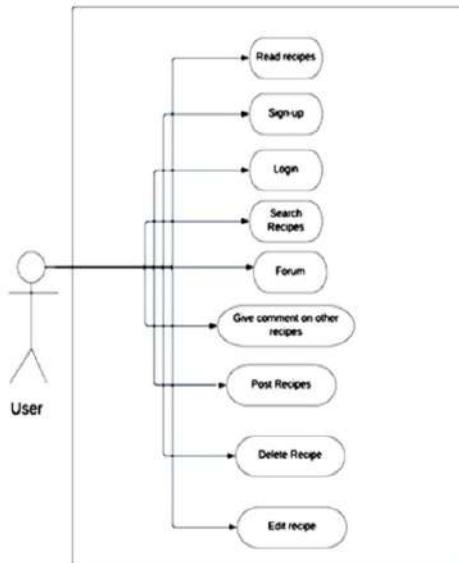


Figure 1. Use Case diagram

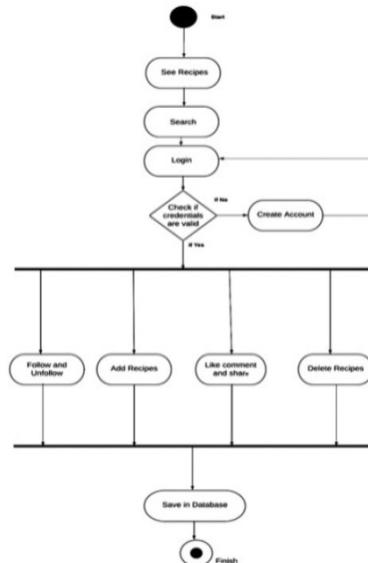


Figure 2. Activity diagram

Home Page: The home page as shown in Figure 3., of our website is the landing page where the users will be able to find recipes from various cuisines and search recipes on our website. The basic implementation of our home page is done with the Search bar working.



Figure 3. Home Page

Search Bar: When a user wants a specific recipe of a dish, they can easily search it in the search bar with auto complete search working on our home page. The search bar is shown in Figure 4.



Figure 4. Search Bar

Cuisine Page: We have also implemented individual cuisine pages for 5 different cuisines which is shown in Figure 5.



Figure 5. Cuisine Page

Recipe page: There are individual recipe pages, shown in Figure 6. with all the ingredients and steps for making the dish. We have also provided videos for references while cooking the dish.



Biryani

One of the most royal delicacies that you can enjoy on any occasion or festival, Chicken Biryani is the epitome of a one-pot meal. Well, no one can resist the sight of the aromatic and delicious Chicken Biryani recipe. If you are also craving

Figure 6. Recipe Page

Sign Up Page: The sign-up page asks the details of the user who wants to create an account in our website. It is shown in Figure 7.



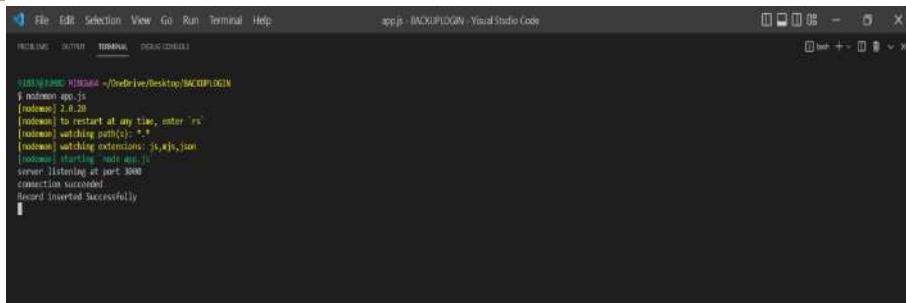
Figure 7. Sign Up Page

Login Page: The login page is shown in Figure 8. It will be used by the user to log in into their accounts after creating the account.



Figure 8. Login Page

Insert Sign Up Details (Successful): The successful record insertion is shown in Figure 9.



```
8135:~/Documents/MongoDB4 ~/OneDrive/Desktop/MACOP/LOGIN
$ nodeapp.js
[nodemong] 2.8.20
[nodemong] to restart at any time, enter 'rs'
[nodemong] watching path(s): '*'
[nodemong] watching extensions: 'js, *js, json'
[nodemong] starting node app...
server listening at port 3008
connection successful
Record inserted successfully
```

Figure 9. Record Inserted Successfully

Account Details Stored in Database: After the user enters their details in the Sign Up page, their details gets stored in our Mongo DB database successfully. This is shown below in Figure 10.



Figure 10. Account Details stored in Database

Create Posts: Any signed-in user will be able to create a post of theirs in the forum section. It is shown in Figure 11.

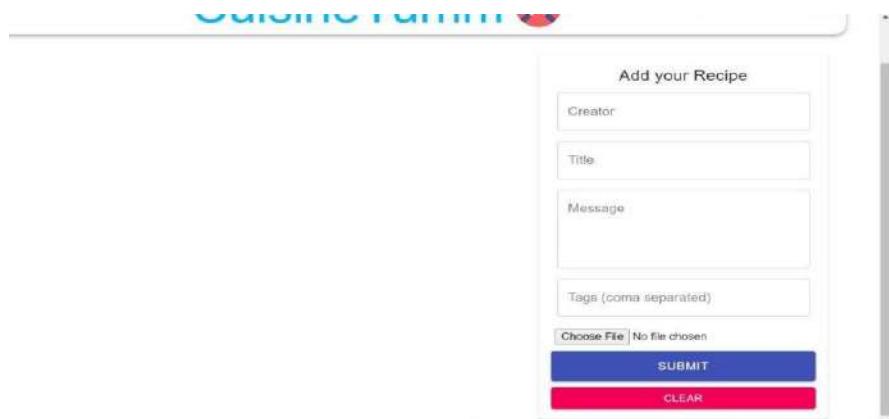


Figure 11. Create Post

V. CONCLUSION

Cuisinyumm is a unique, multi-cuisine recipe website with a community forum page feature which makes it a one of a kind. It is a social media platform for all the food lovers. It is a platform that will unite all culinary connoisseurs from

across different societies, regions, cultures, and nations under one roof. By utilizing contemporary methods and tools, Cuisinyumm will be created. Running ads and other similar methodologies will help generate revenue and make Cuisinyumm a self-sustaining website.

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3D Printed Prosthetic Arm for Tran humeral Amputees using Semi-adaptive Object Detection and Recognition

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Abstract- A 'Tranhumeral amputee' has undergone a Tranhumeral amputation, i.e., the absence of an arm from above the elbow. This paper presents a 3D-printed prosthetic arm for the differently abled (trans-humeral) person. We, in this project, use human eye blinking to control all the significant functionalities using an eye-blink sensor. The eye blink sensor will detect each 'eye-blink' of the user to reduce delay and increase the overall accuracy of the prosthetic arm. Our central computing unit will be a Raspberry Pi 3 B+ model, as our motive is to keep the arm compact and portable. In this project, we also use computer vision to detect and recognize (pickable) objects. The design has an elbow functioning properly that can be used for flexing the arm. This is an easily portable prosthetic arm for the Tranhumeral amputee to move quickly from one place to other. This mobile design is achieved using a portable computational unit, i.e., the Raspberry pi 3 (B+ model). A 16-megapixel Logitech camera will be attached to the user's chest with the help of a holder and belt. The camera will constantly scan the user's environment to keep itself updated and always be ready to act.

Index Terms- Tranhumeral, Prosthetic, Raspberry Pi

I. INTRODUCTION

The most critical asset of *Homo sapiens* is their body. Over 3 million people worldwide have an arm amputation, just 30% of the total amputees; among these, 2.4 million amputees live in developing countries [1]. Prosthetic devices are used externally by disabled people to carry out their day-to-day activities smoothly. In addition, prosthetic devices are beneficial for people who lose their body parts for various reasons like war, trauma, or disease[2]. The non-surgical prosthetic arms available today cost around Rs. 1-1.5 lakhs, and the surgical prosthetic arms costs around Rs. 3-4 lakhs in India and around 5000 USD globally [3].

Replacement of any part of the human body is a difficult task. The complexity and intricacy of the human body remain unmatched by any other machinery in the world,

making it even more palpable. Until recent times the design of prosthetic limbs has progressed relatively slowly. However, the advancement of technology in recent times has also led to the rise in the prosthetic industry. Manufacturers are considering improving not only the physical aspect of the device but also the Biofeedback and control mechanism. In our locality, we see many amputees who desire a prosthetic arm, but this arm is not readily available. We aim to make prosthetic arms accessible for all at an affordable price. Moreover, unlike other expensive prosthetics, our design won't require surgery to imitate user-controllable human hand movement.

II. PROBLEM STATEMENT

Applying simple prosthetics carved out of wood was common in the early days. But these devices provided little to no in terms of control and movement. In our locality, we see many amputees who desire a prosthetic arm, but this arm is not readily available. We aim to make prosthetic arms accessible for all at an affordable price. Moreover, unlike other expensive prosthetics, our design won't require surgery to imitate user-control able human hand movement.

(i) **Design:** The human arm is tough to mimic. Our goal is to design the device with the motive that it can display accurate human arm movement.

(ii) **Practicality:** The device must be helpful to an amputee. However, the aim is also to develop advice which would benefit people who have undergone transhumeral amputation surgery.

Affordability: We have designed the arm such that the component will fit a Transhumeral amputee without the need for any surgery, and our goal is to keep the total cost of this arm between Rs.10000-15000.

III. BACKGROUND WORK AND TECHNOLOGY GAP IDENTIFIED

(i) **Actuation and design of limbs:**

Ognen Tuteski et al., in their paper, describe the technologies used in developing 3D-printed prosthetics. In his article, the different modes of actuation of limbs and other human arm movements are also very clearly explained.[4]

Christoph Kastetal. describe the uses of micro processors in controlling the movement of a bionic arm.[5]

Ronald Pucha-Orzetal. Describe the human arm's leading working anatomy and how to implement it in our design.[6]

Mahid Elsayed Hussein describes the various possible movements of a 3D-printed prosthetic arm. This paper also corrects all the flaws in the author's design.[7]

Niehuesetal. describe the dexterity of the human fingers and imitation of the dexterity of human fingers and hands.[8]

Ivan Vujaklija et al. aim to review the latest state of the upper limb prosthetic market, offering insights on the accompanying technologies and techniques. They also examine the capabilities and features of some of academia's flagship solutions and methods.[9]

Ciarán O' Neill et al. describe how the mechanical structure of the arm is entirely 3D printed while the electronics are loosely based on the Arduino Mega. He also mentions that the EMG sensors are replicas of the open-source Advancer Technologies EMG kit. The manufacturing process was completed using readily available hand tools and a Rep Rap 3D printer. [10]

(ii) Sensor:

Ashik Ali Abdhul et al. describe how signals are input through muscle movement using an EMG sensor (electromyography sensor). EMG is a biological signal which is produced by muscle tension.

[11] Tomasz Kocejko describes how neural networks can be used to improve the accuracy of the reach-and-grab functionality of a hybrid prosthetic arm with an eye-tracing interface. [12]

Alexandre Calado et al., through their paper, present a view of three of the main components of a typical transradial myoelectric prosthesis that can be found in the market. His goal is to provide the reader with an overview of commercially available anthropomorphic myo electric prosthetic hands with high degrees of freedom, pattern-recognition-based micro controllers and EMG sensors used for prosthetic control.[13]

(iii) Experience and adaptiveness:

Catherine Widehammer et al. describe the prosthetic user's experience in their day-to-day life. This paper also explained the influence of prosthetic rehabilitation and other environmental factors.[14]

Ann Edwards et al. describe the usage of Machine Learning(ML) in controlling the prosthetic arm. This paper also compares adaptive and non-adaptive prosthetic limbs.[15]

(iv) Object Detection Model:

Qi Liu et al. propose an improved BiFPN framework based on Yolov4-Tiny to increase object detection precision. They also describe that Yolov4-Tiny needs to be more adequate in feature extraction and make the best of multi-scale features.[16]

Chien-Yao Wang et al. Propose a network scaling approach that modifies the depth, width, and resolution, but also the structure of the network. They have also shown that based on the CSP approach, the YOLOv4 object detection neural network scales up and down and applies to small and large networks.[17]

Alexey Bochkovskiy et al. use new features: WRC, CSP, CBN, SAT, Mish activation, Mosaicdata augmentation, CmBN, DropBlock regularization, and CIoU loss, and combine some of them to achieve state-of-the-art results: 43.5% AP (65.7% AP50) for the MS COCO dataset at a real-time speed of~65 FPS on TeslaV100.[18]

Debojit Biswas et al. implemented Single Shot Detection(SSD) and Mobile Net-SSD to estimate traffic density. They have also shown a key application area for the SSD and MobileNet-SSD framework. The advantages and shortcomings of the SSD and MobileNet-SSD framework was analyzed using fifty-nine individual traffic cameras. In addition, they compared the two algorithms with manually estimated density.[19]

Ayesha Younis et al. develop a technique to identify an object considering the deep learning pre-trained model Mobile Net for Single Shot Multi-Box Detector (SSD).This algorithm is used for real-time detection and webcam feed to detect the purpose webcam, which sees the object in a video stream.[20]

Jindong Zhang et al. used computer vision technology and the deep learning method to automatically detect vehicle paint defects based on small samples in this study. The vehicle body painted effect image was collected in real-time ,and a new data enhancement algorithm was proposed to enhance the database for the over-fitting phenomenon caused by small sample data.[21]

Yiting Li et al. aimed to achieve real-time and accurate detection of surface defects by using a deep learning method. For this purpose, the Single Shot Multi Box Detector (SSD) network was adopted as the meta structure and combined with the base convolution neural network (CNN)Mobile Net in to the Mobile Net-SSD.[22]

IV. PROPOSED MODEL/ TOOL

Our primary goal in this section is to objectively summarize the development process. At the same time, the project was being worked on and placed in a larger scientific and technological context. Initially, we started with the background study of object detection and its existing protocols, where we came across various object detection models and their drawbacks. Then, we moved on to study the components related to the project, which are the raspberry pi and the eye blink sensor. We have then moved to more specific goals of this project, the implementation of our objectives. The data collected for the project is in the form of images. We have used a pre-compiled dataset of ideas and collected images from the internet to compile our dataset. The pictures we have collected are pre-processed by carrying out labeling objects in the image. Object detection is then implemented using different models, which are then evaluated and compared to finalize which model to choose.

A. MECHANICAL DESIGN

A standard measurement was taken for designing the arm. Also, proper space must be kept for the arm's free movement and adequate accommodation for the motors and other electrical components. Some of the mechanical parts are shown in Figure 1 and Figure 2, respectively.

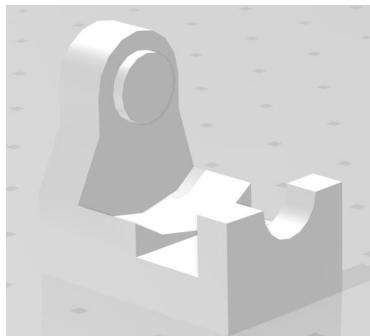


Figure 1. Gear Holder

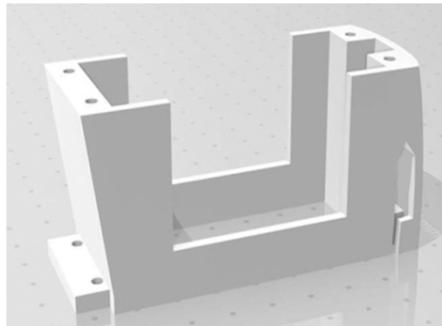


Figure 2. Servo Holder

All the parts are 3D printed using a 3D printer. The material used is PLA; PLA is a vegetable-based material, mainly plastic, and cornstarch is commonly used as the raw material. In addition, fermented flora starch is widely used to make out the monomer. It is thermoplastic aliphatic polyethaneterephthalate (PET). 3D printing is used as the primary raw material [23].

B. ELECTRICAL COMPONENTS

- RaspberryPi 3B+: The prosthetic arm's central computing unit. All the MG 99 pow (servo motors) motors are connected to the raspberry pi via the servo driver. A clear picture of the raspberry pi is shown in Figure 3.



Figure 3. Rasp berry Pi 3B++Servo Motor Driver:

All the MG 99 pow servo motors are directly connected to the servo driver. The servo driver acts as a bridge between the raspberry pi and the servo motors to monitor and control the position of the engines [24]. Figure 4 represents a clear image of a servo driver.



Figure 4. Servo Motor Driver

- Eye-Blink Sensor: The eye-blink sensor, shown in Figure 5, detects eye blinks and sends the data to the raspberrypi. According to the eye blink, the arm performs a specific pre-defined grip. A few grips are pre-defined for performing particular functions.

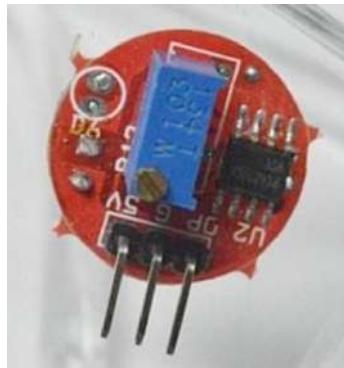


Figure 5. Eye-Blink Sensor

V. IMPLEMENTATION AND RESULTS

OBJECT DETECTION MODEL

We, in this project, have used the mobile-Net SSD V4 320x320 for object detection after comparing it with a few models in our central computing unit, i.e., the rasp berry pi. We first thought of using the Yolo v4 model for object detection, but for a computing unit like rasp berry pi, it would not be possible to run the Yolov 4 model.

Table1. Comparison between mAP and speed [25]

Model	Mean Average Precision (mAP)	Speed in milliseconds (ms)
SSD Mobile Net V2320	22.2 mAP	22ms
YOLO v 3640	35.9 mAP	375ms

Table 1 compares the mean average precision (mAP) and speed of both the SSD Mobile Net 340x340 and the Yolov4640 model. Having known that the accuracy of the Yolo v4 640 model would have been much better, I still needed help to use it due to the earlier-mentioned reason. YOLOv4 is double as fast as

the Efficient Det. Yolo v4 improves Yolov3's AP and FPS by 10% and 12%, respectively.[26]

DENSITY AND WEIGHT:

This project aims to make our product as light and user-friendly as possible. We, in this project, tried to maintain a perfect balance between the weight of the arm and the density of the PLA to be printed. When the thickness of the PLA was kept at 20%, the weight was found to be 253.5g; similarly, when the density was observed at 30%, 40% & 50%, the weight was recorded as 272g, 295g & 312.4g, respectively, while the actual weight is $\pm 5\%$ in each case. This is adequately depicted in Figure 6.

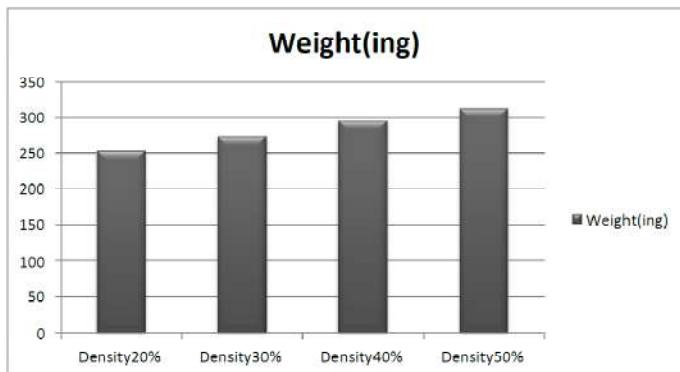


Figure 6. Weight vs Density

TESTING AND FINAL ASSEMBLY:

Figure 7 shows the testing phase of our project, where a few pre-defined grips were tested.



Figure 7. Testing before final assembly

Figure 8 shows the final assembly of the prosthetic arm (without cover), where the motors and the wires are visible.

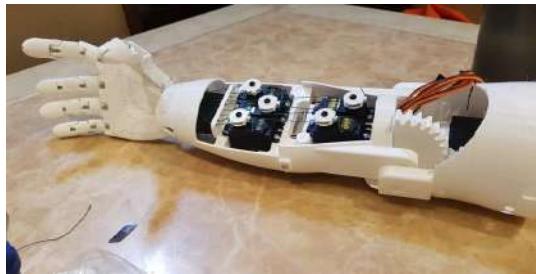


Figure 8. Final Assembly without cover

Figure 9 shows the final assembly of the prosthetic arm (with cover) after all the testing is done.



Figure 9. Final Assembly with cover

VI. CONCLUSION

This project presents a 3D-printed prosthetic arm that is lightweight and has a reasonable grip force. This is the cheapest prosthetic arm one can get in the present market. This project also presents an adaptable design for the user to use the component comfortably. Furthermore, this prosthetic arm can be manufactured according to the customer's arm dimensions. Integration of the project such that all units work together as a single functional unit is our next step in developing this prosthetic arm.

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● Estimated benefits to the society and generation of income

With this project, the middle-class, lower-middle-class, and below-middle-class transhumeral amputees can be beneficial as they can fulfill the most crucial possession of their life, i.e. their body(arm). Moreover, they can fill the void in their body in affordable and convenient ways. This process will also generate income sources for many as assembling the arm needs a workforce, and for a good number of orders, a good strength of skilled workers will be required to create the component.

An Approach of Deep Learning Neural Network Model for Image Security

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Abstract- The advancement in the Internet led to the easy availability of digital data like images, audio, and video. Ease access to multimedia gives rise to the issues such as copyright protection, content authentication, security, and ownership identification. The primary purpose of Image security is to provide security while preserving the quality of the image and reducing possible errors. Watermarking protects digital intellectual property. It helps prove an image's origin and discourages unaccredited copies or distribution. The proposed method uses the concept of hiding a secret image within another ordinary image. Deep neural networks are simultaneously trained to create the hiding and revealing processes and are designed to work specifically as a pair. Different models are implemented to check the performance of the algorithm. The results are evaluated using 20,000 different types of images. Our algorithm performs better than the state of artwork with an accuracy of 97%.

Index Terms- Image Security, Image watermarking, CNN, Autoencoders

I. INTRODUCTION

The security of images has grown to be a serious concern because of the rapid development of digital imaging and communication technology. The accessibility of image manipulation tools like Adobe Photoshop makes it challenging to trust the content of edited and distributed images. Forgery attacks on the photos could be used to disseminate false propaganda. These attacks compromise the authenticity and originality of digital photos. Therefore, image authentication is essential in protecting the image's authenticity. The image authentication process aims to restore the distrust regarding the image content. The overall structure of an autoencoder consists of an encoder and a decoder. The main goal of the proposed method is to hide the image in another image while transferring it from sender to receiver. Many techniques, like copyright protection, private transmission, and watermarks, provide security to the pictures or data. The sender uses the algorithm to hide the secret images in the cover images. At the receiver end, the receiver receives the hidden pictures and uses a decoding algorithm to view the secret images or to remove the cover images by minimizing the noises in the cover images. Figure.1 indicates the architecture of the proposed system. The input image is a

dog image, and the secret image is a flower image. The proposed method hides the secret image in the original image to give the watermarked image as output. The output of the encoder is the container image, also known as watermarked image. The revealing network uses a decoder to decode the secret image at the receiver end.

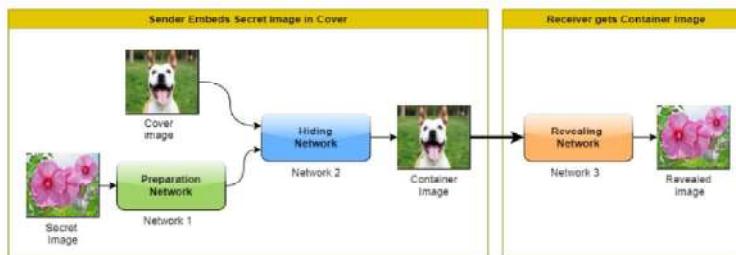


Figure 1. The architecture of the proposed system

II. BASIC CONCEPTS AND TECHNOLOGY USED

Deep learning is part of machine learning, and machine learning the part of artificial intelligence. Artificial intelligence is a technique that allows a device to copy human actions. Machine learning is a technique that helps to achieve Artificial intelligence through algorithms trained with data, and finally, deep learning is a type of machine learning caused by the structure of the human brain. Regarding deep learning, this system is called an artificial neural network. Supervised learning refers to a problem area where written references are labeled within the data used for training. Convolutional Neural Networks: It is also known as CNN or comp net, is also the artificial neural network that is so far most popularly used for analyzing images, although analysis had been the most widespread use of CNN. It can also be used for other data inquiries or to organize problems. We can think of CNN as an artificial neural network specializing in picking out or detecting patterns and making sense of them. This pattern detection shows that CNN is a vital technology for image analysis. So, if a CNN is just some form of an artificial neural network, what differentiates it from just a standard multi-layer perceptron or MLP, or CNN has hidden layers called convolutional layers? These layers are precisely what makes a CNN. Like any other layer, a convolutional layer receives input, then transforms and outputs the information to the next layer with a convolutional layer; this transformation is a convolution operation. CNN learn the most efficient way to hide the secret image inside the container image, which is unpredictable for us. As a result, it adds to the security of steganography by making the process unreliable. 2. The container image is mostly the same, making the changes harder to spot. 3. The changes can only be spotted by the decoder network trained to do it. 4. The process is flexible, which means that before feeding to the network, some changes can be made to the image to make the process more secure. Autoencoders are simple learning networks that help to move inputs into outputs with less possible error. This means that we want the work to be

close to the information. An autoencoder neural network is an unsupervised machine learning algorithm that applies back propagation, setting the target values equal to the inputs. It is an unsupervised ML algorithm like the PCA. It reduces the same objective function as PCA.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED

Jadhav et al. [1] presented a novel method of steganography online information concealment on the instrument's output screens for broadcasting a secret message. Here, the personal information is hidden using a private marking scheme that combines the LSB and symmetric essential steganography techniques.

Chen et al. [2] proposed an image steganography strategy to improve the side match method. The image quality is increased while keeping the embedding capacity the same by hiding additional information in the edge region; furthermore, The embedding capacity can be altered to meet the needs of different users. In addition to enhancing image quality, the suggested method offers decent security.

Sarkar et al. [3] introduced a unique method for image steganography based on Block-DCT, in which DCT converts original image (cover image) blocks from the spatial to the frequency domain. Before performing a two-dimensional discrete cosine transform on each block, a grey level image of size $M \times N$ is first divided into no joint 8×8 blocks. Then, before embedding, Huffman encoding is also applied to the secret messages/images, and each bit of the encoded hidden message/image is placed in the frequency domain by modifying the least significant bit of each DCT coefficient of the blocks of the cover picture. The experimental findings demonstrate the algorithm's high capacity.

Askar et al. [4] introduced a new algorithm for image encryption and decryption based on a chaotic economic map. This work represents the first attempt to incorporate a chaotic economic map into the development of chaotic cryptography. The proposed image encryption and decryption technique have a vast critical space of 1084 , strong sensitivity to all secret keys, close to-ideal information entropy of 8 , and low correlation coefficients relative to the ideal value of 0 , and simulations and experimental findings have demonstrated all these characteristics.

Brindha et al. [5] demonstrated picture encryption using the DES algorithm, increasing transmission security. The suggested solution replicates the original image without sacrificing any information. They employed three different techniques: The idea is first transformed into a byte array, and then the byte array is converted into a string and sent for DES encryption. The input image remains unchanged in the final encrypted version. The comparison study of DES and AES has been discussed. The encryption of text data included in photographs is their future project.

A. Jain et al. [6] proposed employing DNA (Deoxyribonucleic acid) operations and chaotic maps to encrypt images. First, the input image is DNA encoded, and then a mask is created using the 1D chaotic map. Second, this mask is combined with the DNA-encoded image using DNA addition. Finally, a complement matrix created by two 1D chaotic maps serves as the intermediate product, DNA that has been complimentary. The resultant matrix is permuted to obtain the cypher image using 2D chaotic maps and DNA decoding. The suggested method can withstand well-known statistical, differential, and plain text attacks and is invertible.

Keste et al. [7] describe a method for transposing and reshuffling the RGB values of an image in phases that are effective in terms of security analysis. After RGB component shifting, additional RGB value swapping in the image file strengthened the security of the image against all currently feasible assaults.

Zhu et al. [8] suggested an exciting picture discretization method that uses Cat mapping. To achieve image encryption, the proposed method makes periodic adjustments. The encryption process for images of various sizes may employ multiple cycles. The trials demonstrate that the encryption approach may successfully encrypt images by selecting the ideal settings to get the best picture encryption result. According to the sensitivity analysis, this approach should work well for replacing and scrambling image pixels. This method's significant sensitivity to plaintext for encrypted security may factor in how well it handles varied plaintext attack scenarios.

Kaur et al. [9] presented a safe encryption method for digital pictures; it works with any digital file (e.g., text, image, audio, etc.). A block of secret bytes was ciphered using bitwise XORing and shifting, and after that, the ciphered bytes were shuffled N times (N is the secret key size). Utilizing dynamic SBOX and TBOX, this methodology combines substitution and transposition methods. It offers superior protection against brute-force assaults because the key for the proposed cryptosystem is large. The suggested algorithm's high acceptability is also demonstrated by critical sensitivity analysis, statistical analysis, and differential attack analysis.

Zhang et al. [10] suggested a new image encryption technique based on spatiotemporal nonadjacent linked map lattices. In terms of dynamics, the nonadjacent coupled map lattices exhibit more remarkable cryptographic properties than either the logistic map or coupled map lattices. Furthermore, they used a bit-level pixel permutation technique for the proposed image encryption, which allows bit planes of pixels to permute one another without requiring additional storage space. The results of simulations show that the suggested algorithm is more efficient and secure than other techniques.

Chandel et al. [12] examined various methods for encrypting and decrypting images. According to their research, the writers could identify the problem

formulation and analyze it, which allowed them to offer recommendations for future improvement.

In this proposed method, what sets us apart from so far-known methods and techniques is that the secret image is concealed inside the noises of a cover image with the help of three networks. The three networks are the Preparation network, the hiding network, and the Revealing network. Here various learning rates, many epochs, and activation functions like relu, tanh, selu, etc, are used for optimizing the results.

IV. PROPOSED MODEL / TOOL

The proposed model is displayed in Figure 2. The system consists of three networks, i.e., preparation network, hiding network, and reveal network, which helps in hiding and revealing images.

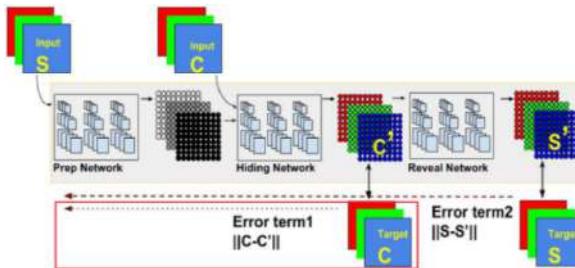


Figure 2. The architecture of the network

Preparation Network: This network develops the secret image to be hidden and serves two aims. First, when the hidden image (size $M \times M$) is smaller than the cover image ($N \times N$), the preparation network gradually increases the size of the small print to the extent of the cover, by distributing the hidden image bit's across the entire $N \times N$ Pixels. (For space reasons, this network does not provide details of experiments with smaller images and instead concentrates on full-size images). And the more crucial aim relevant to all sizes of hidden images is to convert the colour-based pixels into more useful features (such as edges) for succinctly encrypting the image.

Hiding Network: It is close to the preparation network defined above but includes an extra Conv2D sequential layer for connecting Gaussian noise to the cover. Here, the confidential information can be encrypted in bits other than the LSB of the cover image. It takes the output from Preparation Network as input and the cover image and creates the Container image. And the feedback taken in this network consists of $N \times N$ pixel field, with depth-concatenated RGB channels of the cover image and the transformed channels of the hidden image. For a more detailed study of this network, over 30 architectures were attempted with various hidden layers and convolution sizes; the best suited contains five convolution layers with 50 filters each of $\{3 \times 3, 4 \times 4, 5 \times 5\}$ patches.

Revealing Network: This network is used by the receiver and only takes the images from the container images, neither from the cover images nor hidden images. It helps to decode the container images and to reveal the hidden images by removing the cover images from the container images. The loss Function is the function that examines how much data are lost while moving the images. Reconstruction loss of cover image and hidden image are the two error terms that are contained by the loss function $L(c, c_0, s, s_0) = \|c - c_0\| + \beta\|s - s_0\|$. Here, c and c_0 represent original and reconstructed cover images and s and s_0 represents original and reconstructed hidden images. And beta is a hyperparameter that controls how much of the hidden should be rebuilt. The main purpose is to simplify the complete hiding task and reveal the hidden image. This network design model contains three parts, i.e., Preparation-Network, Hiding-Network, and Revealed-Network. Here, we will collectively gather these three parts to form an end-to-end system for hiding and revealing the secret image.

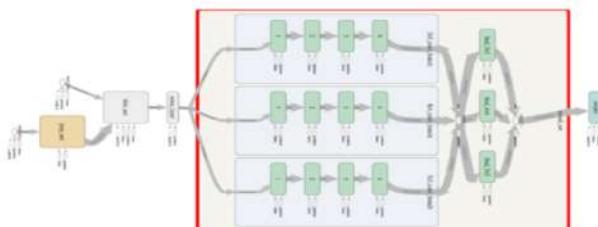


Figure 3. Architectural Design

Noise Layer: During the training of a neural network model, the addition of noise has a regularization effect and, in turn, optimizes the robustness of the model. It has been shown to have an analogous impact on the loss function as the addition of a penalty term, as well as in the case of weight regularization methods. Furthermore, the size of training datasets can be increased by adding noise. A training sample is exposed to the model each time when random noise is added to the input variables making them different every time it gets exposed to the model. This way, a simple form of data augmentation can be done by adding noise to input samples.

Conv2D Layer: Conv2D Layer is a library of Keras and implements a convolutional kernel that is wind with layers input which helps produce a tensor of outputs. A filter or kernel in a Conv2D layer "slides" over the 2D input data, performing an elementwise multiplication. Therefore, as a result, it will be adding up the results into a single output pixel. Similar layers are also represented within the Keras deep learning framework. Two-dimensional inputs, similar to images, are represented by Keras.layers.Conv2D.

The architectural design is shown in Figure 3.

V. IMPLEMENTATION AND RESULTS

In this experiment, the top two models, relu and tanh are compared to get a detailed analysis of which model will work efficiently for 20000 datasets. In other words, we are trying to find the model with the minor final mean image reconstruction.



Figure 4. Results of Conducted Experiment, selu vs tanh vs relu

The output will be derived in the format:

There are six objective examples as represented by six rows. The six columns represent the following:

1. Cover image (Input)
2. Secret image (Input)
3. Encoded cover (Output of encoder Network)
4. Decoded secret (Output of reveal Network)
5. Difference between the encoded and original cover (Diff Cover).
6. Difference between a decoded secret and an original secret image (Diff Secret).

The models are made to run for different epochs, i.e. 600 and 300, to get the optimized output.

The first model, selu, leave too many traces of the secret image while encoding it in the cover image. Due to the less efficiency of the model, we have yet to consider it for comparison.

The second tanh model leaves some traces (features) of the secret image while encoding it in the cover image. For example, a tiny portion of the secret image can be observed in the encoded cover image in this model.

The visible features reaffirm the previous point in the diff Cover column. This illustrates the dissimilarity between the pixels of the generated cover image and the original cover image. Ideally, both images should be the same, and the result should be a black picture as a secret image. But in the case of cover image difference, we can see some visible features which point to the fact that the obtained cover image is not identical by a little margin to the original cover image.

Comparing the results with the third model, we can see that it conceals the secret image much better, as there is almost no trace of the secret image in the generated cover image. Also, the difference between the original cover and decoded cover is mostly a black picture which points to the fact that the generated cover image was very close to the original cover image. Hence, from the metric visualizations, it is confirmed, that the first model performs the best.

Effects of Activation Function: Figures 5(a) and 5 (b) show the result of activation functions, and the corresponding images are given in Figures 6(a) and 6(b), respectively.

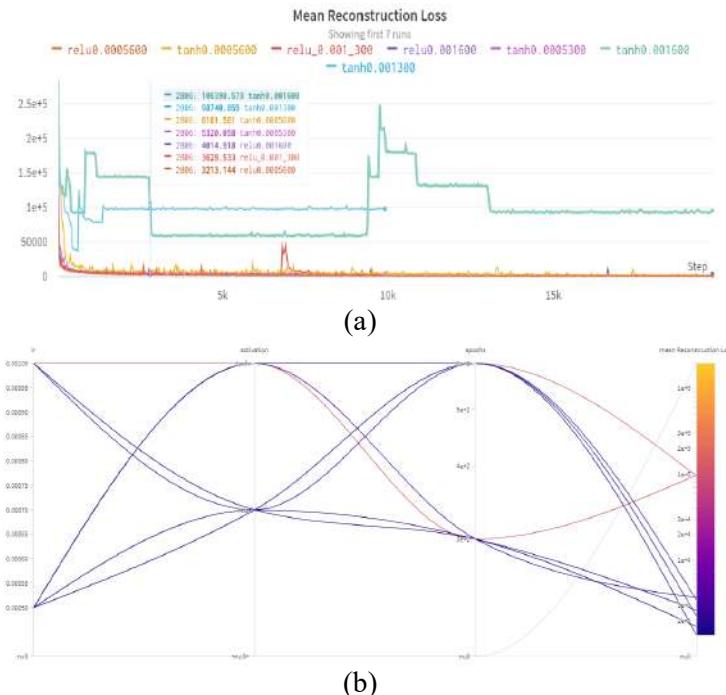


Figure 5. Effect of Activation Function



Figure 6. Results of Activation Function, relu vs tanh

Above, shown in Figure 5, is the effect of activation functions on the performance of the model. We have a side-by-side comparison of two models with all the same hyper-parameters that only differ in their activation functions. One uses relu activation, and the different uses tanh.

Effects of Learning Rate:

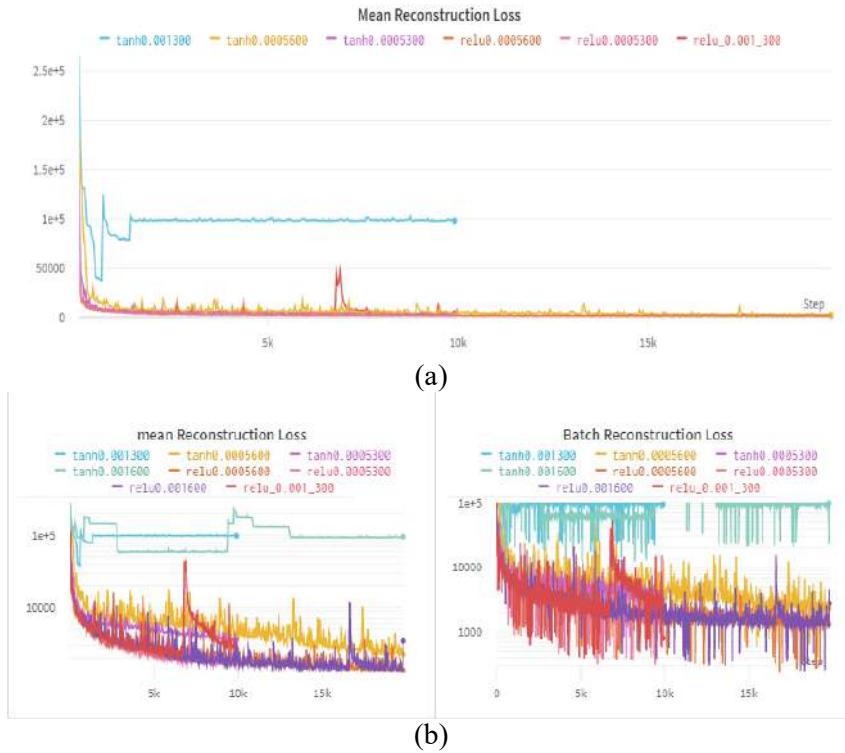


Figure 7. Effect of Learning Rate

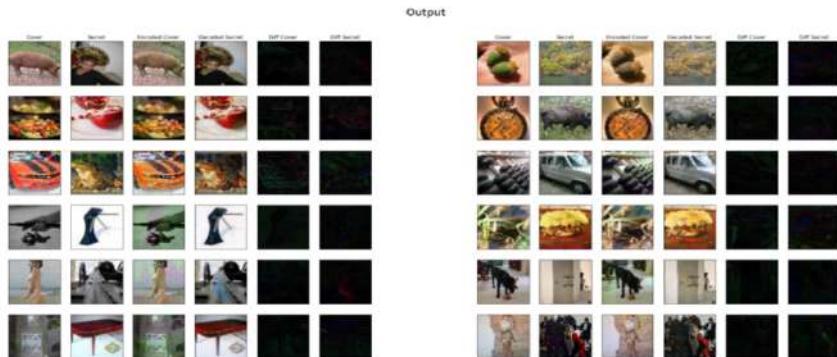


Figure 8. Results of Learning Rate, relu vs tanh

Another fascinating outcome from the metric visualization, as shown in Figure 7 and Figure 8, is that the model with tanh activation, while optimized using a higher learning rate, got stuck in some local minima, as pointed out by the flat mean reconstruction loss curve. Models with relu activation functions don't face this problem. Let's confirm our deduction by visualizing the outputs of the models with tanh activations that got stuck in local minima.

Table 1. Comparison of different compression algorithms

	Proposed	[16]	[17]	[18]	[19]
Accuracy	97	95.34	NA	NA	81.63
Dataset	ImageNet	Medical Images	ImageNet	ImageNet /CIFAR	Bossbase
Image Type	RGB	Gray	RGB	RGB	Gray
No. of images	20,000	4,000	1,00,000	1,00,000	10,000
Size of Image	64	512	64	128,256	512
Epochs	300	NA	NA	30	NA
Learning rate	0.001	NA	NA	0.001	0.001
Capacity	100	100	NA	100	100
Mean Square error	0.0001	NA	0.006	NA	NA

The experimental work of our proposed method is compared with other state of artwork with similar algorithms. Table 1 demonstrates the different parameters for consideration. The above table proves that our approach provides better performance concerning the artwork's condition.

VI. CONCLUSION

The proposed method concentrates on securing the image using the DNN scenario in the beginning; we have started our work by surveying multiple papers and concluded that there is still scope for improving the image and, thus, increase in the accuracy of the retrieved image. We experimented with our proposed work with 20,000 different pairs of datasets taken from Kaggle and other sources. We have experimented with the proposed method using CNN, encoder, and decoder, model with different activation functions like selu, relu

and tanh by varying learning rates, number of epochs and other parameters. After testing the accuracy achieved from the above test work is 97%. Thus, securing the image was successfully implemented in our proposed work. We can extend our proposed work using GAN.

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A Decentralized, Trustless, and Secure Cryptographic Identity Layer for the Internet

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Abstract- The world has applauded India for the fast-paced development of our hyper-scale consumer technologies such as the Unified Payments Interface (UPI), Shiksha Portal, Aadhar, E-Rupee etc which have led to the distribution and penetration of banking, education, identity and decentralized currency services to the extreme fringes of the country. This paper proposes another ecosystem that could be a similar addition to India's long list of technical achievements in the software arena. The SSI (Self-Sovereign Identity) Ecosystem has evolved over the years under the aegis of the SSIMeetup.org foundation. It has resulted in the development of several Proof of Concepts (POCs) based on issuing, accepting and verifying Verifiable Credentials and Presentations [1]. The story of the underlying Decentralized Public Key Infrastructure (DPKI) built upon indigenous blockchain frameworks [2] would usher in an era of Digital Identity for entities in general across domains, including the creation of non-impersonal health cards, secure and independently verifiable digital credentials, a new identity layer for the internet and even the possibility of integration with projects such as MOSIP enabling the creation of a system analogous to a white-labelled Aadhar system readily available for authentication and identity verification across the globe.

Index Terms- Decentralized Public Key Infrastructure, Digital Identification and Authentication, Self-Sovereign Identity, Verifiable Credentials

I. INTRODUCTION

The internet lacks a native identity layer. During its development by DARPA (Defense Advanced Research Projects Agency), networks were mainly experimental and small. The goal was to achieve wireless connectivity and intercommunication of information rather than identity. These early networks were usually limited to a handful of bulky machines operated by researchers who knew and trusted each other. This has changed over the years, with the internet developing into a public space and making it possible to remotely allow clients to connect to servers to avail of certain services. The lack of an inherent identity has emerged as a problem leaving us no way of identifying or verifying the entity controlling the underlying computing power and its intentions. Over the years, several possible approaches to authentication and permission boundaries for users have been proposed. Usernames and

passwords represent perhaps one of the earliest identification methods used for granting permission to authorized personnel and have continued to this date in conjunction with more advanced forms of authentication such as OAuth, 2FA, etc. but have gradually led to the fragmentation of a user's identity across multiple services and websites making them difficult to manage and extending a bad user experience. This was later resolved by introducing Identity Providers such as Google Auth or other social media logins, providing a comparatively safer and more convenient way of user authentication but lacking complete decentralization and rendering such Identity Providers a tempting target for cyber-attacks by malicious agents. These papers have been written in conjunction with an ongoing effort to create a set of open-source standards, frameworks and tools for the issuing, managing, receiving and revoking of Verifiable Credentials in a safe, secure and scalable manner with an approach modular enough to allow morphing and applying of the developed set of tools and frameworks to fit multiple independent use cases. Verifiable Credentials are closely rooted in cryptography and the concept of digital signatures extending a similar concept to those exploited in blockchains. The uniqueness and unawareness of a person's private essentials form the basis of the security and non-repudiation of a person's credentials. The management and handling of the corresponding public keys require the simultaneous development of an underlying robust Decentralized Public Key Infrastructure (DPKI) capable of handling the vast number of Decentralized Identifier Document (DID) resolution requests. Figure 1 shows a model based on a verifiable credential-based framework for the Indian education system.

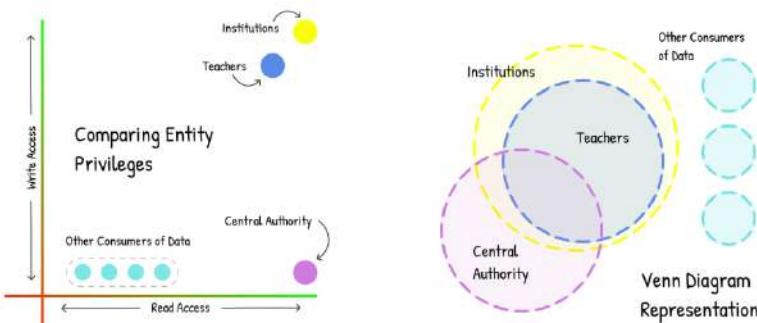


Figure 1. Modelling a verifiable credential-based framework for the Indian education system [d1]

The possibilities and applications that this Ecosystem can introduce are magnanimous, keeping in mind the obvious use cases of non-impersonate identities, including but not limited to verifiable health credentials, instantaneous verification of documents for purposes such as scholarship disbursement or VISA on arrivals, etc. Any document that we today carry in physical form in our wallets can be converted to their digital analogues and stored in a mobile wallet, accessible only by the user and yet verifiable across the globe. Current systems such as Digi Locker are based on centralized, secure

electronic cloud registries (ECRs), which limit their validity to the scope of the mobile app via which they are presented. To make such a system interoperable and promote the Unification of SSI across multiple interested vendors and applications, it is thereby necessary that the credentials themselves act as self-verifiable entities. How our current system and frameworks achieve, this has been discussed in detail in the upcoming sections of this text.

II. STATEMENT OF THE PROBLEM AND OBJECTIVE

The lack of an inherent identity layer on the internet has led to the development of various application layer solutions that try to simulate a virtual identity layer. However, history has shown that such systems have been, time and again, vulnerable to hacking and unauthorized use resulting in losses and giving birth to cybersecurity. Therefore, most of this text revolves around the usage of the w3 specification-based concept of Verifiable Credentials, Verifiable Presentations, Decentralized Identifiers (DIDs) and the establishment and development of an underlying Decentralized Public Key Infrastructure (DPKI).

The objective of this paper is to take the reader through the various frameworks we have experimented with and then define a formal software-oriented approach to designing such a system. The w3 specification on the abovementioned topics abstracts out the technical complexities involved in translating such a concept into modularized real-world code. That is precisely what we have done, and we are open-sourced via this project. The idea of Verifiable Credentials has long attracted attention from identity experts worldwide to achieve a decentralized public identity system independent of any third-party influence and possess the capacity to issue, manage and receive standardized digital credentials globally. This concept was kept in mind while designing the code accompanying this paper.

Furthermore, much thought has been put into enabling the frameworks developed to be interoperable irrespective of the vendor who provides the app. This example is somewhat like how the UPI protocol is used by companies such as GPay, BharatePe, PhonePe, etc., to power transactions and yet have vastly different features and experiences. The vendors may be other, but the underlying protocol, i.e., UPI, is interoperable across those vendors. This magnifies the power of UPI by a significant factor allowing for fair competition and access to a national payments distribution system. This project aims at achieving a similar feat but rather in terms of the methods used for distributing, storing, and managing public and private key pairs to enable an effective identity management system. Figure 2 shows the overview of the centralized model and self-sovereign model.

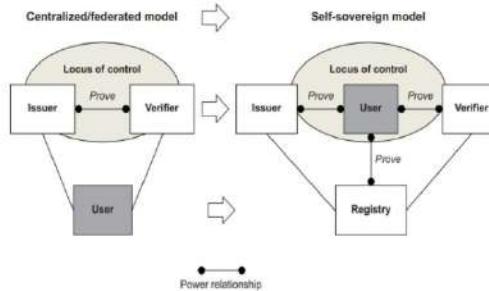


Figure 2. Centralized model vs Self-sovereign model

In our proposed system, every entity in the network is essentially represented by a private and public key pair. The private key is held locally by the entity. In contrast, the public key is published to the Decentralized Public Key Infrastructure (DPKI), which can then be used to verify digital signatures, proving ownership or authority over digital assets such as credentials or messages. Whenever a user creates a new identity, it forms a new public-private key pair and a set of other keys that could be used for purposes such as authentication, authorization or proving ownership over the credential. This digital signature system is what makes the credentials inherently verifiable. As mentioned earlier, certificates are in their native form and stored on the entity's system(s) in encrypted JSON objects. These objects are encrypted using the entity's private key and can only be accessed and decrypted when required with proper permissions by an intermediate vendor app. These vendors or third-party apps help visualize, collect, and present these credentials. All these vendors must comply with a set of rules post which they can use the API exposed by our system and start leveraging the power of verifiable credentials.

Another possible proposed application of this system could be in the form of adding a 6th layer to the existing 5-layer model of the current Internet Protocol Stack, somewhere just beneath the application layer, to render identity services to the application layer directly and thereby fill the void and vulnerabilities that the absence of such an identification layer posed as the internet developed. This would also result in accelerated growth towards realizing a robust underlying DPKI infrastructure fueled by the need to store trillions of public keys in a secure, decentralized, and non-tamperable manner. Links and references to the appropriate resources, as well as specifications which were followed or generated during the development of the framework, have been added as and where deemed required for a better understanding of the problem statement and objectives which the result of an open-source SSI ecosystem aims to solve. As already mentioned in the earlier sections of this text, the vast applications make Verifiable Credentials a venture worth exploring on a large scale. Singapore seems to have taken a step further into digitizing experiences and services for its citizens via the creation of Singpass. This online digital identity allows the delivery of services and information to citizens in a convenient manner and at scale. We hope that our project will be able to significantly impact the

development of an open-source Self-Sovereign Identity Ecosystem and help usher in a new era of digital identity, something that has been missing since the birth of the internet.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED.

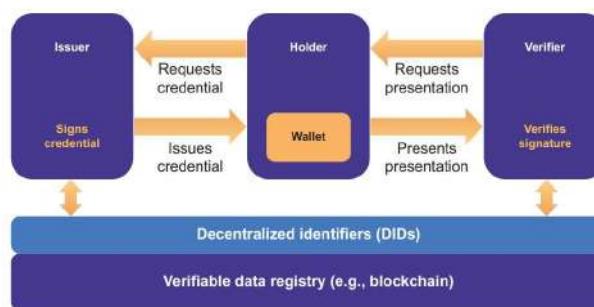
The project presented via this paper is the culmination of months of ongoing effort during the national Code 4 GovTech Fellowship, 2022. During the development and creation of this project, a lot of brainstorming sessions ensured that the decisions being made were in line with not only the core aspects of the Verifiable Credentials but also scalable and robust in nature, ready to be deployed across use cases and domains which could significantly benefit from the use of non-impersonal identities. The first and foremost challenge was to create the tools necessary for the underlying Decentralized Public Key Infrastructure (DPKI) [3]. The initial and most obvious conclusion was to use a Golang-based Ethereum Virtual Machine called Geth with inbuilt support for Proof of Authority (PoA) and Proof of Work (PoW) consensus mechanisms. Other consensus mechanisms also exist [4]. PoA and PoW are thought to be the most popular and widely used ones. This was built and tested, but the architecture's scalability soon became evident due to the prohibitively high gas fee costs on the Ethereum Blockchain. With the Ethereum Virtual Machine out of the way, the focus was directed towards Dhiway, a rust-based, indigenously developed blockchain with negligible gas fees.

While development on Dhiway-based containers was underway to establish a blockchain network for testing, our research introduced us to verifiable credentials. They were comparatively much simpler and more cost-effective rather than using bulky nodes to run the blockchain kernels. The problem, however, lay in the architecture of the underlying DPKI system, which had to be decentralized and made non-tamperable [5], something which we thought would not be possible without a blockchain. After searching for alternatives, we came across two potential candidates for distributed and decentralized databases [6]: GunDB and OrbitDB. GunDB was chosen due to its lightweight and easy-to-set-up nature. It is a real-time graph-based distributed decentralized database with built-in authorization and permission management systems. The architecture can be better understood by referring to the diagram under the Proposed Model Section. The development of gateway servers, DID resolvers (and keeping in mind the associated security vulnerabilities [7]), verification servers, issuers, wallets and the underlying DPKI network was done, and version 1 of the system was created, successfully tested and presented. Work on version 2 commenced shortly after, with plans to make the system even more robust and smooth and integrate it deeper into existing technologies such as the IP Stack. Current efforts on this project are directed towards developing a custom IP Stack which leverages the underlying test DPKI network to introduce verifiable credentials at the core level to the internet. Suggestions from our mentor(s) have been extremely helpful in fine-tuning the tech stack

used throughout this vastly complex project with various tangents, each capable and noteworthy of being separately mentioned and defined in the context of the SSI ecosystem. As mentioned earlier, very few functional projects exist in this domain, primarily due to the highly complex nature and the amalgamation of many frameworks involved [8]. It is again worthwhile to note that the most progress in work done in the field of digital identity can be seen in Singapore and its Singpass initiative that has empowered service and information distribution to citizens and ushered in smoother G2C (Government to Citizen) communication. The fact that this technology is not available in the open-source domain has motivated us even further to create this project to help mass cross-domain adoption of this technology. We have been working and shall continue to work on the technological shortcomings in this project with the help of the open-source community and hope to leave an impact on the Self-Sovereign Identity (SSI) Ecosystem.

IV. PROPOSED MODEL / TOOL

AckShare (the name of our verifiable credential-based credential-sharing framework) represents a collection of software spanning multiple tech stacks, working independently to enable the creation of an ecosystem capable enough to handle the sharing, managing, and receiving of credentials between participating entities. The proposed model has been divided into a few significant components. A brief overview of these components has been given below, followed by a slightly deeper introduction to the functionalities of each of these components.



The primary roles involved with exchange of verifiable credentials

Figure 3. Proposed Model Architecture

- Maintaining a **Centralized Registry** and an associated **API Gateway** containing user identities and associated data (such as public keys and fields related to the verifiable credentials) and acting as an intermediate storage medium for authorization, credential issuance/presentation requests.
- Creation and Maintenance of independent **Verifiers** (Django servers which expose REST APIs to clients) can be used to easily verify credential signatures and validate request structures.

- Creation of the **Holder App (Digital Wallet)** to store private keys and enable convenient sharing, verification, and presentation of digital credentials. A mobile application, web application or desktop application could represent this app.
- Creation of an **Issuer Interface (Web Dashboard)** to allow issuing new credentials, requesting data from specific certifications, and easy management of already given credentials.
- Maintenance of an open-source community-maintained **Specification Registry** containing mutually agreed **field names, rules, and constraints**, using which credentials would be validated by the verifiers before being issued or signed for integrity testing.

Every system/tool is responsible for performing a particular core set of functions. Listed below are the most atomic and fundamental operations performed by the abovementioned modules.

Active Components (Voluntary Participants)

- **Issuer Features (Desktop Application)**
 - Login / Register as an Issuer (Individual / Organization).
 - Issuing and Revoking a Credential (Managing).
 - Requesting Credentials and Data from Holder.
- **Holder Features (Mobile Application)**
 - Login / Register as Holder (Individual / Organization).
 - Presenting a Credential and Authorizing Requests.
 - P2P Transferring of Credentials.
- **Verifier Features (Web Server)**
 - Exposing an API endpoint to allow services to verify signatures.
 - Update Cache upon broadcast from Specification Registry.
 - Cache Public Keys to Database.

Passive Components (Facilitates Exchange of Data in the System)

- **Specification Registry (Open-Source Repository)**
 - Stores various fields and associated validation constraints.
 - Stores a list of trusted verifiers.
 - Consists of a register.json file for quick look-up and validation.
- **Centralized Database (SQL Database, PostgreSQL)**
 - Stores Templates and Schemas created using fields agreed upon by the maintaining community and present in the Open-Source Specification Registry.
 - Contains public holder/issuer data mapped to their respective public keys.
 - Acts as a repository that temporarily stores authorization requests and encrypted credentials until they are fetched and approved/rejected by the intended receiver.
- **API Gateway (Web Server)**
 - Exposes a set of authenticated APIs for secure access to data.
 - Implements middleware functionalities like authentication, logging, load balancing, etc., to enable horizontal scalability of the system and adopt microservice architecture.

- Provides integrated DID/ID resolution services to efficiently map URIs or Decentralized URIs to the correct resources as and when required.

A complete Software Requirement Specification (SRS) for the above core functionalities has been provided in this document, and the reader is encouraged to go through it for further understanding of the system that has been developed.

A further layer of classification can be introduced to the proposed model based on the various user types and user classes the AckShare framework represents. We do this in the hope of providing the readers with a far better and deeper insight into the entities involved in the proposed Ecosystem.

Based on User Type

- Individuals who leverage the platform for sharing peer-to-peer credentials.
- Companies / Organizations that adopt the platform to issue verifiable credentials to their clients, customers, employees, etc. and possess the ability to revoke credentials at their discretion.
- GovTech (Government Technology) firms that extend the use cases of identity management and the promise of verifiable credentials to enable more competent governance and G2C services.

Based on the Role played in the Ecosystem.

- *Issuers*: Individuals or organizations involved in issuing Verifiable Credentials can also request specific credentials from a holder.
- *Holders*: Individuals or organizations who own the Verifiable Credentials in their digital wallet and present them in a verifiable manner to the required people or organizations when necessary.
- *Verifier*: Independent servers which are used to cache public key data for future use and help in verifier signatures (which in turn help in verifying credentials)

V. IMPLEMENTATION AND RESULTS

The v1 Proof Of Concept (POC) for the AckShare framework was created to prove the impact that verifiable credentials can have on the GovTech Ecosystem as well as the further extension of these use cases to domains other than just governance, such as the Healthcare sector, Banking Sector, Food Sector (where it could be used to combat misinformation related to food products and help in raising consumer awareness), and many more. However, our imagination limits the possible use cases of this technology and morphs itself seamlessly to represent all these use cases, and it is of utmost importance to make it as interoperable as possible.

The various frameworks and technologies leveraged to develop, test, and ensure the interoperability, scalability, and reliability of the AckShare framework have been mentioned as follows.

- **Mobile Application (Digital Wallet)**: React Native, Cross Platform, Android & iOS

- **Desktop Application (Issuer Dashboard):** Express, Cross Platform, Windows & macOS. The user interface is accessible via any browser. In addition, local APIs are accessible via Postman.
- **Verification Server (Web Server), API Gateway (Web Server):** Django, Cross Platform, Windows & macOS. The user interface is accessible via Django's built-in admin panel.
- **Storage:** Cloud-based auto-scalable PostgreSQL containers. Redis for caching and message publishing. Decentralized solutions such as IPFS can be exploited for immutable storage.

The initial approach took a monolithic system for the gateway server, a custom private blockchain network based on the Proof of Authority consensus mechanism running on the Goland implementation of the Ethereum Virtual Machine, and the ability to connect to multiple public blockchains to deploy and interact with publicly available smart contracts or minted tokens via the python Brownie framework [9]. In addition, a privately hosted IPFS Cluster was to be used as a storage mechanism in conjunction with a caching service to index and speed up frequent queries. The system architecture for the initial proposed design can be seen below in Figure 3.

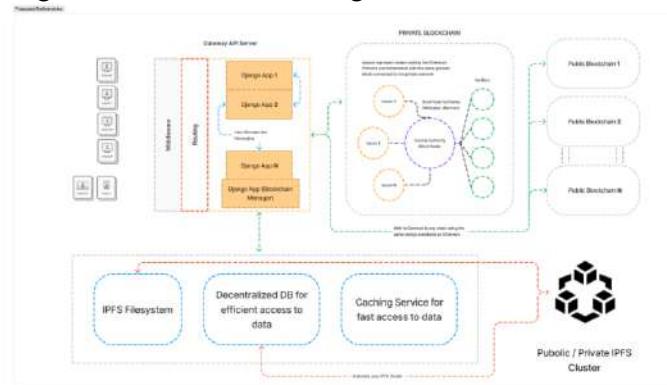


Figure 3. System architecture for AckShare v1 [d2]

This version was subject to iterative changes as research progressed in this area, and we came to know about the existence of the W3 Specification on Verifiable Credentials. The specification has been of utmost help and pushed towards redesigning the entire system towards a more modular and components-based architecture involving distinct entities interacting with each other via cryptographically secured and signed credentials. The transfer of certificates between entities is shown in Figure 4.

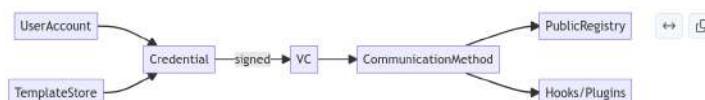


Figure 4. Transferring credentials between entities

The entire architecture we finally developed has been described in detail in the Proposed Model Section, along with the various tools and frameworks we used to translate the abstract specification into concrete, tangible code. The system consists of verifiers, issuers and holders who communicate with each other in the presence of a central registry (which is responsible for validating the integrity of the transactions), and all this is based on a solid underlying DPKI ecosystem.

The testing of the backend revealed a smooth and properly functioning system. The exposed API endpoints were tested via Postman requests, and dummy data was pushed to the central registry to initialize the verification servers and local desktop application. There are a lot of other things we plan to contribute, including but in no way limited to the containerization of these services into docker images enabling single-step setups and the development of a robust Python SDK. Support would be extended to other languages as the project grows and more contributors well-versed in different programming languages decide to contribute translations of the SDK. We are currently working on improving the UI integrations for the backend systems to improve user experience and bring verifiable credentials to the general public while abstracting out the jargon involved. Interested readers can view the action flows documentation here to get an idea of the functionalities that our system is currently capable of.

VI. CONCLUSION

Verifiable Credentials and the Self-Sovereign Identity Ecosystem are set to revolutionize how we handle digital identities in today's modern world. It is high time that we accelerate the development of identity management and enhance already existing techniques by looking at possible intersections where merging them with the concept of Verifiable Credentials would be of logical significance. Even though this project was developed with a purely govtech focus in mind, we have realized the critical role it can play in innumerable arenas and upcoming domains. Other technologies, such as Zero Knowledge Proofs (ZKPs), can end up being integrated with Verifiable Credentials and hence result in an even more secure identity layer that prevents information leaks by providing a particular amount of information required. The best aspect of having Self Sovereign Identity is that users can now be the sole and complete controllers of their online identities.

No third-party identity provider would be required, and privacy would be at its peak. Concerns regarding the proper management of private keys and methods to enable personal key recovery are currently being addressed by ongoing research on these topics. A possible inspiration could be from existing cryptocurrency wallets that will allow users to view and manage their cryptocurrency funds. These wallets inherently work based on public-private key pairs, with a part of the public key forming their public address. Upon account creation, they usually display 12 words which are supposed to be kept

secure and can be used to recover the account in case of loss of private key. A similar mechanism can be adopted for the system proposed in this paper, ensuring individual access to the resources is maintained even after losing private keys. A lot of work still needs to be done, but we hope this paper can contribute something worthwhile to this Ecosystem.

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Design References

- [d1] <https://www.figma.com/file/x7bJb8ris4aMR7458pClbe/Entity-Privileges-and-Relationships>
- [d2] <https://www.figma.com/file/RUeqndfGndsiQ0s26R6TVe/Low-Level-Overview?node-id=0%3A1>

• Estimated benefits to society and generation of income

The primary benefit that this project aims to develop is directed towards the implementation of a national verifiable credential ecosystem. Although the project does not directly contribute to a generation of income, it enables the easier and faster verification of credentials which may lead to faster disbursements of compensations by the government, easier proof of ration cards and more efficient distribution of G2C services. The measurable factors are listed in the next section of this text. They can give the reader an idea about

how indirectly the development of this system can lead to income generation or better distribution.

- **Measurable Project Indicators**

Following are the ten tangible/non-tangible indicators according to the SERVEQUAL model to assess the service quality of the project developed:-

S.No.	Indicators
1	Increase in crop production
2	Increase in land productivity
3	Change in land use pattern
4	Increase in family income
5	Improved linkages with Distt. authorities/State Govt/ PRIs
6	No. of SHGs/technology user groups/cooperatives and/or enterprises formed
7	Improved linkages with market/enterprises
8	Adoption of newly developed products indicated by the number of adopters
9	No. of organizations motivated and mobilized for replication of project achievements
10	No. of publications produced (Title, Journal, issue, yr.)

Our project has been developed to cater to and keep in mind the following indicators.

Improved linkages with Distt. Authorities/State Govt/ PRIs allow faster benefits disbursements under the various active government programs and enable easier verification.

Improved linkages with markets/enterprises are again somewhat like the point mentioned above, where markets can be decentralized. A great example of this is already underway at the Beckn foundation, where they are trying to decentralize the eCommerce space and help consumers with the freedom to discover services, including day-to-day services like mobility, food, and grocery delivery in any consumer-facing application.

The number of adopters indicates the adoption of newly developed products. There exist numerous possible adopters of our technology. One such example could be MOSIP (Modular Open-Source Identity Platform) which aims to help Governments and other user organizations implement a digital, foundational identity system cost-effectively. Even nations can use MOSIP freely to build their identity systems, and verifiable credentials could emerge as a fundamental part of this Ecosystem.

Smart Battery Charger

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Abstract- This project is used to build a charging station that charges the battery efficiently and is user-friendly. The charging status and other operations can be monitored anywhere using the internet. As petrol and diesel are exhausted, the project aims to make intelligent and user-friendly battery charging stations. The station consists of two operation modes: regular and fast charging. The customer itself selects these modes. Depending on the method chosen, the time taken to charge the battery varies. These stations can be installed for every 5-10 km distance. As the new era is emerging for electric vehicles, power up the batteries is used. Thus, to charge them for a long-distance ride, these types of stations are used. The user can either swap the battery or can wait and charge his battery. A simple buck-boost converter is used to charge the battery and to change the mode. The clock pulse is sent, and the switching speed varies depending on the method.

Index Terms- Battery, Charging Station, Buck-boost converter

I. INTRODUCTION

The project's main aim is to build a charging station with an efficient charging circuit that charges the battery fast and efficiently with other facilities to the user, like checking the status and availability of the battery through the internet. A battery charger is a circuit that helps to charge the battery. Depending on the type of battery, the charging circuit varies. Constant current, voltage, pulsed charging, and burp charging (negative pulse) are some methods for charging. Constant current and voltage method is used to assess the lithium-ion battery. We use a buck-boost converter; initially, the circuits work at CC mode (Constant Current) until the battery reaches 50-60%, and then the mode changes to CV mode (Constant Voltage) until the battery is fully charged. The process should be done carefully so the battery does not get damaged. Buck-boost converters are used to switch the mode and supply constant voltage and current. Buck-boost converters consist of both buck converters and boost converters. At first buck converter is used to provide continuous current, and then the boost circuit to supply constant voltage. The battery temperature should be monitored. The battery must not be charged when the temperature is lower than 0°C or greater than 45°C. The sensors take care of monitoring the

voltage, current, and temperature. The Wi-Fi module sends all the received data to the internet, which the user can see and access.

II BACKGROUND WORK AND TECHNOLOGY GAP IDENTIFIED

The authors of [1] explain the design and formulae required for an interleaved buck-boost converter. First, the inductor and the capacitor values are calculated as the author specified. Next, the author gives information buck-boost converter, which converts variable DC voltage from the windmill to the constant DC. Here, the author proposes the design and implementation of the bi-directional DC-DC converter.

The authors of [2] mentioned charging the battery in constant current and voltage mode with waveform. Here they use the same buck-boost converter. The battery operated here is for Standalone photovoltaic systems. It introduces charging algorithm aspects, the topology of the converter, and its control loops.

The authors of [3] discussed Multiphase dc-dc converters and how they are designed and constructed. The effect of a coupled inductor on both the inductor and the output current ripple is studied in detail. The analysis showed that the coupling coefficient should be high enough to reduce the inductor current ripple effectively.

The authors of [4] analyze the effect of switching frequency on the performance of buck converter. The higher the switching frequency, the smaller inductor and capacitor are needed, and a better dynamic performance can be achieved while it decreases the efficiency with the increase of switching frequency. The influence of changing frequency on buck converter performance in terms of efficiency can be seen in this report.

The authors of [5] describe the design and implementation of Interleaved Buck Converter used in network communication for Femto Technology. The reduction of the input voltage ripple and the increase in the efficiency of interleaved buck converter for a suitable supply side of the femtocell were discussed. Here the comparison of the open loop and the closed operation of the interleaved buck converter is made with the increase in the stability and the dynamic performance using the PID controller.

The authors of [6] describe the working of a basic buck-boost converter. First, the waveform of the waveform modes (CC and CV) are shown clearly. Here they use a buck-boost converter to design a power bank. The electrical performance is also discussed.

III. PROPOSED MODEL

The overall block diagram of the proposed project is shown in Figure. 1. Each component of the block diagram is briefly introduced in this section.

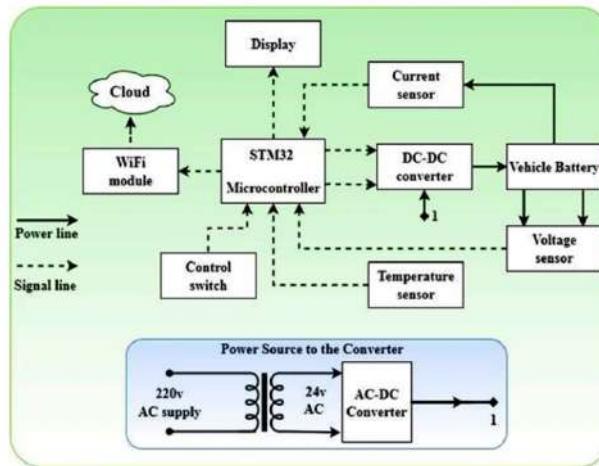


Figure 1. Block diagram

AC to DC converter: This circuit converts AC to DC. There are three AC-to-DC converters, half-wave rectifiers, full-wave rectifiers, and bridge rectifiers. Here we use a diode bridge rectifier module(KBPC3010). The output obtained is pulsating DC which is not pure dc. A bridge rectifier consists of 4 diodes interconnected in a bridge form.

DC to DC converter: DC to DC converter is a circuit that increases or decreases the voltage magnitude of the DC supply. Depending upon the mode of operation, the dc voltage magnitude varies. Here we use an interleaved buck-boost converter. Depending upon the mode of operation, the voltage and current are kept constant; in CC mode, the wind is kept constant, and in CV mode, the voltage is kept constant. The modes are varied using the MOSFET switching process, and the switching speed is decided by action. The inductor and capacitor are used to store and restore the charge continuously, so there is no interruption in the switching operation. PWM is connected to the MOSFET gate to control the switching speed. A freewheeling diode is used for protection.

Microcontroller: Here, we use STM32 (STM32 F103 C8T6 or STM32 F401CCU6) as a micro controller. It is a 32-bit processor, having a CPU frequency of 72MHz and 12 PWM pins. Compared to other boards like Arduino, it works faster. It has 37 GPIO pins and a (12-bit) Analog pin. The project's main component calculates, transfers, and receives the sensor's data and displays the value. Programming this board is done by many methods, One by STMCUBEIDE and another by installing the required drivers in Arduino. Then, we can upload the program. Here the controller gives suitable PWM to the Mosfet, receives the sensor's data, and displays it in the LCD. It also transfers all the received data to the internet through a Wi-Fi module.

Voltage sensor: This sensor works based on the principle of resistor divider to reduce the input voltage by five times. The maximum input voltage of the controller is 5V, and the minimum of 3.2V. The analogue resolution of the

module is 0.00489V (5V/4095), so the voltage detection module detects that the input minimum voltage is $0.001221V \times 5 = 0.00610V$. According to the value measured, the voltage is calculated and displayed. The sensor has three pins as an output, ground, VCC, and signal. The signal pin is connected to the analogue pin of the controller. The input is connected in series to the battery to monitor the voltage.

Current sensor: This sensor is connected in series to the battery to measure the current. Initially, when the battery is not connected, the module will have an internal voltage of 2.5V. Thus it is necessary to subtract 2.5V from the voltage measured at the analogue pin. The sensor has three pins as an output, ground, VCC, and signal. The signal pin is connected to the analogue pin of the controller. The analogue resolution of the module is similar to the voltage module; the results are subtracted by 2.5V.

Temperature sensor: The surrounding temperature of the battery is sensed by the temperature sensor. Here we use LM35, which measures range from $-55^{\circ}C$ to $150^{\circ}C$. The sensor has 3-pins ground, VCC, and signal. The signal pin is directly connected to the analogue pin of the controller. The temperature measured is shown in Celsius. The battery should not cross less than $0^{\circ}C$ and more than $45^{\circ}C$.

Display: Here, we use a 16x4 show. It has 16 pins; connecting these 16 pins to i2C, we connect to the controller. Using i2C, we can transfer data to be transferred within two pins. The i2C module has four pins, SCL, SDA, Ground, and VCC. SDA is connected to the i2C data pin, and SCL is attached to the controller's clock. The address of the i2C should be mentioned in the program. LCD comes with green and blue backlights.

Wi-Fi module: ESP8266 is used to send the data to the internet. Here we send data to the think speak website. Think speak is a website that gives free access to non-commercial projects. ESP8266 is an 8-pin module. It transfers data serially. The API key should be mentioned in the program. The module should always be connected to the internet.

Control switch: Here, we use three push buttons, one to go to the menu, one to select regular charging, and the other to choose the fast charging mode. There are two modes of operation one is for normal charging mode and the other for fast charging mode.

IV. IMPLEMENTATION AND RESULTS

Gathering data: The formulae used for calculating inductor and capacitor are calculated using as per in paper(1). The circuit for the inter-leaved buck-boost converter is done, and the program is in such a way that, in CC mode, the clock pulse is applied to the buck (MOSFET 1), and in CV mode, the clock pulse is applied to the buck (MOSFET 1). Here the frequency assumed is 1kHz and 50%

of the duty cycle. Figure.2 shows the clock pulses applied to the converter circuit.

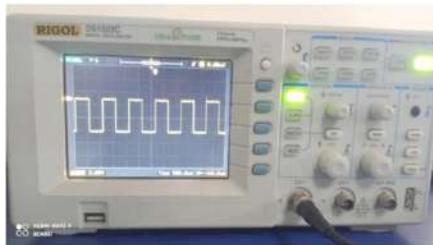


Figure 2.Clock pulse to the converter circuit

Processing: At first, when the power is turned on, the project's name is displayed. Then the sensors detect the value of the parameter. The value detected. i.e. voltage, current, temperature, and other parameters are calculated and displayed in the display. Next, the sensor's detector detects whether the battery is connected; if connected, the status of the battery is shown. If not connected, the display displays battery is not connected. After connecting the battery, the status is analyzed by the sensors and displayed in the display. Now the system asks the user to select the mode of charging. Depending upon the method chosen, the display shows the charging symbol and charging status. In the charging circuit, the supply 220v is step-downed and converted to dc using a bridge circuit; this converted power is given to the input to the DC-DC converter. Then, depending on the mode of operation selected, the gate pulse is applied to the converter. Finally, the converter's output is connected to the battery to charge. While charging the real-time status of the battery is calculated and displayed in the display by the STM32 processor. When the battery is fully charged, the display indicates that the "Battery is fully charged", and it automatically stops charging the battery. The displayed parameter can also be seen using the internet. Figure .3 shows the prototype model.

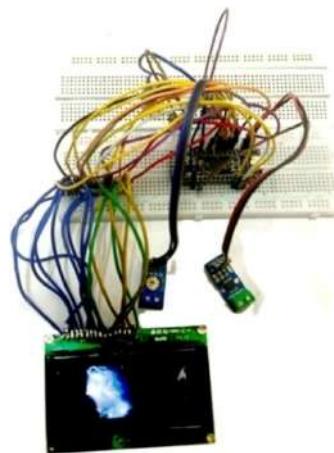


Figure 3.Prototype model

V. CONCLUSION

In the project, the intelligent battery charger is made to charge either in normal or fast charging mode. The voltage, current, and temperature parameters are measured by the sensor and displayed. The project uses interleaved buck-boost converter for DC-DC conversion. The values required to calculate the inductor and the capacitor are calculated by referring to [1]. Depending upon the type and model of the battery, the time taken for charging varies. The parameters of the battery are regularly monitored, and data is updated to display.

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Web-Based Application for Healthy Lifestyle

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Abstract- A healthy lifestyle is essential for human beings. Work pressure, environmental factors, lifestyle, food intake, etc. are some of the main challenges in maintaining a healthy life. These challenges became worst during the pandemic due to the Covid-19 virus. Due to a hectic work-from-home schedule, health management, regular exercise, and even doctor consultation on time have become challenging. Nowadays, technology is a part of every sector, including health monitoring. To make a robust intelligent health monitoring system, in this study Web-Based health monitoring application is proposed to provide different user-friendly interfaces that allow users to track all the information regarding their health. The application uses Log Meal API (Application Programming Interface) and RFID (Radio Frequency Identification) cards to provide the daily and weekly wise nutrient values in the food consumed by the user. Google Charts is integrated with the application to give a graphical representation of their nutritional content daily and weekly. This helps the dieticians to suggest proper food for the users and to track the food consumed by them. Management of dieticians' appointment scheduling through the application helps reduce the Workload of users and dieticians. The application also allows dieticians to access previous medical reports of patients by scanning a one-time QR-Code. This facility secures the patient medical information from unauthorized access. The Tablet Remainder hardware model is proposed to help users to take their tablets on time.

Index Terms- Nutrient, QR-Code, LogMeal API, RFID cards and Auth0, Appointment Scheduling

I. INTRODUCTION

In recent years, the world is witnessing substantial health-related challenges. Millions of people worldwide are facing health problems like obesity, heart disease, nutrient, vitamin and calcium deficiency, cancer, weakness, etc. [1]. The main reason is eating junk food, overeating, lack of fitness and an unhealthy life style. Before Covid19, most people failed to maintain good health due to a heavy workload, lack of exercise and unhealthy food. Since Covid19 hit, people have become more conscious of taking care of their health by managing diet plans and training [2]. As the number of people with health problems is increasing alarmingly daily, more people are visiting hospitals; because of this, there are long lines for checkups, scans, and tests. With patients

visiting multiple hospitals for different checkups, managing all the files is becoming a tedious process for the healthcare community, which may result in the loss of specific crucial files or prescriptions. Fewer user-friendly health monitoring applications or websites are currently available to provide all information in one eye glance[3]. Currently, there is no application which provides all the following facilities in one single application,

- Tracking exercise duration,
- Type of healthy food the user must take.
- Automatic notification regarding the percentage of nutrients consumed daily and weekly wise.
- Automatic scheduling of doctor/dietician appointments.
- A notification facility for the patients as a reminder regarding the medication from time to time and how much they eat still needs to be created.

The main aim of this project work is to provide an interactive and user-friendly health application/ website. With this application/website, people can accurately track the food they eat and the nutrients in it. Based on the track of nutrients consumed by the user, the application encourages the user to work out and exercise daily to keep themselves fit and healthy. The registered dieticians/doctors can track the percentage of nutrients consumed by the patients, enabling the dieticians/doctor to suggest healthy food tips, exercise, and medication. The project also focuses on providing users interface to schedule their appointments according to their convenience. Users can securely store their medical reports/scans/prescriptions on the cloud. Registered doctors/dieticians can access registered users' previous/ current health records by scanning the user's QR code. With this, analyzing the users' medical history becomes easy for the doctors/dietician. The implemented application provides a one-stop solution for all healthcare needs, efficiently managing the doctors' Workload and encouraging users to stay fit and healthy.

II. BASIC CONCEPTS AND TECHNIQUES USED.

Monitoring health in a busy workload is challenging for most people. Therefore, there is a need for a fully web-based automatic health monitor application that works like an assistant for the user. To develop a fully functional web-based application to track registered users' daily and weekly wise nutrient consumption through Google charts. It allows the user to store their medical records securely on the cloud and to schedule the doctor/dietician appointment. The application should allow only the registered doctors to access the medical records of users in a secure way by scanning the QR code assigned to the user. In addition, the application provides reminder notifications to the users to take the medications on time.

Objectives:

- To track the calorie intake of the customers.

- To monitor patients' health conditions and medicine in take.
- To enable customers to watch their exercise/workout.
- To enable doctors to provide the time slots during which they are available to allow patients to book appointments accordingly.
- To store the records digitally.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED

Prolonged exposure to food deserts can contribute to inequalities in health outcomes [4][5]. Even though individuals can physically access healthy foods; however, additional economic, educational, and behavioural constraint can limit real opportunities for behavioural change[6][7].

The “Smart APPetite” research project was presented in [8]. In this proposed work upfront survey, study monitoring with web analytics software, experience sampling, and follow-up surveys and interviews were considered to determine the food behaviour of the participants. In the result analysis phase, a total of 208 participants were supposed to carry out follow-up surveys and interviews to assess the food behaviour of the participants. These properties were used to determine the nutrient intake of participants. In[9],the study focused on validating dietary record apps. The diets were exclusively self-reported in a real-life setting. The pooled results from the included validation studies showed that dietary record apps could underestimate energy and macro nutrient intakes compared with traditional methods. Finally, the author[10] investigated the features and abilities to assess dietary intake among Japan's five popular diet-tracking apps.

In[11], a health monitoring system was proposed based on a user behavior model implemented with Complex Event Processing (CEP). J Riprule-based classifier was applied to extract the thresholds from the previous dataset to set the threshold for the current set of rules. The proposed model was tested on both hospital and activity data set. The result analysis showed an accuracy of 15% for adaptive health monitoring systems against non-adaptive health monitoring systems. The intelligent home development work was proposed in [12] based on integrating fog computing with the Internet of Things (IoT). The health monitoring system was developed with embedded data mining and fog computing. The work also facilitated distributed storage of the data and notification of services. Work was evaluated on the health data of 67 patients collected from IoT smart homes for 30 days and achieved higher accuracy than the Bayesian Belief Network classifier. The IoT-based intelligent health monitoring system was proposed in[13]. In this architecture, fog computing and IoT were integrated using the health centre's computers that act like servers. Connectivity among the IoT components of the innovative health system was established with Long Range (LoRa) wireless communication. Users equipped with wearable devices, medical devices and sensors were connected to servers through their computers (edge user devices). Sensed data were communicated via LoRa to the health computer for further analysis. The work carried out

in[14] used machine learning algorithms to implement an intelligent health system to monitor the extensive daily activities of registered users. The mental health monitoring system proposed in[15] model was developed to reduce the delay in processing the wearable sensor collected data. In[16], the health monitoring system was implemented with sensors to sense the different parameters such as heart rate, ECG, respiration rate and other sensors like GPS and accelerometer to the surrounding environmental condition of the patients. The CEP model analyzed sensor data to identify any abnormality in the patient data and sent the notification to the concerned caretaker.

IV. PROPOSED MODEL / TOOL

The methodology of the project is explained in detail in Figure 1.

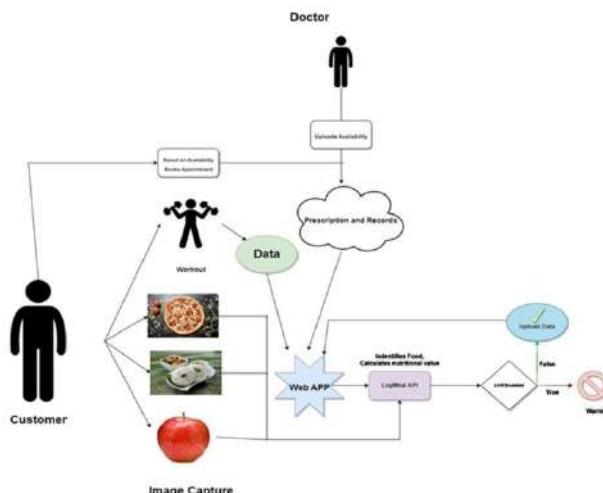


Figure 1.The architecture of a web-based health monitoring system

Over-eating is one of the most common reasons for increasing health problems. To overcome this problem, the project uses LogMeal API. The API uses machine learning algorithms to track and measure the nutritional value of the food. The user can take a picture of what he is eating and upload it on the website, as shown in Figure 2. The algorithm processes the image and calculates the nutritional value of the food. This information will then be displayed on the website in graphs and charts to allow users to interpret better. In-visual interpretation is always a better way of communication than the traditional way. The website alerts the user if the number of calories exceeds the set limit. Eating less is not sufficient; eating healthy is essential. Based on the daily food consumption of the user, the website recommends food for the users keeping in mind the amount of food consumed on that day and how many calories remain, to provide the best possible diet plan.

V. IMPLEMENTATION AND RESULTS

The user uploaded an image of a pizza. The website requests Log Meal API and fetches the nutritional value. The API returns the nutritional value of more than 50 parameters. Calories, Proteins, Total Fats, Saturated Fats and Sugar are considered.



Figure 2. Interface to add food images by user

Figure 3 represents the dashboard of the website. The dashboard has all the general details of the customer. There is also a timeline chart, which logs foods eaten every week.



Figure 3. Weekly usage chart

Figure 4 represents the detailed chart of the nutritional value of the current day. It shows the recommended limit and the amount consumed. Based on the recommendation, the user can plan what to eat for the rest of the day.

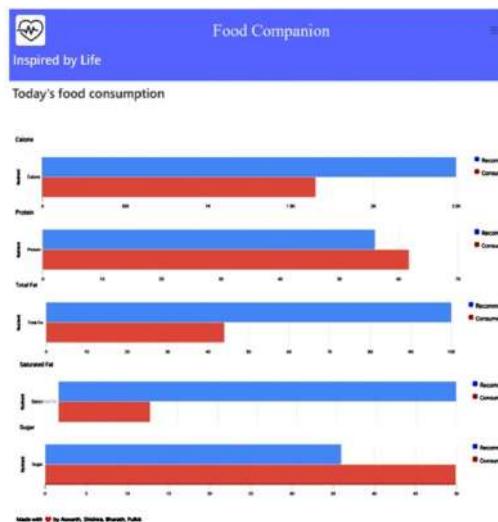


Figure 4. Daily usage chart

Figure 5 represents the exact nutritional value for the day in the form of a table and the time at which food was eaten. Exercising: Apart from eating less and eating healthy, exercise and workout are also very important. Some people like gymming, some may like running or cycling, and some may even prefer yoga or activities at home. Based on the user's preferences, the website recommends the best workout plan for the users. Smart watches, if any, used by the user can be integrated with the website, which extracts all the necessary data daily. The data includes Steps, heart rate, sleep data, Calories burnt, etc.

Food Name	Calories	Protein	Total Fat	Saturated Fat	Sugar	Time
water	94.5	7.9	2.3	1.5	10.6	13-12
apple	94.6	0.5	0.3	0.1	18.9	13-13
pizza	701.9	22.3	21.7	5.9	5.0	13-14

Figure 5. Daily usage table

Figure 6 shows the recommended workout on the recommendation page.



Figure. 6 Fitness Recommendation

Managing Workload of hospitals: The long lines and waiting periods for tests, reports, and consultations are increasing year after year. This causes chaos at hospitals and clinics. The website allows the users to schedule appointments, according to the slots available at the hospitals, using the Appointment scheduler System by selecting the doctor's name so they can go to the hospital/clinic at that time. Hence reducing the Workload on doctors, and they can even focus on each patient in more detail. This chaos also results in patients losing their reports and prescriptions. Firebase Storage has been integrated where users can store all the records in one place. This makes it easier for doctors to access all the patient's previous medical records in one click. In addition, a One-time QR-Code is given to the users once the user books an appointment. Scanning this QR-Code doctor scan access the patient medical records only once, providing security to the user's medical records.

Figure 7 shows the appointment scheduling interface where users can select the name of the doctor using a dropdown menu. Once the name is selected, a timeline chart is displayed to the user, which shows the available timeslots to book appointments. The user can book an appointment with the doctor according to his convivence. The QR-Code used the medical records of the patients. This is a one-time QR code, which, once scanned, cannot be used again.

Tablet Remainder System: It is often the case that people forget to take their tablets on time. This system reminds the users to take pills when it is time to take it. Each tablet will be placed in a different box, with a LED placed under the box. The user initially needs to enter the time the tablet needs to be taken. When it is time to take the pill, the LED glows, and a buzzer is used to alarm the user. The capacitive touch switch is placed inside the box; when the user puts his hand inside the box to remove the tablet, the LED and buzzer turn off. There by helping customers to take their medication on time.

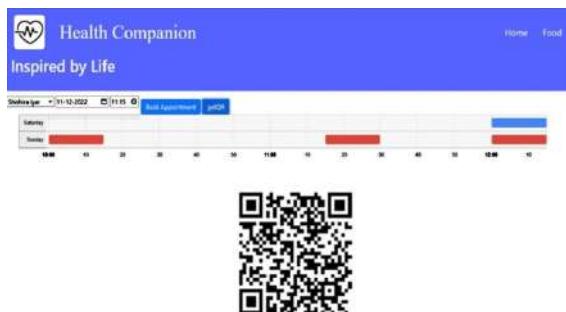


Figure 7. Appointment Scheduling

Figure 8 shows the hardware model used for the tablet reminder system. An ESP8266 micro controller is used along with cups with an LED underneath them. In addition, a buzzer is used to provide an audio alert.



Figure 8. Hardware Model of Tablet Remainder system

Figure 9 represents the interface which is used to schedule tablets. The tablet box is mentioned with an input element to enter the time the tablet is supposed to be taken. The data is stored in Fire base Real time Database, which is integrated with the Hardware model.



Figure 9. Interface to schedule tablets

Figure10 shows the working condition of the hardware model.



Figure 10. Working on the hardware model

Motivation: There are many apps where users can track their daily workout schedule, but they tend to lose motivation in just a few days. To prevent this from happening, gamification has been inducted into the project, where coupons and cheat days are provided to the users if they stick to their diet and workout plans for at least one month. In addition, friends and family members can connect to form a group, so there is an in-built competition among each other, and rewards are provided for the month's topper former, encouraging users to work harder.

Authentication and Security: Authentication and security in websites are essential, especially in web-based applications. The website uses Auth0 for authentication to log in users and doctors. Auth0 is an API provider that provides a secure login method using Google login. Google OAuth is in-built into Auth0. The users can either log in through Google or create their username and password credentials to log in. Authentication is essential because customers use the website to store confidential information. These may include medical records, prescriptions, etc. No user would like to see his data leaked into the public space. Because of this reason, when a customer schedules an appointment with the doctor, a one-time QR-Code is generated. This prevents the access of these records to the doctor after the consultation is completed. Figures 11 and 12 below represent the login screen and Authentication screen.



Figure 11. Login Screen for customers and Doctors

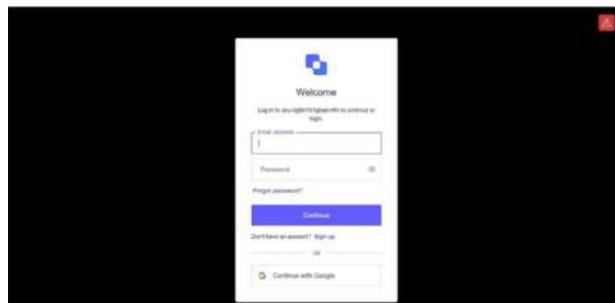


Figure 12. Autho interface used for login

VI. CONCLUSION AND FUTURE SCOPE

In this work, a Web-Based health monitoring system is proposed and implemented. The proposed health monitoring systems have shown great success compared to traditional ones, which are limited to delayed service and lack in providing medication, exercise, and nutrient information to registered users. The daily and weekly nutrient intake information makes the user more conscious about food consumption and encourages them to maintain a healthy lifestyle. Integration of exercise recommendations and scheduling doctors/dieticians' appointments for the user reduces the user's Workload. The unique feature of the developed application allows the user to store their medical records securely by providing a QR code/user. With this, only the doctor under whom the user was registered only gets the authority to access the user's medical records. The tablet recommendation system is one of a kind which is extremely useful for old-aged people who live alone at home to ensure that they take their tablets on time. This healthcare application helps society to reduce health issues.

The Proposed work Web-based health care system to assist the user in keeping track of their nutrient consumption, recommendations for proper exercise and websites to get knowledge about the nutrient products. The future scope of the project is to implement a mobile application to provide new features, such as communication establishment of the app with a user smart watch—enhancement of the application to support users from different locations.

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Estimated benefits to the society and generation of income

In this work, a Web-Based nutrient-tracking application is proposed and developed.

Benefits of proposed work

1. The application provides details of daily consumed nutrients based on the food taken.
2. Based on calculated monthly nutrient intake and comparison with specified threshold application provides a diet recommendation
3. Provides exercise recommendations.
4. Also recommends suitable websites for the same exercise and diet tips.
5. Helps in the doctor's appointment schedule Patients E-record maintenance

Measurable indicators of the project:

Sl. No.	Indicator
1	Increase in the number of people to know the benefits of having nutrient food.
2	Reduction in mortality rate due to improper nutrient food
3	Helps the health care community
4	Allows people to schedule doctor's appointment
5	Suggest that people select proper exercises to maintain their health
6	Medical E-record maintenance

Recyclocity - The Trail to Treasure to Create Secondary Resources through Recycling of Waste Printed Circuit Boards

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Abstract- With rapid advancements in Information and Communication Technology like 5G, Smart Sensors, and Algorithms to reconnect electronic devices, demand for product development increases. It leads to the generation of electronic waste of complex nature, which may affect the earth's nuclear, biological, and chemical response and atmosphere. However, e-waste can act as a secondary resource for various vertical product developments and recover original material from the composite material. This paper proposes an integrated waste management system to quantify costly metal from a discarded printed circuit board through a base metal secondary hydrometallurgical operation process. This work shows a process model and critical economic analysis of electronic waste. The Printed Circuit Board can act as an attractive secondary resource and at the same time an environmental burden. However, the modern smelter and refinery process affects the recycling efficiency in terms of elements and recovery of value in terms of toxic control and overall environmental performance. The research focuses on application areas in electronic waste to make fundamental differences in human endeavours.

Index Terms- Electronic Waste, Waste printed circuit board, Pyro-metallurgical technique, Urban mining.

I. INTRODUCTION

In this hoggish world, every company is heading towards improvising the applications through an advanced model of their electronic gadgets. However, they need to catch up to the technology and management of their waste when the product meets its dead end. It is one of the most challenging issues in India and around the globe. Through ultra-accelerated industrial activities and an aim of a five trillion-dollar economy, India has become the fastest-growing electronic waste market. However, the formal sector needs more infrastructure, advanced technology, and proficiency to collect and recycle e-waste. Therefore, developing an integrated way to mitigatee-waste and transform it into suitable opportunities is essential. E-waste consists of precious metals like gold, silver, lead, etc., that can be extracted out through various processes of urban mining. It can be used as a secondary resource for the nation. "Erase your e-waste before it erases you". The research aims to recycle thee-waste generated from

the printed circuit board by employing smelting and electro-refining methods and recover precious nanoparticles such as gold, silver, and titanium. Later these materials can be developed for commercial use. Because of its high industrial implications, better refining capability and efficiency, the smelting and electro-refining method is the most suitable. While designing the business model for e-waste management, an application is under way where sellers can directly send their waste to the processor avoiding complicated intermediaries' processes.

Breaking the chain of the informal and illegal recycling sector is the main objective of this project. E-waste, including the Waste Printed Circuit Board (WPCB), offers one of the significant challenges in the field of waste management. It is estimated that the total electronic waste will grow to 110 million tons by 2030 (Zeng & Li, 2016). The total amount of the metal is around 30 % of the overall weight of WPCBs. It mainly consists of copper with high conductivity and purity of about 99.3% (Awasthi et al., 2017; Cucchiella et al., 2016). Apart from that, WPCBs are enriched with a substantial quantity of metallic constituents such as nickel (Ni), iron (Fe), tin (Sn), copper (Cu), zinc (Zn), lead (Pb), silver (Si), palladium (Pd), gold (Au) along with non-metallic component like epoxyresin and fibre glass. Therefore, WPCB can be considered as an essential article for Urban mining (Ha et al., 2009; Zeng & Li, 2016). The precious metals in the printed circuit boards are majorly crushed and exported to other underdeveloped countries for recycling, and hence we transfer our treasure in the form of e-waste to other nations. It has been observed that there are more than 1000 registered e-waste recycling companies in India, but they are not end-to-end recyclers. As per the guidelines for e-waste recycling by extended producer's responsibility (EPR), producers still need to optimize the methods and processes. Therefore, it is mandatory to provide a suitable solution which will provide a direct interface from the seller to the recycler to reduce the functioning of informal sectors with those primitive methods. According to (Zeng & Li, 2016) there will be an exponential increment of e-waste in the future, which will significantly threaten the earth's and nature's existence. The composition of essential and costly materials in the e-waste opens the door to secondary resources (Awasthi et al., 2017; Cucchiella et al., 2016). It is proposed that WPCBs as an alternative source for modern mining (Ha et al., 2009; Zeng & Li, 2016). The latest technologies for extracting precious metals (Maryam Ghodrat, M. Akbar Rhamdhani, Geoffrey Brooks, Syed Masood, Glen Corder).

This paper addresses the detected gap developed among the e-waste recyclers, especially in recycling waste printed circuit boards (WPCB) in an environmentally compatible manner. It elucidates in adequate knowledge of extended producer responsibility (EPR) and producer responsibility schemes. According to the Swachh Bharat Mission guidelines, it is required to channel the informal sector of e-waste and turn them into a production stream. In the

broader picture, this idea will help society increase awareness about managing waste.

This project needs to deepen the transformation leading to the circular economy and resource efficiency. Figures.1 shows the mechanism of resource efficiency, and Figures.2 shows the trend of e-waste generation in India. [5]

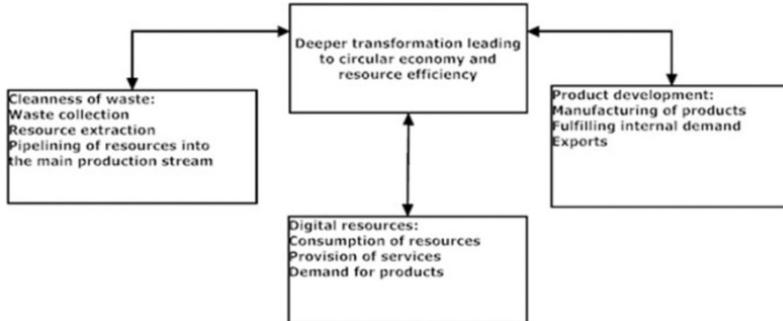


Figure 1. Mechanism of resource efficiency

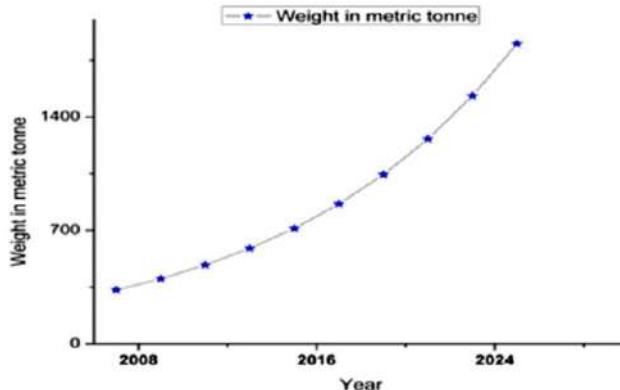


Figure 2. The trend of e-waste generation in India

II. BASIC CONCEPTS AND TECHNIQUES USED

Problems

- Informal recycling methods - Many slum areas in India and poor developing countries involve informal recycling. The primitive methods used by them cause many adverse effects on the environment.
- Health concern-This Waste contains harmful elements like Pb, P, etc., if not treated effectively may lead to generate diseases like cancer, asthma, tuberculosis, etc.
- High cost of setting up advanced recycling provision- India limits itself to the initial processing of e-waste.
- Lack of infrastructure – Lack of sustainable, environmentally sound

technologies which needs more study supply of raw material.

- Lack of developed mass balance system - There is no online portal to manage the inflow and the outflow of e-waste, and there need to be proper records about the local manufacturing industries.

The technology used as a solution:

Collection- A user-friendly online interface for the sellers is developed to expedite the collection mechanisms. Sampling- The collected Waste will be shredded with the help of a shredder into small sizes. Then the role of the rotating tube divider comes, which divides the ferrous and the non-ferrous part. Then comes the final separation part, where it gets ready into the dust for further processing.

Smelting and Refining-This is the most crucial stage of this project. The basis of the whole process is lead, copper, nickel and precious metals such as Sb, Bi, Sn, Se, In, and Te. The innovative plant will have high productivity amalgamated with high efficiency. Moreover, it optimizes metal recovery rates. Extractive metallurgy processes (pyrometallurgy, hydrometallurgy, electrometallurgy) and their combinations have been used for processing and recovering valuable metals from e-waste. Figure. 3 shows a simplified process flow diagram, showing essential processing steps.

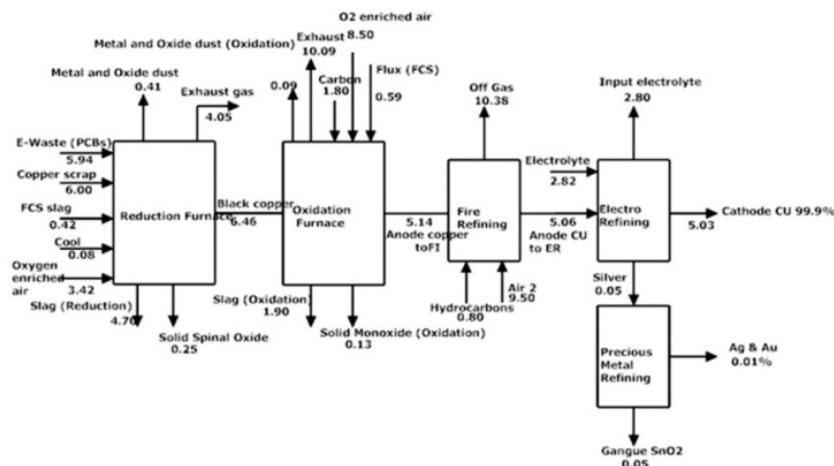


Figure 3. Key processing steps

III. PROPOSED MODEL / TOOL

The basic idea of this project is to design and develop general recycling guidelines and schemes through its interface and to collect the e-waste to recycle it appropriately. The flowchart, as depicted in Figure 4, portrays the same overview of this paperwork.

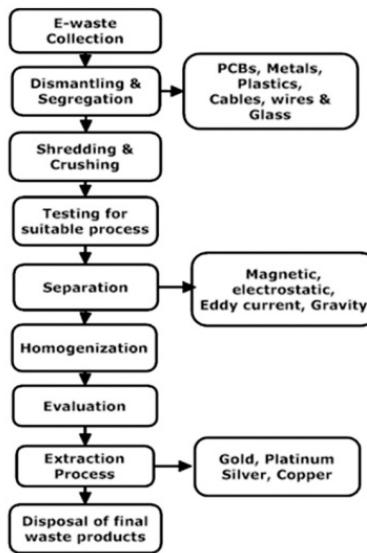


Figure 4. Functioning of an integrated plant for extraction of precious metals from waste printed circuit boards

STEP 1-Through the generation of an online interface will help make a cluster of e-waste and fulfil the need for the EPR approach for e-waste management.

STEP 2-Dismantling and separating different parts of e-waste will be done to make recycling feasible.

STEP 3-All the waste-printed circuit boards went to the shredder machine and were converted into dust for sampling and testing.

Suitable machines will separate STEP 4-Metallic and non-metallic parts of the dust.

STEP 5-Homogenization is on the separated parts of the dust.

STEP 6-Evaluation is done on the different separated components of the dust.

STEP 7-Various extraction process is applied to the components of the dust.

STEP 8-Disposal of the final waste product and residues is done to make the whole method eco-friendly.

IV. IMPLEMENTATION AND RESULTS

The project will be implemented using techno-economic evaluation in a three-step methodology consisting of a process simulation followed by an economic analysis. Stage 1- Collection of e-waste, Stage 2-Dismantling and separation of ferrous and non-ferrous, Stage 3-For further smelting and electro-refining to obtain precious metal. By using Thermodynamic analysis, the equilibrium calculations were performed. It has been reported to recover 5.03tonnes of copper, 2.91kg of gold and 5.7 kg of silver from 12 tonnes of copper scrap and

e-waste (PCBs). Figure. 5 shows the presence of limited metal around the globe. It is required for the industry to realize its sensitivity. Arbitrary usage and mining may create a vacuum in future engineering requirements.

LIMITED METALS IN THE PERIODIC TABLE (Source: SCS Green Chemistry Institute)																		
Li																		He
	Mg																	
	Sc	V	Cr	Mn		Co	Ni	Cu		Ag	Cd	Fe	As	Se				
	Sr	Y	Zr	Nb	Mo	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te				
			Hf		Ta	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi					
					Nd													
					U													

Figure 5. The limited metal in the periodic table

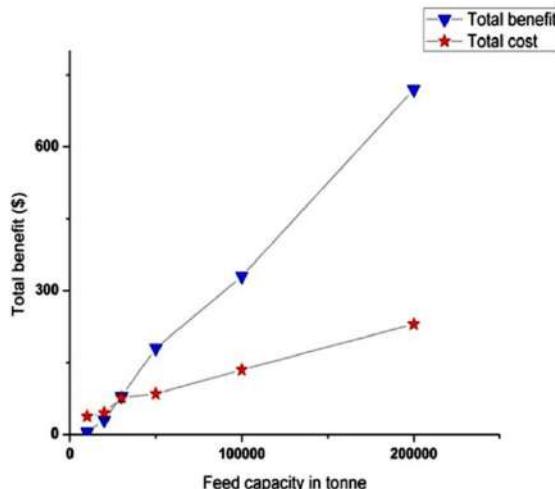


Figure 6. The impact of changing feed capacity on the total benefit

V. CONCLUSION

Earth is deteriorating because human practices such as illegal virgin mining, dumping of e-waste, and plasticizing oceans have distorted the earth's core, creating an imbalance in the environment. The outcome indicates that recycling precious metal from electronic waste is thermodynamically possible. The aim is not only to focus on recycling e-waste but also to extract precious nanoparticles via an eco-friendly and sustainable method. In future work, the economic model of the process can be redesigned through cheaper feedstock through various process configurations and process intensification. From the issues, it is

concluded that the management of e-waste has been challenging. However, the scenario can be improved if the corporate sector and the government work hand in hand together and take some initiatives to handle the e-waste and make the EPR model successful.

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- [3] Urban mining concept; Ha et al.; Zeng and Li
- [4] Technology for extraction; Maryam Ghodrat; M.Akbar Rhamdhani; Geoffrey Brooks; Syed Masood; Glen Corder
- [5] <https://www.meity.gov.in/>
- [6] <https://green.gov.in/>

Privy Share

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Abstract- Everything is available to us through the internet, legally or illegally. An image is one of the major file types shared widely through the internet. With the increase in digital communication, and multimedia data such as digital images, videos etc., we require fast and robust security systems. This Project involves encrypting an image and securely transmitting it through the internet. A user can encrypt an image and send it privately over the internet to another user. If the user has the key to decrypt the image file, he can solve the file. Only the key generated along with the encrypted image file is compatible with the encrypted image file during decryption. The encrypted Image can be stored or shared via any application. The use of chaotic methods in the encryption makes it more difficult for the attackers to decrypt the Image. When your data is encrypted, even if an unauthorized person or entity gains access, it will not be able to read it.

Index Terms- Digital communication, Encryption, Decryption

I. INTRODUCTION

In this modern world, everything is accessible to us via our phones and computers. With increasing facilities, there are growing risks involved for those using these facilities. With the internet has reached a level that merges with our lives, growing explosively during the last several decades, data security has become a main concern for anyone connected to the web. Various algorithms have been developed to achieve this level of protection, one of them being the AES algorithm. Cryptography can be defined as cypher data, making the data unreadable to the human eye unless decrypted by algorithms predefined by the sender. It is used to protect data from unauthorized access. Encryption is one of the ways that guarantee safe communication between the sender and the receiver. Encryption is the process through which data is encoded to remain hidden from or inaccessible to unauthorized users. It helps protect private information and sensitive data and can enhance communication security between client apps and servers.

II. BASIC CONCEPTS AND TECHNIQUES USED.

The application uses the AES algorithm to encrypt and decrypt an image file. The app takes in an image and generates an encrypted copy of the original

image file and an auto-generated key. Only the encrypted file and the key generated along with it are suitable for decryption. Another image with the other generated key or some random key won't work, and vice versa. The application is developed on android studio using kotlin as the programming base. The app uses an image picker which lets the user pick an image from the gallery and import the Image into the application. After encryption, the app uses the android device's internal storage to store the key and the imported Image. For decryption, the app uses a file picker which lets the user import the encrypted file and the key. Finally, the app decrypts the file after selecting a compatible key with the encrypted image file.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED

1. Umair Adil, Embrace It, Encrypting images using AES in Android with Kotlin + Glide + RxJava2
2. Android Developers, Cryptography, Docs, Guides.
3. P. P. Dang and P. M. Chau, "Image encryption for secure Internet multimedia applications."

The paper mentioned in point 1 had a similar approach to encoding and decoding an image file. This helped us know how to efficiently design the application and determine how these algorithms are implemented and performed on similar tasks. Cryptography implementation in Android documentation helped us with the performance of the AES algorithm in the Android Environment and support for Android devices. Image encryption for secure Internet multimedia applications by P.P. Dang and P.M. Chau provided us with valuable information regarding Image resizing and rescaling.

IV. PROPOSED MODEL / TOOL

This Project uses an app developed on android studio using kotlin. The block diagram of the proposed model is shown in Figure 1. The app takes in an image and encrypts it using AES encryption and then generates a key along with the encrypted file of the Image. The encrypted file and the key, by default, are stored in the internal memory of the user's android device and are shareable through any medium.

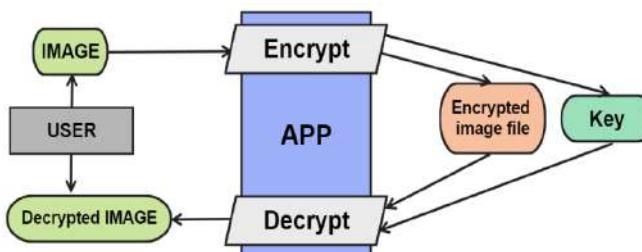


Figure 1. Proposed model architecture

The app needs the encrypted image file and the key as input for decryption. The app takes in the encrypted Image and the key and generates the actual Image as the output. Only the original key is required to decrypt the encrypted Image.

V. IMPLEMENTATION AND RESULTS

This Project is based on **AES Encryption** and was developed using the **Kotlin** language and implemented in **Android Studio Code IDE**. **Lookup tables** were used for **crucial expansion** and **sub-byte** conversion. A series of methods, such as

- I. void KeyExpansionCore
- II. void KeyExpansion
- III. void SubBytes
- IV. void MixColumns
- V. void AddRoundKey
- VI. void AES_Encrypt
- VII. void PrintHex

were used and called in the primary function int main, where we input the string to be encrypted and print the encrypted message.

For **decryption**, the methods remain the same except

- void invSubBytes
- void invShiftRows
- void invMixColumns
- void AES_Decrypt

The primary function takes in an image from the device's existing images and is encrypted for safe sharing. Then, the recipient can decrypt the Image using the secret key and view it.

Here is a test case attached with respective figures.

Original Image: test.jpg



Figure 2. Test image



Figure 3. Sample images encrypt the app

The encrypted file generated: test.enc

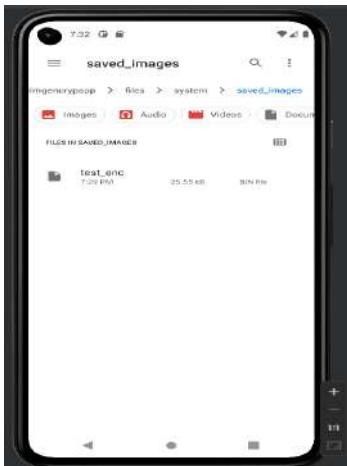


Figure 4. Encrypted file



Figure 5. Decrypted Image

VI. CONCLUSION

In conclusion, the Project includes encrypting an image and securely transmitting it via the internet. A user can encrypt a picture and send it privately over the internet to another person. If the user has the vital key to decrypt the photograph document, he can decrypt the Image. We tested the app with various sizes and types of image files, and it worked perfectly on both the encryption and the decryption end. We also tried with keys other than the original key, and as expected, the app failed to decrypt the file with the help of the wrong key. The Project aims to determine absolute privacy between a sender and a receiver. The project application can be scaled up to transmit videos, doc files, and other files using the same algorithm.

REFERENCES

- [1] Umair Adil, Embrace It, Encrypting images using AES in Android with Kotlin + Glide + RxJava2.
- [2] Android Developers, Cryptography, Docs, Guides.
- [3] P. P. Dang and P. M. Chau, "Image encryption for secure Internet multimedia applications", IEEE Transactions on Consumer Electronics, 2000.

• Estimated benefits to society and generation of income

This Project would be beneficial to people who need absolute privacy. This comes in handy when architectural plans, artwork, or high-priority diagrams must be transferred across the internet. This application also comes in handy while sharing private information like bank statements and legal documents.

A Low-Cost IoT-based Refreshable Braille (*ALPHA VISION*) for Enhancing the Basic Education of the Visually Impaired and Blind Peoples

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¹mayankk1903@gmail.com, ²swagatkumar.jena@tat.ac.in

Abstract: In the modern era, one of the most alarming issues is the education of visually impaired people, including people who are blind, deafblind or who have low vision. Recent development in science and technology has extended their helping hand towards these visually impaired people [1] in the form of different refreshable Braille system for blind people to educate them. However, in the true sense, the existing technologies are not affordable to all classes of blind people. In this work, we addressed the above problem and proposed a low-cost IoT-based refreshable braille device prototype, "*ALPHAVISION*", to educate blind people. This will help them gain basic literacy for facing the world. *ALPHAVISION* receives input from the user through the buttons available in the prototype or from the cloud and displays the corresponding Braille, which represents different alphabets, digits, or special symbols. Currently, *ALPHA VISION* is tested with English alphabets and can be applied to letters and the alphabet of any language. Therefore, our device will help visually impaired people to learn the alphabet of any language they want. Hence, *ALPHA VISION* is a very cost-effective and portable braille display which can provide affordable and easy access to education for the blinds.

Index Terms: visually impaired, Braille system, IoT,

I. INTRODUCTION

According to World Health Organization (WHO) ^[4], globally there are approximately 2.2 billion people who are visually impaired in the world (Oct 2019), out of these 39 million are blind and 245 million have a moderate or severe visual impairment. India is home to around 12 million blinds which is 1/3rd of the world's blind population. Traditionally, braille-based education is widespread and is crucial to literacy, and employment among the blinds. Braille is a tactile writing system used by visually impaired people, including those who are blind, deaf blind or who have low vision. However, due to the lack of Braille-based educational resources and technological solutions, the blind literacy rate is very low ($\approx 1\%$), far lower than the regular literacy rate ($\approx 77.7\%$). In addition, the existing devices ^[2] used for teaching braille

alphabets are very much overpriced and can't be afforded by all classes of blind people. So, we are introducing "*ALPHAVISION*", a low-cost Refreshable Braille Display device that can be affordable by all to teach the braille alphabet of different languages just through a single device. As India is a developing country, so everyone can't afford so much money to train. Hence our device *ALPHA VISION* will provide them with the facility to learn the alphabet of different languages at home. *ALPHA VISION* the refreshable braille display consists of a Braille cell. The braille cell electromagnetic actuators can refresh a braille cell. *ALPHA VISION* receives input from the user through the buttons available in the prototype or from the cloud and displays the corresponding Braille, which represents different alphabets, digits, or special symbols.

II. STATEMENT OF THE PROBLEM AND OBJECTIVES

People can become a resource in a country through education. When education and technology are combined, it provides a concept that could change a person's life regardless of their disabilities. However, in the twenty-first century, where ordinary people are accessing information through social networking services, disabled students still struggle for a good education. Traditionally, braille-based education is popular among the blinds. Braille is a recognizable system of raised dots that can be read with the fingers of people who are blind or have low vision. Braille is not a language; it is a code by which many languages can be written and read. Braille was devised in 1821 by Louis Braille. Each Braille symbol consists of patterns of raised tangential dots called a cell. Cells consist of 6 dots arranged in two columns of three dots each. Different combinations of dots in a cell represent different letters and symbols of other languages.

Many Braille devices have been developed to help visually impaired people educate themselves. However, the existing devices ^[2] are very much overpriced and are limited in accessibility, availability, and affordability to all classes of visually impaired people. Hence, in this work, we addressed the above problem and proposed a low-cost refreshable Braille device prototype, "*ALPHAVISION*", to educate blind people. This, in turn, will help them to gain basic literacy for facing the world. The *ALPHA VISION* module receives input from the user through the buttons available in the prototype or from the cloud and displays the corresponding Braille, which represents different alphabets, digits, or special symbols. Our device will help visually impaired people to learn the alphabet of any language they want. Hence, *ALPHA VISION* is a very cost-effective and portable braille display which can provide affordable and easy access to education for the blinds.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED

A range of diverse initiatives and interventions have been introduced worldwide to solve problems and issues associated with visual disability.

Visually Impaired Students may therefore take advantage of an increasing number of effective assistive technologies for their learning purposes.

As manufacturers like Thinker Bell Labs^[1], American Printing House^[2], Freedom Scientific etc., are quick to point out, the braille market is a small, specialized, low-incidence market. As a result, until recently, even a tiny braille display that will fit in a pocket and connect by Bluetooth to a computer, tablet, or smartphone cost nearly Rs.10,000 approx., and a notetaker with a small braille display that includes the other features you might expect in a tab, like a word processor, Wi-Fi, or email, can start at nearly Rs. 40,000 approx. Electronic Braille has been disproportionately expensive from the outset.

In 2014, a project named Annie^[1] was introduced, made with a raspberry Pi and coded in python. Project Mudra was Annie's simple predecessor. The tactile hardware modules tailored to teach and a soft human voice guiding students through lessons eliminate the need for handholding and constant supervision. With Annie, a visually impaired student can learn to read, write, and type in Braille.

Another device, Chameleon 20^[3], introduced in 2020, is a Braille display from the American Printing House for the Blind. It has twenty cell display and a standard perkin-style braille keyboard. Featuring Text- to- Speech, the Chameleon 20 is a device for learning and reinforcing braille literacy skills. As a portable braille display with local apps, like an editor and library, this device is used to improve productivity in the classroom or the work place.

After getting knowledge from the background projects conducted in past. We came across several limitations. As we have seen that there are many solutions to the problem we have selected, but all of them had some drawbacks. Keeping these drawbacks in mind, we have introduced AlphaVision, a very cost-efficient and portable braille display that can provide an affordable way to learn and educate visually impaired persons. This, in turn, will help them to gain basic literacy for facing the world. We have focused on keeping the device simple, easy to use, and affordable to the visually impaired.

IV. PROPOSED MODEL/ TOOL

ALPHAVISION, the refreshable Braille display, consists of one Braille cell. The design of the Braille cell is based on an innovative method, e.g., the braille cell consists of 6 single electromagnetic actuators, moved on a linear slider, which can refresh a Braille cell. An external controller can configure each actuator in a low or high state. The prototype contains four buttons: PREV, NEXT, AUTO and CONNECT. In addition, there is a DELAY CONTROL SWITCH, a SPEAKER, and a POWER button. When the user presses the NEXT button present on the left side of the prototype, the braille cell displays the corresponding next character.

Similarly, upon pressing the PREV button on the right side of the prototype button, the braille cell displays the corresponding previous character. When the user presses the AUTO button, the prototype automatically shows all the alphabets of the language one after another in increasing order with a specific delay. The SPEAKER speaks out the alphabet whenever it displays on the Braille. The delay time can be controlled with a DELAY CONTROL switch. The POWER button is used to power the device. *ALPHA VISION* also allows the user to interact with the Braille module through a cloud server, e.g., the user can send specific alphabets, digits or special symbols using an interface, and the corresponding Braille character will be displayed by *ALPHA VISION*. The interface can be accessed using an Android App or from a webpage. Currently, the prototype is being tested and developed for the English alphabet. However, language can apply to the alphabet of any language. The system architecture is shown in Figure 1.

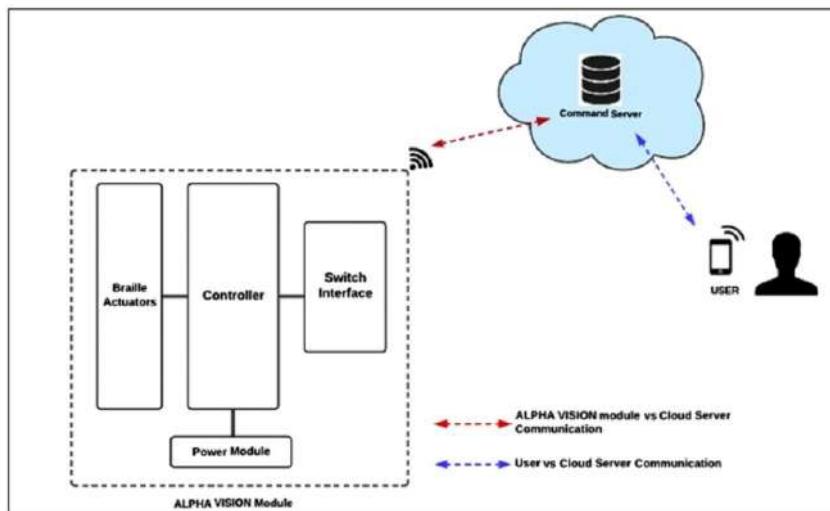


Figure 1. System Architecture

The working procedure of the proposed module is depicted through a flowchart in Figure 2. The flowchart consists of two parts. PART-A of the flowchart shows the operating procedure of the developed *ALPHAVISION* module and PART-B shows the processing done in the cloud server.



Figure 2. Working procedure of the proposed module

V. IMPLEMENTATION AND RESULTS

The proposed module is implemented using the following hardware setup. One *ALPHA VISION* module consists of (i) one controller module (Node MCU in our case), (ii) a Braille module with sixelectromagnetic actuators (liner sliders), (iii) 4 pushdown switches, (iv) one potentiometer, (v) oneinternal speaker, and (vi) one on/off switch for POWER and (vii) USB Power supply. In addition, we have usedAdafruit IO as a cloud service provider, e.g., for storing and retrieving the user's inputted commands. The details connection of the *ALPHA VISION* module is presented in Figure 3.

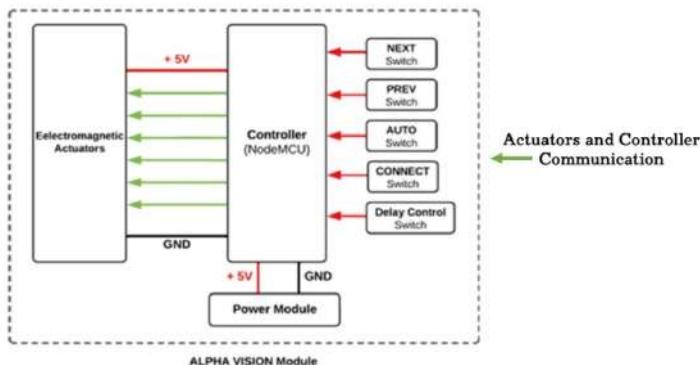


Figure 3. ALPHA VISION module

As described in the previous section, four pushdown switches are used, ad four buttons: NEXT, PREV, AUTO, and CONNECT. The potentiometer controls the delay time between successive alphabets of the language upon pressing an AUTO switch. The proposed prototypeis being tested and developed for the English alphabet. However, language can apply to the alphabet of any language. Therefore, some visually impaired persons have also used it.

VI. CONCLUSION

Despite so many devices related to the Braille system, the literacy rate is so low. Therefore, Braille remains a preferred or secondary medium for many visually impaired persons for its level of control overreading and the granular view it provides. This paper has presented the contributions to improving the education of visually impaired people to communicate with others. Generally, blind people cannot afford the existing Braille reader because of their high cost, and all these current devices are only available in institutions and organizations for experimental purposes. Hence, we addressed the above problem and developed "*ALPHA VISION*", a low-cost IoT-based refreshable braille device prototype to educate blind people. Our device is a very cost-effective and portable braille display that can provide an affordable way to learn and educate visually impaired persons in society. This, in turn, will help them to gain basic literacy for facing the world.

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- Estimated benefits to society and generation of income:

ALPHA VISION will be helpful for the visually impaired and blind to learn the alphabet of their language. Our device will try to increase the literacy rate of the blind in society. Our machine is very cost-effective; hence, it can be directly affordable and accessible to visually impaired people. Anyone can buy this from the Commercial market. From our project, we can generate income sources, and the seller, whoever would be selling this device, will be beneficial. Hence our project will help provide job opportunities for the needy one.

- List out the measurable indicators for the project (from below)-

SL.NO	INDICATORS
1	Increase in literacy rate of visually impaired people
2	Improvement in the life style of blind people
3	Easy and remote access to education for poor blind people

Track the Missing Child

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Abstract: On average, a child goes missing every 10 minutes in India, according to the women and child development ministry website for tracking missing children. At this rate, around 54,750 children would have been reported missing in the last year in India, and only about half of them would have been traced if one goes by the police record on the missing children. So, our project revolves around building software through which a citizen can check whether an unattended child is a missing child from the 'Track the missing child' database of the WCD Ministry using Facial Recognition Software. This project uses technology such as open cv and Python for the facial recognition system, and the front end is designed using javascript templates. The face recognition systems can operate in two modes: Verification or authentication of a facial image: It compares the input facial image with the facial image related to the user, which requires authentication. Facial Identification or facial recognition: It compares the input facial image with all facial images from a dataset to find the user that matches that face.

Index Terms- Facial Recognition, OpenCV, Python

I. INTRODUCTION

Countless children go missing every year. The category of missing children includes a few possible reasons, such as abduction or kidnapping of children by family members and by non-family members, run-away children or those forced to run away by family and surrounding circumstances, children who are in a complex or aggressive environment, trafficked children or lost children. Missing children often end up on the streets in poverty. This portal is dedicated to the cause of tracking missing children. This portal holds the database of missing and recovered children in the country. Users can join the initiative to locate missing children and facilitate their reintegration into their families. Detailed information has been provided on citizen's services, parents' corners, and stakeholders to simplify finding missing kids. The "Tuanyuan", or "reunion" in Chinese, the app developed by Alibaba Group Holding Ltd., helped Chinese authorities recover hundreds of missing children [1]. The need for such a project is that, on average, a child goes missing every 10 minutes in India, according to the women and child development ministry. It becomes abruptly tricky for the police department and the child welfare committee to deal with cases of missing children to coordinate with stakeholders and respond

with urgency to issues of the missing child. This paper presents a novel use of deep learning methodology for identifying the reported missing child from the photos of many children available, with the help of face recognition. On a significant scale, how it will help society; it is a cost-efficient project for implementation and eases the work of police department on a considerable scale and help children reunited with their families. Objectives of the Track Child portal

1. To ensure timely tracking of "Missing Children."
2. To ensure ultimate repatriation and rehabilitation of the missing children.
3. To ensure proper care and development of the children.
4. To set up a framework for participating organizations involved in the process.

II. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED

In India, countless children are reported missing every year. Among the missing child cases, a large percentage of children remain untraced. This paper presents a novel use of deep learning methodology for identifying the reported missing child from the photos of many children available, with the help of face recognition. An application is developed based on Artificial intelligence and automation, which might effectively track the missing person by co-relating the database and the individual identity fed. A citizen of the country can check whether an unattended child is a lost child on verification with the compatible photo files maintained in the software's data set. The missing children's data sets and details are safely secured. The public can upload photographs of a suspicious child into a common portal with landmarks and remarks. The photo will be automatically compared with the registered pictures of the missing child from the repository. Classification of the input child image is performed, and the photo with the best match will be selected from the database of missing children. For this, a deep learning model is trained to correctly identify the missing child from the disappeared child image database provided, using the facial image uploaded by the public. The technology used in the application developed is using Bootstrap open source, which includes JavaScript templates. A deep learning [2] architecture considering all these constrain is designed here. OpenCV- Python is used to implement the facial recognition system, importing various libraries. In, missing child identification is proposed, which employee's principal component analysis using Eigenvectors is used for face recognition system.[3] OpenCV- Python is used to implement the facial recognition system. The earliest methods for face recognition commonly used computer vision features such as HOG, LBP, SIFT, or SURF.[4] Even With less system RAM, OpenCV works better. For this implementation, libraries such as OpenCV, dlib, and Facial recognition are imported with the following snippets:

```
pip install OpenCV-python
```

```
conda install -c conda-forge dlib
pip install face_recognition
```

1. Criminal and missing children Identification using face recognition and web scrapping S.Ayyapan Department of computer science engineering, IFET College of Engineering
2. Missing child Identification System using Deep Learning with VGG-FACE Recognition Technique. D J Samatha Naidu, R.Lokesh Annamacharya PG College of Computer studies

The above papers mentioned state that this project is wholly relayed on a static dataset and hence requires a prolonged time interval for training the face database.

Considering the national government portal track the missing child <https://trackthemissingchild.gov.in/trackchild/index.php> all the data sets of the missing children aren't secured and acts as an open source for the public, which may lead to misusing of abandoned children. Further, there are nearly 10000 slides, each containing up to 10 children's faces, and it is difficult for the nation's citizens to help track the missing child. Instead, in our application, we have secured all the data sets of the children, so there is no chance of misusing/ abusing them. Rather than checking on numerous slides, one can easily find the child's match through scanning.

III. PROPOSED MODEL/ TOOL

Along with the hardware case files of a missing child, the details about them are added to the data sets of our application "TRACK THE MISSING CHILD". The above-proposed software enables the nation's citizens to scan the faces of an unattended children.

The scanned face is then checked with the most compatible photos of the missed children and data set and is immediately informed to the police department and the child's guardian.

On scanning children's faces (irrespective of whether it matches the given list of children), a notification message is sent to the administrator end with the respective IP address of the mobile phone. Thus, it prevents any misuse of children or indulging them in arduous labour.

This type of software eases the process of tracking missing children. The data sets of the missing children and their details are completely secured. This information can be allowed access by administrators in charge of data security and can run tests for safety. Administrators use general data security to improve databases along with backups of encrypted information that can prevent more data breaches and cyber-attacks. The flow chart of the proposed system is depicted in Figure 1.

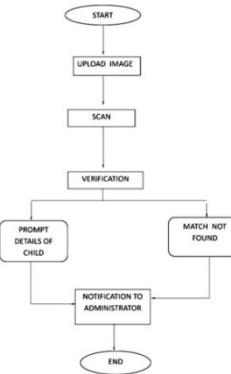


Figure 1.Proposed model

IV. IMPLEMENTATION AND RESULTS

1. Gathering data: Initially, a dataset is created with details of the missing children, organizing all images into folders, each folder containing photographs of only one person. All these real-life data sets among 1 lakh are gathered from the union government portal for tracking the missing child. The data sets contain all the information, which includes viz., name, age and other personal details and the details of the police station which has filed the case.
2. Prepare Training Data: Read training images for each person/subject along with their labels, detect faces from each photo and assign each detected face an integer label of the person it belongs. We create a CSV file to handle our whole dataset since we require unaltered images, so our data pipeline focuses on transmitting the data without changing the image quality.
3. Train Face Recognizer-Facial recognition system: Train OpenCV's LBPH recognizer by feeding it the data we prepared in step 1. Introduce some test images to the face recognizer and see if it predicts them correctly.
4. Modules used:
 - cv2: This is the OpenCV module for Python used for face detection and face recognition.
 - os: We will use this Python module to read our training directories and file names.
 - NumPy: This module converts Python lists to NumPy arrays as the OpenCV face recognizer needs them for the face recognition process.
5. Web development: The robust front-end framework is designed using BOOTSTRAP open source. This front-end software includes JavaScript templates for typography, navigation, buttons, and other essential UI

components. JavaScript tools make it easy to create front-end design elements of responsive websites quickly and easily. With its pre-built components, required themes and icons to the designs are added.

6. OpenCV- Python templates: OpenCV has three built-in face recognizers. Some of the face recognizers and the OpenCV calls used:

- EigenFaces – cv2.face.createEigenFaceRecognizer()
- FisherFaces – cv2.face.createFisherFaceRecognizer()
- Local Binary Patterns Histograms (LBPH) – cv2.face.create LBPH Face Recognizer()

This paper presents a novel use of deep learning methodology for identifying the reported missing child from the photos of many children available, with the help of face recognition.

WEB DESIGN USING HTML AND JAVASCRIPT:

The front-end designs of the proposed model have been shown in Figures 2, 3, and 4.



Figure 2: Design of our web portal-track the missing child



Figure 3. When Facial Features Matches, A Prompt with details of the Child are Displayed



DETAILS

NAME
ENTER NAME HERE

AGE
ENTER AGE HERE

GENDER
ENTER GENDER HERE

MISSING DATE
ENTER THE MISSING DATE

Figure 4. Details of a missing child are to be entered at the administrator's end
The mobile app version of the proposed model is shown in Figures 5, 6, 7, and 8 below:

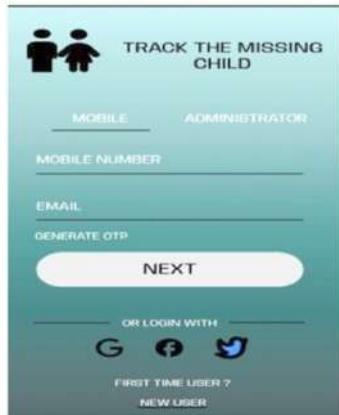


Figure 5. Loginpage for user Credentials

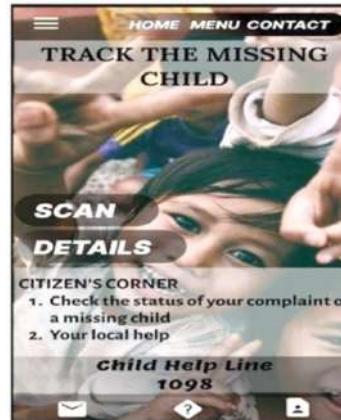


Figure 6. Home page of Track the MISSING CHILD application



Figure 7. Face Scanning

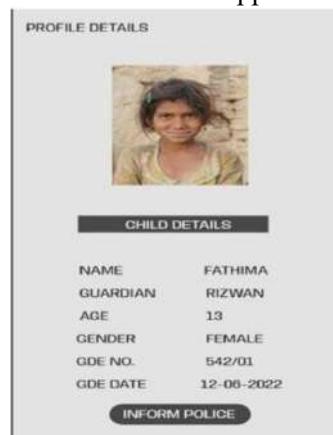


Figure 8. Prompt displaying child details on finding the match

V. CONCLUSION

Therefore, it is concluded that the introduction of such a portal will help majorly to society demolishing all the unjust actions against children, which include labouring, illegal children organ trafficking, child abuse or child maltreatment, especially unattended children under the age of 18. Furthermore, this application dramatically helps society by reuniting the lost children with their parents and reducing the burden of the police department in tracing the lost children. Moreover, this portal improvises the average time to resolve a case regarding missing children and enables citizens to actively participate in helping a child find its home.

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AkshayLok-Distributing Renewable Energy

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Abstract- AkshayLok is a Renewable resource management software that uses blockchain technology. We propose a novel decentralized security model between the user and the government. The technology integrates blockchain technology with the Interplanetary File System (IPFS) that allows buyers and sellers of electricity to enter a market long dominated by central power plants and enormous utilities and allows the generators, buyers, and sellers to be able to manoeuvre along the transmission path. This allows renewable energy certification processes to be sped up and automated, as there is greater traceability. This technology also guarantees the transparency and security of the transaction, which remains permanently recorded in the platform, allowing all parties to audit the results. This project also makes it possible to work under smart contracts performed automatically when both parties fulfil the agreed terms, thereby cutting out intermediaries and simplifying the process. This reduces costs and increases privacy.

Index Terms- Distribution companies (DISCOMs), Smart Contract, Blockchain Technology, Interplanetary File System (IPFS), Renewable Energy, Smart Grid.

I. INTRODUCTION

Efficient energy management has never been more crucial than today, and renewable energy is undoubtedly the industry's future. Here Blockchain can change the power balance between consumers and centralized power authorities. The booming market in Distributed Energy Resources (DER), like solar photovoltaic systems (PV), batteries, microgrids, and embedded networks, has moved the power balance from central authorities to the edges of the grid, to where citizens have control. And it is not just about controlling the cost of energy consumption, it reflects people's desire that their energy supplies are more sustainable, more socially responsible, more local, more resilient, and more democratic. All that is needed to move the revolution into the mainstream is a model for energy trading that takes control out of the hands of central players and puts everyday citizens in charge of a co-created energy future. DISCOMs (distribution companies) will play a vital role in the expansion of RTS (rooftop solar system) as DISCOMs have direct contact with the end user and provide approval for installation, manage the distribution network, and have a billing interface with rooftop owners. We, as a DISCOM, will be more transparent, secure, and faster than most existing DISCOMS because Existing trading

platforms require third-party settlement and reconciliation of millions of transactions between hundreds of thousands of traders across 5- minute trading intervals, and a central player is necessary for taking control of all parties' data, prescribing fees, requiring trust, proving the accuracy, and binding the market up in red tape and bureaucracy.

The main contributions of this project are threefold as follows:

1. First, removing the dependency on significant companies and creating a systematic distribution channel for renewable energy.
2. We allow everyone to produce renewable energy and sell it to the government.
3. Removing the dependency on non-renewable energy.

II. STATEMENT OF THE PROBLEM AND OBJECTIVES

Trading model available in the current energy sector and its limitations:

India has recently made great strides in expanding access to electricity, as more than 130 million people have joined the power grid since 2013. India is the third-largest producer and consumer of electricity worldwide, with an installed power capacity of 404.13 GW as of July 31, 2022, but with electricity demand predicted to triple by 2040 [1], India's reliance on coal poses a significant pollution problem. Despite having the world's fourth-largest coal reserves, India fell 14 percent short of meeting coal demand in the fiscal year 2016. Electricity is a critical enabler. The global population is currently electrified to the tune of 84%. To support their development and growing prosperity, advanced and transitional economies require secure access to modern energy sources. Access to affordable and reliable energy is critical in developing countries for reducing poverty, improving health, increasing productivity, increasing competitiveness, and promoting economic growth. The electricity demand is predicted to triple by 2040 due to Electric vehicles (EVs). The global threshold of Electric Vehicles (EVs) on the road surpassed 1 million in 2015, with the total number closing at 1.26 million. In 2015, there were an estimated 1.45 million electric car charging points worldwide to service this growing fleet. EVs are expected to reach price parity with combustion engine vehicles by 2025, owing to falling battery costs and increased fuel density. EVs will be a significant burden to the energy sector. Hence a shift to renewable energy resources is needed. Figure 1 shows a graph that depicts EV sales in the last three years.

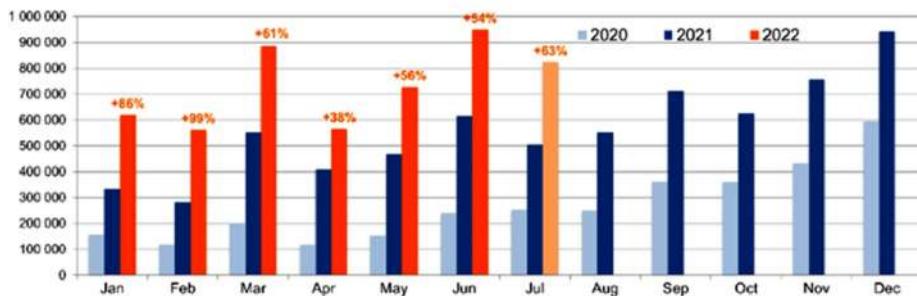


Figure 1. EV Sales last 3 Years

- Between 2 to 20 million EVs will be in use worldwide by 2020;
- Between 18 to 60 million by 2025;
- Between 22 to 140 million by 2030.

The brisk market for Distributed Energy Resources (DER) such as solar photovoltaic systems (PV), batteries, microgrids, and embedded networks has shifted power away from central authorities and toward the grid's edges, where citizens have control. And it is not just about lowering the cost of energy consumption; it is also a reflection of people's desires for more sustainable, socially responsible, local, resilient, and democratic energy supplies. All that is required to bring the revolution into the mainstream is an energy trading model that removes control from the hands of central players and places ordinary citizens in charge of a co-created energy future.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED.

Vertically integrated energy companies sit in the middle of the system, like spiders spinning a web out to the last consumer requesting a connection. They decide where and when to build big power plants, how to bridge the distance between generators and loads, and how to keep the system balanced by applying pressure on the central entity. While progressive utilities and regulators attempt to position themselves as consumer-focused or consumer-centric, even the most developed rephrase a narrative that categorizes citizens as consumers. Consumers are fed a steady diet of price and product while clinging to the umbilicus of the power network. Control, certainty, and economic independence are all costs associated with energy security. In 2012 in New York City, Hurricane Sandy destroyed the century-old concept of utility power supplies and heralded a new era of distributed energy supplies that value resilience over tradition. Likewise, an energy supply crunch tied to the war in Ukraine could cause widespread blackouts in the European Union this winter.

The world needs the infrastructure of proper management of distributed power resources where each consumer can become a retailer. This will reduce the dependency on non-renewable energy sources and help a country become self-reliant in the power sector. There is a dire need for discoms in the renewable

energy sector. The Government of India has laid the baseline for renewable energy development. As of July 31, 2022, India's installed renewable energy capacity (including hydro) stood at 161.29 GW, representing 39.91% of the overall installed power capacity. Solar energy is estimated to contribute 57.97 GW, followed by 40.89 GW from wind power, 10.68 GW from biomass, 4.89 GW from small hydropower, and 46.85 GW from hydropower. But there is no model for the consumer to sell their renewable energy to the grid, which will benefit both parties. Users get one more source of income, and the government receives a backup energy source, ultimately reducing dependence on non-renewable resources. In addition, consumers can get electricity at cheap rates—companies looking to implement blockchain technology into wholesale electricity distribution focus on connecting end-users with the grid. Blockchain technologies and IoT devices enable consumers to trade and purchase energy directly from the grid rather than from retailers.

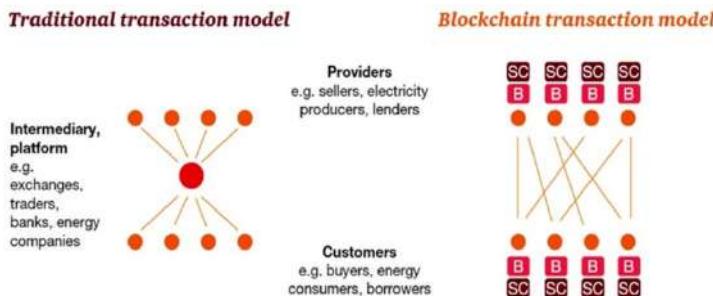


Figure 2. Traditional vs Blockchain Model

Blockchain Technology

Blockchain is a software innovation for establishing digital trust between users facilitating transactions of value, over a network. The Blockchain enables trust to be distributed throughout a network without a central intermediary needing to track, verify and approve the digital exchange of value. [2] However, this is proving to be expensive, slow, and attackable. By functioning as a decentralized distributed database with a continuously expanding list of entries called blocks, the Blockchain solves these problems. While blockchain technology is still in its infancy, existing implementations demonstrate that it has the potential to be better, more efficient, and more secure than current systems. As a result, banks and governments throughout the world are starting to experiment with it.

Smart Contracts: On-chain computer code, often known as "Smart Contracts," is a type of computer protocol that eliminates the need for a contractual clause by facilitating, verifying, or enforcing the performance of a contract. The logic of contractual terms is frequently imitated in intelligent contracts. Smart contracts eliminate the need for a middleman by enabling the transparent, conflict-free exchange of money, assets, shares, and anything else of value.

A procedure typically entails payment to a middleman, governmental body, bank, attorney, or notary, followed by a processing period before receiving goods or services. However, everything can be automated thanks to innovative contract technology. Smart contract technology can be compared to that of an automated vending machine. With a vending machine, money is deposited into the vending machine, and the desired item drops for collection, provided that the correct amount is deposited. Similarly, with a smart contract, funds are deposited into escrow on the Blockchain in exchange for the receipt of a transfer of a token (such as a digital certificate of title for a home), which is instantly transferred into a counterparty's hands once conditions are met. Similar to a typical contract, intelligent contracts specify the terms and conditions of an agreement and also give a means of enforcing those responsibilities.

PDF

The Interplanetary File System (IPFS) is a distributed file storage protocol that allows computers all over the world to store and serve files as part of a massive peer-to-peer network [3]. Any computer can download the IPFS software and begin hosting and serving files. If someone installs IPFS on their computer and uploads a file to the IPFS network, that file can be viewed and downloaded by anyone else running IPFS worldwide.

IV. PROPOSED MODEL / TOOL

We, as a DISCOM, will be more transparent, secure, and faster than most existing DISCOMS because Existing trading platforms require third-party settlement and reconciliation of millions of transactions between hundreds of thousands of traders across 5- minute trading intervals, and a central player is necessary for taking control of all parties' data, prescribing fees, requiring trust, proving the accuracy, and binding the market up in red tape and bureaucracy.

We will use efficient technologies like a distributed ledger and smart grid system [4], which will free up giant corporations from their monopoly and allow regular people to not only become independent but also earn more cash. To maintain the contract's legitimacy, a smart contract will be created and safely held on IPFS, which depends on cryptographic hashes that are simple to put on a blockchain. However, users cannot share files with specific individuals via IPFS. The strategy we outlined below enables nations wealthy in renewable resources (such as tropical and subtropical countries with easy access to solar energy) to be self-sufficient and independent of traditional energy sources. Additionally, ending the monopoly. The walkthrough of the proposed model is shown in Figure 3.

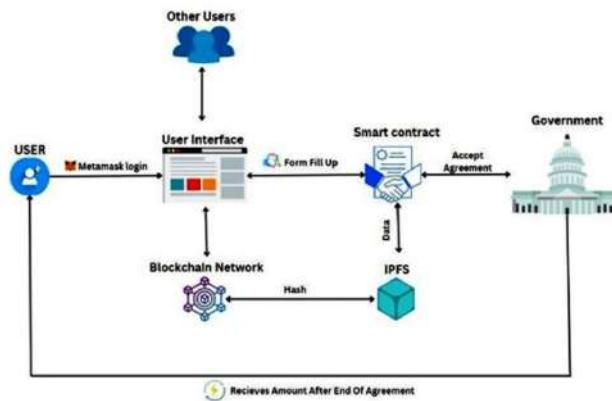


Figure 3. Walkthrough of Model

A user will log in to our Website using their wallet (metamask), after which they will be prompted to fill out a form clearly stating the terms and conditions laid out by the governing body, and an agreement will be reached between the two parties, which will be publicly available, and anyone can look it up. In our backend, a smart contract will be created after the user submits the form with information kept in IPFS, giving us a unique hash stored in the blockchain network. Then, anyone can access the content of the agreement using that hash, which will increase transparency and build trust between them.

V. IMPLEMENTATION AND RESULTS

Gathering of Data: Users enter the required data like their personal details, type of plant (e.g.: rooftop solar system), the technology used to generate energy, and average energy generated monthly and annually on the Website.

Preprocessing: After receiving the details, these details are reviewed by the smart contract. The smart contract checks whether the criteria given by the government, both financial and technical, are met or not. If the intelligence agreement accepts the information, the digital certificate is signed between the government and the client, which is reviewed annually.

Transactions: All transactions between the government and client are done through Metamask wallet including the fee generated for deploying the smart contract.

Data Analysis and Storage: The full client details and the innovative contract information are stored in the IPFS. IPFS will generate a unique hash specific to the transaction, which will be held in the blockchain network.

Web-App Development:

- **FrontEnd:** For Frontend, we use HTML, CSS, and ReactJS.
- **Backend:** To develop smart contracts we use Solidity; to connect smart contracts with the Frontend, we will use EtherJS and NodeJS; to store data, we

use IPFS; to conduct transactions, we use Metamask, and all the information will be deployed in the Polygon Network.

Deployment:

To host the Website, we will be using Heroku.

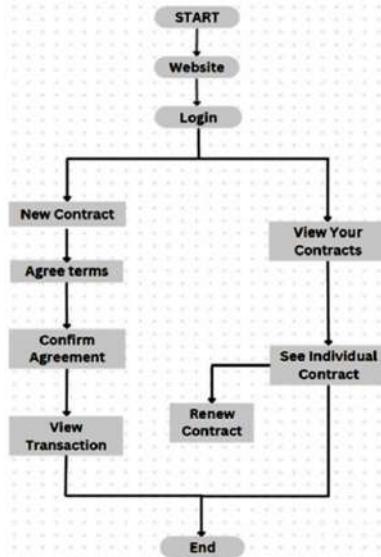


Figure 4. Data Flow Diagram

Key Findings

- The government on December 30 2015, approved a program called "Grid Connected Rooftop and Small Solar Power Plants Program" for the installation of 4,200 MW RTS plants in the country by the year 2019-20, of which 2,100 MW was through CFA, the balance 2,100 MW was without CFA.
- It aims to achieve a cumulative capacity of **40,000 MW from Rooftop Solar Projects by the year 2022**.
- To create an enabling environment for the **supply of solar power from rooftops and small plants to the grid**.
- This scheme is being implemented in the state by **distribution companies (DISCOMs)**

Estimated Benefits to Society and Generation of Income

The benefit to society is depicted in Figure 5.

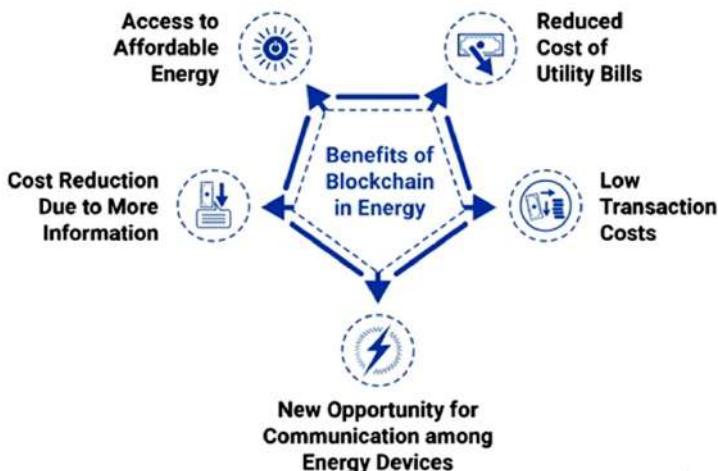


Figure 5: Society Benefits

The four significant benefits for the energy sector are: -

- Access to Affordable Energy
- Reduced Cost of Utility Bills
- Low Transaction Costs
- New Opportunity for Communication among Energy Devices.

It gives an additional value proposition that could spur even more investment in distributed renewables, and a new era of network management is presented by a network that enables users to derive profit from their DER investment. Moreover, ever-increasing levels of automation and resilience will be driven by this new paradigm, not by a few large-scale centralized investments but by millions of small-scale dispersed assets.

VI. CONCLUSION

A decentralized security model for renewable energy management using the IPFS has been proposed. Our proposed model ensures that the excess energy produced by an entity does not go to waste; instead, it can monetize that energy by selling it to a merchant. The focus of this project is that Blockchain is set to transform the renewable energy industry in many ways, from certifying the source of green energy by allocating generation assets to a specific point of consumption to making energy grids more accessible through data-sharing in real-time and through enabling a transaction between two parties.

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Text Analytics of Peer Group - WhatsApp Communications for Mental Health Analysis of Peers

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Abstract- Mental health encompasses emotional, psychological, and social well-being. It influences cognition, perception, and behavior. It also determines how a person handles stress, interpersonal relationships, and decision-making. When several people are communicating with each other through different forms of channels it is known as group communication. The members of this group are likely to influence the individual's beliefs and behavior. WhatsApp Messenger is a cross-platform instant messaging application that allows smartphone users to exchange text, image, video and audio messages for free. It also allows users to communicate in peer-to-peer or form groups where information can be exchanged via media and text. As WhatsApp groups may contain individuals from different backgrounds, fields of interest and age groups as well there is an exchange of a variety of opinions. Humans being social animals do get influenced by this kind of communication to fit in or agree to the flow of discussion. Hence it does create an impact on peers' mental health. Text analytics is the process of translating large volumes of text into quantitative data to uncover insights, trends, and patterns. This project would be utilizing text analytics techniques to analyze the WhatsApp group communications to peer mental health.

Index Terms- COVID-19, Mental Health, Text Analytics, WhatsApp Communications

I. INTRODUCTION

The COVID-19 pandemic brought us close yet miles apart. Everyone's life was drastically affected during this monstrosity with a rapid phase change to the lockdown period where people were not only affected by the virus but also by the aftermath of it [3]. This included the whole world experiencing numerous emotions such as fear of the virus, sudden cut-off from the physical world, loneliness from rare physical human interaction etc. [4]. As we know, Mental Health determines one's psychological, emotional and social well-being. During these times people's mental health was challenged which caused them

to shift to online means of relationships and exchange of information, particularly text-based chatting platforms like WhatsApp [6].

WhatsApp Messenger is an instant messaging and multimedia-sharing application with around 2 billion users worldwide that allows smartphones and personal computer users to exchange text, image, video, and audio messages for free with new additions to its application, as we read. It saw an immense increase in usage during the recent pandemic. Text-based group conversations became the common ground for discussion and sharing information with the introduction of this application, creating a virtual interactive environment. These text-based groups consist of people from various backgrounds with unique opinions discussing a plethora of topics and contributing their perspectives since these conversations became a part of daily life and even more so during these difficult times it confirmed the possibility of individuals getting mentally and physically affected by the same [11]. WhatsApp generates a humongous amount of text data every single minute and we are focusing on making use of the same. This paper will demonstrate how WhatsApp group chat data can be analyzed by utilizing text-analytics techniques to determine the effect of these group communications on peer mental health. The proposed model would be based on the 'Bag of Words' model.

II. STATEMENT OF THE PROBLEM AND OBJECTIVES

The sudden cut-off from the whole world due to the COVID-19 pandemic led individuals to start to resort to digital platforms to support the lack of physical communication. This encapsulates various people from different racial and financial backgrounds, ethnicity, age, languages etc. Consequently, leading to a humongous amount of information being exchanged, and perspectives being put forward which in turn affects the mental health of the people participating in the same. In this paper, we are analyzing the text data taken from a peer-group chat, in a chat platform (WhatsApp) and flagging the peer group based on its positive, neutral, or negative effects on any individual's mental health who is part of these groups. The dataset that we have used contains a Formula One Racing (a.k.a. F1 Racing) based peer-group chat which has 254 participants from different backgrounds, ages ranging from 17 - 43 years old belonging to the countries of England, India, USA, Morocco, Mauritius, Kenya, Zimbabwe, Netherlands, Belgium, France, Spain, Ireland, Italy, Switzerland, Germany, Mexico, Brazil, Australia, and Portugal. The group was created on 28th August 2021 for which we have taken the data from the months of August, September, and October of the year 2022 while implementing our model. The participants of this group are from different cultural backgrounds, and hence they give an insight into the different opinions of various people about the given topic. They also have different ages and gender which can affect their attitude towards a particular situation and/or have a unique opinion about the same giving us a wide variety of conversations to analyze and conclude our results. The chat is derived from WhatsApp, as it is the most used

chat application in the world currently. We start with converting the text chat into a CSV file. The words from the texts are then pre-processed i.e., they are tokenized as individual words, furthermore, they are converted into lower-case letters with the removal of punctuation and stop words along with performing word stemming on the various strings generated. The frequency of these occurring words is then found out from which a document-term sparse matrix is made. A bar graph is then plotted showcasing the frequency of the topmost used words with the previously attained matrix. We disambiguate the words based on the probability that a word occurs with a particular tag, i.e., we need to mark up the words in text format for parts of the message based on their definition and context. We then utilize the process of chunking in making groups of noun phrases. The resulting group of words are called chunks. The possible tags are -

FW-(foreign word), JJR-(adjective, comparative), JJS - (adjective, superlative), LS - (list market), MD - (modal), NN - (noun, singular), NNS - (noun, plural), NNP-(proper noun, singular), NNPS-(proper noun, plural), PDT-(predeterminer), POS - (possessive ending), PRP - (personal pronoun), PRP\$ - (possessive pronoun), RB - (adverb), RBS-(adverb, superlative), RP-(particle), TO - (infinite marker), UH-(interjection), VB-(verb). We will consider positive words to be the ones which are encouraging or uplifting in nature. Neutral words are ones which come under the tag such as NN, NNS, NNP or NNPS, meaning they exist to give meaning to the sentence and are not targeted to portray a positive or negative image. Negative words are the ones which are abusive in nature such as cuss words. From the chunks formed we determine the nature of the words which have occurred most frequently in the chat. We see the nature of these words and based on this observation we flag the group into one of the three possible categories - positive, neutral, or negative.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED.

Table 1. represents the background study that has been done for this work.

Table 1. Literature review

Year/Author	Title	Proposed	Advantage	Disadvantage
[1] [12] [13] 2022/ Taquet, Maxime et al.	Neurological and psychiatric risk trajectories after SARS-CoV-2 infection: an analysis of 2-year retrospective cohort studies including 1 284 437 patients	To find out how COVID-19 is related to the increased risks of neurological and psychiatric sequela.	Discovered that there is an increased risk of a range of neurological and psychiatric diagnoses in the first 6 months after COVID-19 diagnosis. They found drastic differences in the results of these risks within the first 2 years after diagnosis. The results were much different in children compared with adults and older ages differing	COVID-19 appeared to be more severe than other respiratory infections, and the severity of the illness was not taken into consideration during the analysis. Only individuals who were diagnosed early in the pandemic contributed to this dataset for the whole 2-year follow-up.

			between variants of SARS-CoV-2.	
[2] 2022/ Sophie Lythreatis et al.	The digital divide: A review and future research agenda	A systematic review of the prevailing digital divide i.e. unequal access to digital technology including two new potential forms apart from 'type-of-internet access' are 'algorithmic awareness' and 'data inequalities'.	Structurally analyzed and critically reviewed the previous studies regarding the digital divide reviewing what determines while discovering new levels and forms of the existing concepts, which is going to help organizations, governments and policymakers to assess, adjust and develop ways how technology creates an inclusive prosperous and sustainable society.	The coding for the results was done by hand which could include subjectivity. The results of 2021 are not complete as all the articles for the same were not completed at the time this paper was written. Their methodological approach was eliminating certain articles; also only the articles in the English language were included in the same.
[3][14][15][16] 2022/ Ali Cheshmehzangi et al.	The digital divide impacts on mental health during the COVID-19 pandemic	A study on how the COVID-19 pandemic brought an intensifying scale change in the digital divide (DD) whilst affecting people's mental health unnaturally.	Revealed that the impact of the COVID-19 pandemic, digital exclusion and social exclusion driven by DD had worsened people's mental health and people are prone to depression and loneliness as a consequence.	They did not shed light on the study that should overlap the factors between DD-prone people and/or social exclusion. The impact of DD on mental health was not backed up as expected.
[4][17][18][19] 2020/ Nina Vindegaard, Michael Eriksen Benros	COVID-19 pandemic and mental health consequences: Systematic review of the current evidence	A systematic review of the literature to provide an overview of the psychiatric complications of COVID-19 infection and how it is, directly or indirectly, affecting the mental health of psychiatric patients and the general public.	Revealed that there are indications of PTSD and depression following the COVID-19 pandemic. Evidence backs up an increase in depressive and anxiety symptoms and adverse effects on general mental health.	Restrictions were recognized in the dataset as the studies were conducted mostly in Asia. The studies were not case-control studies and with a variety of reported outcomes, measuring of outcomes and statistical analysis were revealed. The literature on psychiatric symptoms among patients with SARS-CoV-2 was limited.
[5][20][21] 2020/ Shen Zhu et al.	The immediate mental health impacts of the COVID-19 pandemic among people with or without quarantine managements	To test mental health problems using early survey data with a mobile app "Sojump" to determine how it was related to COVID-19 quarantine.	Results showed a relatively high prevalence of mental health problems in the sample dataset, which were closely related to the impacts on daily life that were created and not the control measure of quarantine itself.	The study couldn't focus on the potential psychological risk factors associated with mental health problems under quarantine limited by their early data.
[6] 2016/ J A Naslund et al.	The future of mental health	Offering a perspective on	The results revealed that people with serious	With the benefit comes the risk of

	care: peer-to-peer support and social media.	how online peer-to-peer connections among people with serious mental illness could advance efforts to promote mental and physical well-being in this group.	mental illness did benefit from interacting with peers online from greater social connectedness, and feelings of group belonging and sharing their stories helped them cope with the daily challenges of living with their condition. Individuals also gained insights on important healthcare decisions which promoted healthcare-seeking behaviours for their mental illness overall.	getting exposed to misleading information, facing hostile or derogatory comments, or feeling uncertain about one's health condition. These are the potential risks that tag along. They also need to determine that the skills learned through this method of peer-to-peer support bring an impact on their offline lives and overall physical and mental well-being.
[7][22][23] 2020/ Anna Lavis, Rachel Winter	#Online harms or benefits? An ethnographic analysis of the positives and negatives of peer-support around self-harm on social media.	To know the potential detrimental impact of social media on young people's mental health, with a focus on online harm and getting to know the reason behind the same.	The results of the data shed light on peer support being the central component of online interactions around self-harm.	The authors have not taken physical communication as a factor affecting mental health and were only limited to digital platforms.
[8][24][25] 2022/ Conor J. Wild et al.	Disentangling the cognitive, physical, and mental health sequelae of COVID-19	Study on the suggestion of the fact that the subjective experience of "long COVID" related to physical symptoms and cognitive deficits, especially executive dysfunction.	The results supported the existence of cognitive impairments in the aftermath of COVID-19 disease and include other important findings. Emphasized the fact that the physical, emotional, mental and cognitive sequelae of COVID-19 were not bound together as a single neurocognitive syndrome and that executive function and verbal abilities were the key domains that were affected in COVID-19 survivors.	There was selection bias in the sample dataset is drawn by them. Several other outcomes of COVID-19 were not measured such as PTSD which might have been interrelated with the sets of symptoms discussed in their study.
[9][26][27] 2022/ Stephanie Scott et al.	Australian Psychologists Experiences with Digital Mental Health: a Qualitative Investigation	This study explores psychologists' attitudes and experience with digital mental health intervention by taking a qualitative exploratory	They discovered that their study was fruitful for the future design of digital mental health resources and service delivery	They focused mainly on the larger cities for the samples of the psychologists whereas the experiences of rural healthcare professionals should have also been included. The sample of 10

		approach with the help of thematic analysis.		psychologists acquired by them did not represent the broader population.
[10][28][29] 2022/ Jonathan Campion, FRCPsych et al.	Public mental health: required actions to address implementation failure in the context of COVID-19	It outlines the specific actions to improve the coverage of Public Mental Health (PMH) which had an increase in interest due to the onset of the COVID-19 pandemic.	They confirmed that evidence-based, cost-effective PMH interventions exist to prevent mental disorders from arising, which have broad health, social, and economic impacts that also support the achievement of a range of policy objectives, failing to achieve the same breaches results in the breaching of the right to health leading to large-scale associated impacts and economic costs. These actions are also being found to be more important due to the COVID-19 pandemic consequently piquing the interest of the government and people in the mental health of the population.	They broadly focused on the high-income countries for this study and the low-income and medium-income countries were not taken into consideration, which breaches the idea of a general opinion of public mental health showcasing the prevalence of selection bias.
[11][30][31] 2020/Shweta Singh, Deblina Roy et al.	Impact of COVID-19 and lockdown on mental health of children and adolescents: A narrative review with recommendatio ns	It aims at reviewing multiple articles related to mental-health aspects of children and adolescents impacted by the COVID-19 pandemic and enforcement of nationwide or regional lockdowns to prevent further spread of infection.	The infection of COVID-19 among young children and adolescents is low however the stress confronted by the same is considered to be highly vulnerable. The study revealed that the pandemic and its preventions which led to lockdown and quarantine affected children by them having disturbed sleep, clinginess, poor appetite, inattentiveness, and significant separation problems. The containment measures not only showed a rise in loneliness, anxiety and stress among the children and youth but also the economically underprivileged children were prone to exploitation and abuse.	The review articles were taken during the time of global lockdown when the issues and challenges were new with the global crisis at its peak. They were unable to track the measures of the management targeted towards the children. The strategies reported were isolated to geopolitical conditions. There was also selection bias which persisted along with a short period of data collection restricted by only the use of electronic databases for their research.

IV. PROPOSED MODEL / TOOL

The flowchart depicted in Figure 1. represents the proposed model for the process of implementation of all our objectives which we have defined in section II of this paper.

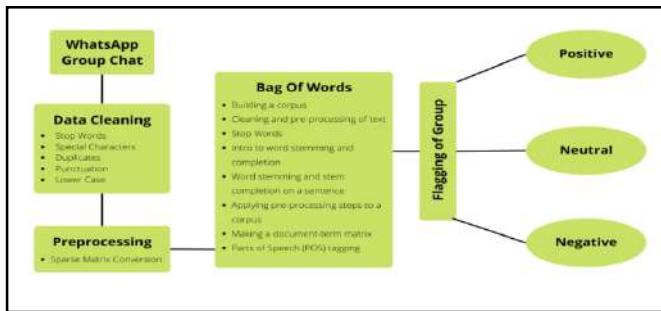


Figure 1. Flow chart of the Proposed Model

Python - Python is a high-level programming language which is widely used for its easy-to-read syntax. It also has multiple libraries which cater to different fields hence is a general-purpose language with its statistical and data analysis libraries and modules it is the perfect choice for our paper.

Collections - Collections in Python are containers used for storing data and are commonly known as data structures which include tuples, lists, dictionaries, etc.

Pandas - Pandas is a software library written for the Python programming language for data manipulation and analysis.

Matplotlib - It is a data visualization library in Python and its numerical extension, NumPy. It helps in plotting graphs and charts, across various platforms.

Seaborn - The Seaborn package in Python allows the creation of statistical visuals. It consolidates closely with Pandas data structures and is built upon the Matplotlib library.

Natural Language Toolkit (NLTK) - It is a platform to develop Python programs that incorporate data collected from human language for statistical natural language processing (NLP). It contains text-processing libraries for parsing, tokenization, stemming, classification, tagging, and semantic reasoning.

Scikit-learn (Sklearn) - It provides a diverse range of effective methods in Python for machine learning and statistical modelling, including classification, clustering, regression, and dimension reduction.

V. IMPLEMENTATION AND RESULTS

PYTHON

We have implemented the entire code in Python with the help of Jupyter Notebook. Various libraries which have been mentioned above have been used to implement the Bag of Words model on our dataset to acquire the results.

PANDAS

We utilize Pandas to display the data in a tabular format as shown in Figure 2.

	Date	timestamp	Person	title	day	hour	dayofweek
0	8/6/22	2022-11-08 18:59:00	A	Plastri has dominated everything he has done e...	2022-11-08	18	Tuesday
1	8/6/22	2022-11-08 18:59:00	A	Wc in all categories	2022-11-08	18	Tuesday
2	8/6/22	2022-11-08 18:59:00	A	Would definitely learn this new car faster	2022-11-08	18	Tuesday
3	8/6/22	2022-11-08 21:03:00	A	W11 was a beast	2022-11-08	21	Tuesday
4	8/6/22	2022-11-08 21:03:00	A	Rocket on rails	2022-11-08	21	Tuesday
5	8/7/22	2022-11-08 19:40:00	A	Will never happen sadly	2022-11-08	19	Tuesday
6	8/8/22	2022-11-08 15:32:00	A	In all this chaos u forgot u are still aiming ...	2022-11-08	15	Tuesday
7	8/8/22	2022-11-08 15:33:00	A	They should announce it already	2022-11-08	15	Tuesday
8	8/9/22	2022-11-08 05:08:00	A	What I meant is, He's already competing at the...	2022-11-08	5	Tuesday
9	8/11/22	2022-11-08 17:39:00	A	How long is this summer break	2022-11-08	17	Tuesday
10	8/11/22	2022-11-08 23:12:00	A	Kimi	2022-11-08	23	Tuesday
11	8/11/22	2022-11-08 23:26:00	A	https://nypost.com/2022/08/09/ferrari-recalls-...	2022-11-08	23	Tuesday
12	8/12/22	2022-11-08 21:13:00	A	Why r fans even using Twitter	2022-11-08	21	Tuesday
13	8/12/22	2022-11-08 21:13:00	A	Nothing good ever comes from that platform	2022-11-08	21	Tuesday
14	8/12/22	2022-11-08 21:14:00	A	Even Chris meolland posts are put here by prana...	2022-11-08	21	Tuesday
15	8/12/22	2022-11-08 21:14:00	A	Id prefer such groups and Instagram anyday	2022-11-08	21	Tuesday
16	8/12/22	2022-11-08 21:15:00	A	Had to be either a mercedes or a rb fan	2022-11-08	21	Tuesday
17	8/13/22	2022-11-08 15:10:00	A	no wonder elon is hesitating to buy	2022-11-08	15	Tuesday
18	8/13/22	2022-11-08 17:17:00	A	Hope no rain this year.. should be a good race	2022-11-08	17	Tuesday
19	8/18/22	2022-11-08 18:18:00	A	Is he talking about himself	2022-11-08	18	Tuesday

Figure 2. Data in tabular format

NLTK

We utilize this library to convert all strings into lower-case, remove all punctuations, tokenize strings into individual words, remove stop words, and perform word stemming on the dataset.

COLLECTIONS

This Python module was used to calculate the frequency of individual words appearing in the corpus. This is shown in Figure 3.

```
Counter({'plastri': 5,
'dominated': 2,
'everything': 11,
'done': 3,
'earlier': 1,
'wc': 1,
'category': 1,
'old': 31,
'definitely': 2,
'learn': 1,
'new': 18,
'car': 70,
'faster': 6,
'beast': 1,
'rocket': 2,
'rail': 1,
'never': 18,
'happen': 5,
'sadly': 2,
'chaos': 2,
'u': 33,
'forget': 7,
'still': 26,
'aiming': 1,
'drive': 5,
'pinnacle': 1,
'sport': 3,
'maybe': 12,
'guy': 13,
'know': 25,})
```

Figure 3. Frequency of individual words in the corpus

SCIKIT-LEARN

We used this tool to convert individual strings into vectors along with Pandas library we utilize them together to obtain the document-term sparse matrix, as shown in Figure 4.

	08	09	17	2022	ago	announcing	amp	announce	anyday	anywhere	—	sec	weekend	winning	wins	won	wonder	worth
Plastri has dominated everything he has done earlier. From F4 to F2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wc in all categories	0	0	0	0	0	0	0	0	0	0	—	1	0	0	0	0	0	0
Would definitely learn this new car faster	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0
W13 was a beast	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0
Rocket on rails	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0
Will never happen sadly	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0
In all other cases u forget to add winning to drive at the top level of the sport. Maybe these guys know that they could get a seat in other formats of racing. Also he's loaded already. It's not a good disappointment ig	0	0	0	0	0	1	0	0	0	0	—	0	0	0	0	0	0	0
They should announce it already.	0	0	0	0	0	0	0	0	1	0	0	—	0	0	0	0	0	0
What I meant is. He's already competing at the highest level in racing. He's not winning. Didn't say it's disappointing. He can always do something else if there is situation where no one signs him. For people like me, formula 1 is stupid, he is in this position due to his own choices. It's disappointing he's not at the top anymore winning like before.	0	0	0	0	0	0	0	0	0	0	1	—	0	0	1	1	0	0
How long is this summer break	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0
Kimi	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0
https://www.reddit.com/r/F1/comments/111111/ferrari_recalls_17_years_worth_of_cars_over_possible_b/	1	1	1	1	0	0	1	0	0	0	—	0	0	0	0	0	0	1
Why r fans even using Twitter.	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0

Figure 4. Document term sparse matrix

SEABORN AND MATPLOTLIB

We utilize these libraries to plot a word-frequency bar graph. This is depicted in Figure 5.

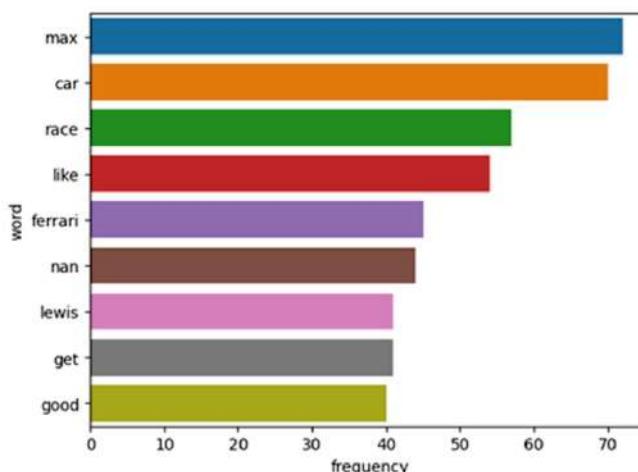


Figure 5. Word frequency bar graph

Figure 6. shows the bar graph which was made using ngrams for pairs of words which occur the most frequently.

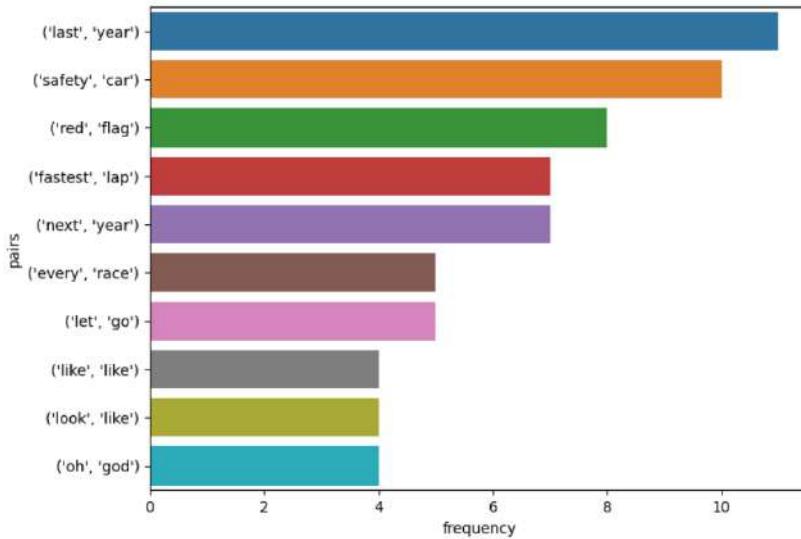


Figure 6. Word pair frequency graph

We utilize the Parts of Speech (POS) tagging technique and tag the various chunks which are formed into their individual categories.

After Split: ['Piastrī has dominated everything he has done earlier. From F4 to f2', 'We in all categories', 'Would definitely learn this new car faster', 'Will was a beast', 'Rocket on rails', 'Will never happen sadly', 'In all this chaos u forget u are still aiming to drive at the pinnacle of the sport. Maybe these guys know that they could get some formats of racing but he is loaded with more formats', 'Just disappeared from it', 'They should announce it already', 'What I meant is. He is already competing at the highest level in racing. But fighting for more/wins. Didn't say it's disappointing. He can always do something else if there is situation where no one signs him. For people like us, he is in this position due to his own choices. It's disappointing he's not at the top anymore winning like before.', 'How long is this summer break', 'Kimi', '[https://nypost.com/2022/06/09/ferrari-recalls-17-years-worth-of-cars-over-possible-brake-failure/amp/](https://nypost.com/2022/06/09/ferrari-recalls-17-years-worth-of-cars-over-possible-brake-failure/)', 'Why r fans even using Twitter', 'Nothing good ever comes from that platform', 'Even Chris mehdian posts are put here by pranav and others.', 'Id prefer such groups and Instagram anyday.', 'Had to be either a mercedes or a fan', 'No wonder elon is hesitating to buy', 'Hope no rain this year.. should be a good race', 'Is he talking about himself', 'What on day when elon retires they could be better friends', 'Mercedes have won for so long they got very cocky very soon', 'It's time Ferrari and rb come back up again.', 'Does max prefer oversteer or understeer', 'Rained this somewhere long ago', 'I mean a little bit.', 'Since last season his cars rear tend to slide around, visually atleast.', 'Interesting', 'At first I thought he doesn't have the right balance but he keeps winning with this setup', 'Maybe even gets more temp on tyres that way considering the sliding around', 'Let's gooo', 'At least now they must announce about piastrī', 'Raining this weekend at spa wtf?', 'Both days', 'After Token: ['Piastrī has dominated everything he has done earlier. From F4 to f2', 'We in all categories', 'Would definitely learn this new car faster', 'Will was a beast', 'Rocket on rails', 'Will never happen sadly', 'In all this chaos u forget u are still aiming to drive at the pinnacle of the sport. Maybe these guys know that they could get a seat in other formats of racing. Also he's loaded already. It's not an L, just disappointment iq', 'They should announce it already', 'NNP', 'What I meant is. He's already competing at the highest level in racing. But fighting for more/wins. Didn't say it's disappointing. He can always do something else if there is situation where no one signs him. For people like us, feeling bad for daniel not being in formula 1 is stupid.. he is in this position due to his own choices. It's disappointing he's not at the top anymore winning like before.', 'NNP', 'What I meant is this new car faster', 'NNP', 'Kimi', 'NNP', '<https://nypost.com/2022/06/09/ferrari-recalls-17-years-worth-of-cars-over-possible-brake-failure/amp/>', 'J3', 'Why r fans even using Twitter', 'NNP', 'Nothing good ever comes from that platform', 'NNP', 'Even Chris mehdian posts are put here by pranav and others.', 'NNP', 'Id prefer such groups and Instagram anyday.', 'NNP', 'Had to be either a mercedes or a fan', 'NNP', 'No wonder elon is hesitating to buy', 'J3', 'Hope n o rain this year.. should be a good race', 'NNP', 'Is he talking about himself', 'NNP', 'Maybe one day when Lewis retires they could be better friends', 'NNP', 'Mercedes have won for so long they got very cocky very soon', 'NNP', 'It's time Ferrari and rb come back up again.', 'NNP', 'Does max prefer oversteer or understeer', 'Rained this somewhere long ago', 'I mean a little bit.', 'Since last season his cars rear tend to slide around, visually atleast.', 'NNP', 'Interesting', 'NNP', 'At first I thought he doesn't have the right balance but he keeps winning with this setup', 'NNP', 'Maybe even gets more temp on tyres that way considering the sliding around', 'NNP', 'Let's gooo', 'NNP', 'At least now they must announce about piastrī', 'NNP', 'Raining this weekend at spa wtf?', 'NNP', 'Both days', 'NNP', 'NNP']

Figure 7(a). Part of Speech tagging technique

```

After Chunking (S
{mychunk
  Piastris has dominated everything he has done earlier. From F4 to f2/NNP
  Win in all categories/NNP
  Would definitely learn this new car faster/NNP
  Will was a beast/NNP
  Rocket on rails/NNP
  Will never happen sadly/NNP
  In all this chaos u forgot u are still aiming to drive at the pinnacle of the sport. Maybe these guys know that
  they could get a seat in other formats of racing. Also he's loaded already. It's not on L , just disappointment
  ig/NNP
  They should announce it already. /NNP
  What I meant is. He's already competing at the highest level in racing. But fighting for more/wins. Didn't say
  it's disappointing. He can always do something else if there is a situation where no one signs him. For people like
  us , feeling bad for daniel not being in formula 1 is stupid.. he is in this position due to his own choices. It's
  disappointing he's not at the top anymore winning like before./NNP
  How long is this summer break/NNP
  Kidding/NNP
  https://hypost.com/2022/08/09/ferrari-recalls-17-years-worth-of-cars-over-possible-brake-failure/amp/33)
{mychunk
  Why r fans even using Twitter./NNP
  Nothing good ever comes from that platform /NNP
  Even Chris medland posts are put here by pranay and others./NNP
  Id prefer such groups and Instagram anyday./NNP
  Had to be either a mercedes or a rb fan/NNP
  no wonder elon is hesitating to buy ./NNP
{mychunk
  Hope no rain this year.. should be a good race/NNP
  Is he talking about himself /NNP
  Maybe one day when lewis retires they could be better friends ./NNP
  Mercedes have won for so long they got very cocky very soon./NNP
  It's time Ferrari and rb come back up again./NNP
  Does max prefer oversteer ? Heard this somewhere long ago/NNP
  I mean a little bit./NNP
  Since last season his cars rears tend to slide around , visually atleast../NNP
  Intersting/NNP
  At first I thought he doesn't have the right balance but he keeps winning with this setup/NNP
  Maybe even gets more temp on tyres that way considering the sliding around/NNP
  Let's gooo/NNP
  Atleast now they must announce about piastris/NNP
  Rainning this weekend at spa wtf ?/NNP
  Both days /NNP
  /NNP)

```

Figure 7(b). Chunks

As we can see from the results most of the chunks are categorized in either the NNP category or the NN category in the dataset meaning the words with the highest frequency are either Nouns or Pronouns pointing to an object or a person. Since the words with the maximum frequencies are neither positive nor negative, hence we flag the group to be neutral.

VI. CONCLUSION

A lot of research has been done on text analysis for the identification of emotions and predicting the choice of people based on the text generated by them. Mostly this emotional analysis has been done for products, services and political implications which is thoroughly profit-oriented and has been capitalized by commercial giants for their benefits. None of the studies to date has considered the impact of this emotional analysis on human beings and specifically students so that the mental health and physical well-being of the current and next generation could be enhanced. Hence, this project of ours concentrates on this loop of the virtual world and its impact on students, and their physical and mental health specifically during the times of pandemic when they were compelled to be part of this virtual world without any choice. The presented study could be enhanced and could be utilized further for making the virtual interactions flagged with their mental health implications as to be positive implications, negative implications, or neutral implications. The same could be utilized for preparedness for any other natural calamity like the COVID-19 pandemic to be managed in a way which will have little or no impact on the mental and physical well-being of the current and next generations. This paper also comes with its limitations. Firstly, the dataset taken was a Formula One-related peer group which might arise a selection bias.

Secondly, emojis, images and videos were not taken into consideration hence we won't get the full picture of what was occurring in the group. Thirdly, abbreviations were kept intact which might have affected the maximum frequency of certain words. These are a few limitations which we hope to be worked on as future studies and improvements.

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Biochar Filtration for Grey Water Treatment

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Abstract- Water scarcity will soon incapacitate the entire world; therefore, novel technologies are needed to utilize water in all possible forms for a better humanity. The groundwater and surface water are rapidly getting contaminated by pollutants and hence cannot be used for irrigation, drinking and other purposes. Moreover, the renewable resource of water is decreasing day by day. Thus, an alternative water source of greywater comes into play. Grey is readily available through an inexpensive laboratory-scale treatment method. It can be purified so that it can serve irrigation purposes. This method uses the Biochar of banana peel and other organic, agricultural waste to treat the water. The greywater sample has been effectively treated and can be used for irrigation, industrial, commercial, and other purposes.

Index Terms- Biochar, filtration, grey water

I. INTRODUCTION

Water is essential for human life and health. It is nature's gift to the human race. Water plays a vital role in irrigation purpose industrial, and commercial purposes. It is also essential for the development of any city in the world. In recent days population are increased suddenly, which causes water scarcity and health hazards. 80% of consumed water comes out as waste which should be treated and reused. So, the need for water is so high, leading to more freshwater extraction. Water is a non-renewable resource that is decreasing day by day due to artificial activities. Due to population, the environment is affected and gets polluted easily. So, we are in a position to save non-renewable resources for future generations. So, we are using the renewable waste resource in our project. Because of the charcoal content, we will use organic waste as Biochar instead of the charcoal layer in filtering media for treating the water. Biochar is a type of charcoal layer which is made of organic and agricultural waste. The primary crop residues produced in India are paddy and wheat. In India, most agricultural wastes are burned and cause air pollution, and global warming .in alternate agriculture, waste is used as a filtration media to treat the wastewater and reuse it for their purposes. Water passes through a biochar filter; water comes out from the filter media with suitable impurities. Instead of burning Agri waste, it can be used as a reusable material. This method reduces the amount of freshwater extraction and water scarcity. Waste generation is also

minimized.

II. STATEMENT OF THE PROBLEM AND OBJECTIVES

Filtration passes water through granular materials' beds, known as filtration. Before the filtration process, sedimentation and screening may be carried out to remove the larger, heavier, and floating objects for ease of water. The elements are responsible for turbidity, colour, and odour and make water aesthetically attractive—the process of removing the impurities present in water. But even then, the resultant water is not pure and may contain some fine suspended particles and microorganisms such as bacteria. Therefore, to remove or reduce the contents of impurities, the water is filtered through the beds of fine granular material like sand and charcoal. As a result, the filtered water is potable and palatable and free from undesirable impurities like colour, odour, turbidity, pathogenic bacteria, etc.

The filtration process forms the most crucial stage in water purification. It has been noticed from experienced that during the process of filtration, the chemical characteristic of water is altered, and the number of bacteria present in water is considerably reduced. Here we are using a **slow sand filtration** concept. The sand used for the filter should be free from clay, loam, vegetable matter, organic impurities, etc. It should be uniform in nature and size. The anthrafil is sometimes used instead of sand. It is made from anthracite, a stone coal that burns without smoke. It contains almost carbon. The material has many advantages, such as low cost in handling, high rate of filtration, durability, better efficiency etc. We use three types of layers, such as sand, gravel, and organic waste, as the charcoal layer. The organic charcoal layer is responsible for altering the chemical characteristic of water. Gravel is a base material; sand is the topmost layer, and organic charcoal is the intermediate layer. Biochar is prepared at a significantly lower controlled temperature of 350° to 450°C. In slow sand filtration media, water slowly passes through the beds of the layer due to gravity. The resultant water is pure. They are expected to remove about 98 to 99% of the bacterial load from raw water, which satisfies that.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED.

- The capacity of Biochar Filters for wastewater Treatment in onsite systems, SLU, Swedish university of agricultural sciences, Uppsala, Sweden (2016)
- Quality of greywater treated in biochar filter and risk assessment of gastroenteritis due to household exposure during maintenance and irrigation J. Appl. Microbiol., 121 (2016), pp. 1427-1443
- The challenges of wastewater irrigation in developing countries Agric. Water Manag., 97 (2010), pp. 561-568
- Comparative Study of Bark, Biochar, Activated Charcoal Filters for Upgrading Grey-Water Master SLU Swedish University of Agricultural

Sciences (2014)

The papers mentioned above proved our assumption that filter media works better. Here we conclude that the selected layer effectively treats grey water and wastewater. Biochar is an effective and altered solution for non-renewable resources. It reduces biological impurities and also alters the chemical characteristic of water.

IV. PROPOSED MODEL/ TOOL

In this model, first, we use only banana peel as a charcoal layer. The resultant water is pure than expected, so we are moving towards other organic wastes. The water is allowed to pass through a layer of beds. The first topmost layer filters the larger and floating objects in raw water. Then second layer, i.e., the charcoal layer, alters the chemical characteristic of water and some impurities. The third layer of sand is used to prevent the mixing of a coating with sand and reduce the carbon content. The fourth and fifth layer of gravel is used to alter water's physical and chemical properties. The resultant water is free from less turbidity, ph., conductivity, BOD & COD. The proposed model is depicted in Figure 1.



Figure 1. Proposed Model

The filtration media consists of five layers:-

- Layer 1: sand with a size of 11 to 20 mm
- Layer 2: biochar with a thickness of 20 mm
- Layer 3: sand with a length of 25 to 30 mm

Layer 4: Gravel with a height of 60 to 70 mm

Layer 5: Gravel with a height of 20 to 40 mm

V. IMPLEMENTATION AND RESULTS

The result of the proposed system is depicted in Table 1.

Table 1. Findings of the experiment

Parameters	Standards	Before treatment	After treatment
pH (mg/l)	6 - 7	7.9	7.3
Conductivity (μs/cm)	400	520	457
Turbidity (NTU)	5	22.4	14.8
Hardness (mg/l)	396	497	300
BOD (mg/l)	1	19	12
COD (mg/l)	0 - 1	79	5
Sulphate (mg/l)	12	14.8	11
TDS (mg/l)	392	741	402

VI. CONCLUSION

Here we conclude that the Biochar filtration system is an effective method for treating grey water. It gives better results when compared to standard filtration, which consists of charcoal or wood. Wood is a non-renewable resource, so we move on to renewable resources and waste material. A large number of impurities are successfully removed using this biochar filtration. This project also helps in solid waste management, reducing and utilizing waste. The resultant water can be used for industrial, commercial and irrigation purposes. Fresh water extraction is also reduced. In the future, we will use Biochar from other organic or agricultural waste instead of charcoal layer. We tested only grey water with Biochar. In future, we are going to treat the other wastewater. For quick quality checking, we are going to use IoT-based sensors to monitor the quality of water. Ph, turbidity, and conductivity sensors check whether the rate is potable.

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Smart Black Box for Cars

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Abstract- The term "internet of things" refers to a network of physical items, or "devices," that are connected to and exchange data with other devices and systems via the internet. These "devices" are equipped with sensors, software, and other technologies. In other words, the Internet of Things (IoT) is a network of physical objects—gadgets, instruments, vehicles, structures, and other things—that are outfitted with hardware, circuits, programming, and system networks to enable them to collect and exchange data through a wireless communication module installed on the nodes. This paper describes the design and implementation of various intelligent services by a box installed in cars. This box is known as Smart Black Box. It is a device which maintains a diverse history of a vehicle. Details for the last hour are saved. Services such as GPS location tracking will let us know where the car was in the previous hours of the accident and where the vehicle is stuck. Also, with the help of GPS, the nearest police stations, NGOs (public help centres), and hospitals will be alerted so that needed medical help can be given to the victim. The message will be sent to emergency contacts. The black box also stores information regarding the different status of the engine, like its temperature, wear, and tear, and keeps a record of fumes produced in case of engine heating. The message will be sent to emergency contacts. There also will be a microphone that will keep recording the last 30 minutes. All these data will be stored in a chip accessible by using that chip only for later usage.

Index Terms- Black box, GPS, Microphone, Sensors

I. INTRODUCTION

The term "internet of things" refers to a network of physical items, or "devices," that are connected to and exchange data with other devices and systems via the internet. These "devices" are equipped with sensors, software, and other technologies. In other words, the Internet of Things (IoT) is a network of physical objects—gadgets, instruments, vehicles, structures, and other things—that are outfitted with hardware, circuits, programming, and system networks to enable them to collect and exchange data through a wireless communication module installed on the nodes. This equipment includes everything from everyday domestic items to high-tech industrial

equipment. Experts predict that by 2025, there will be 22 billion linked IoT devices, up from the current total of over 7 billion. The Internet of Things makes it possible to find articles. [1, 2]. The majority of accidents involve cars. These days, lousy riders who speed, drive intoxicated, don't wear helmets, ride while fatigued, etc., are contributing to an ongoing rise in this issue. The number of fatalities because of delayed aid to accident victims.

In this Project, a Smart black box using an Ultrasonic sensor and GPS location tracking system is developed for accidental monitoring. When the accident happens simultaneously, GSM will send the authorized mobile phone. The Location of the vehicle sends a short message using a GPS device to a family member. The system consists of an accelerometer sensor, Arduino Uno microcontroller, GPS device and GSM module for sending a short message. An accelerometer sensor is applied to X, Y, and Z direction fall detection of an accident. The car's speed and threshold algorithm can decide a fall or accident in real-time. A mobile short message containing the position from GPS (latitude, longitude) will be sent when a motorcycle accident is detected...! And if the manual switch is pressed, all the information will be recorded after 15 minutes and updated to a family member through SMS...!

The IoT Project is divided into three phases; the first phase is making a smart black box which records and stores data in solid state memory (chip) regarding the car, different situations, and other objects near or within the vehicle. In the second phase, the recorded data is transferred to a server which keeps data safe and secure from fire/water or any other damages that can be done because of an accident; hence there will be a backup for the data.

In case of an accident, either a deployment event or a non-deployment event, the data gathered by the crash recorder about the vehicle's motions before, during, and after a crash can be used by the accelerometer sensor to pinpoint an accident. The rescue team or the police control centre acquired the car's license plate number and the person's contact information shortly after the accident. The police quickly located the accident scene after receiving the notification. Once the Location has been verified, the necessary action will be taken. The nearby NGOs, hospitals, and families will be notified with the required information. Once the message is sent, the black box will go into locked mode; hence the data can be retrieved and not changed. In case there is a theft kind of situation or any other suspicious activity that the driver detects, there is a manual button to click. This is the third phase...! Now the inquiry commission can only access the solid-state memory (the chip)!

II. BASIC CONCEPTS AND TECHNIQUES USED.

The main motive for creating a smart black box is to help the inquiry officer get a clear overview of the situation before and after the accident, which would help solve the case and require prompt actions against the suspect. To develop this Project, we need the following hardware and software to implement.

Software (Integrated Development Environments)

- ❖ **Android Studio:** Built on JetBrains' IntelliJ IDEA software and created exclusively for Android development, Android Studio is the recognized integrated development environment (IDE) for Google's Android platform. It can be downloaded on Windows, macOS, and Linux-based operating systems. As the primary IDE for creating native Android applications, it takes the Eclipse Android Development Tools (ADT) position.
- ❖ **Arduino IDE:** Initiated by Arduino. Cc, an official software, is primarily used for writing, building, and uploading code to Arduino devices. This open-source software is compatible with nearly all Arduino modules and is readily available to install and begin compiling the code on the move.

Language used:

- ❖ **Embedded C Language**

The Embedded C programming language is a straightforward computer language created to support complex object-oriented programming. C is described as a condensed but rich set of ANSI C language enhancements. Smalltalk, one of the first object-oriented programming languages, served as the foundation for most of its contributions to C. C's full object-oriented programming features are intended to be provided clearly and straightforwardly.

Most object-oriented development environments consist of several parts:

- An object-oriented programming language
- A library of objects
- A suite of development tools

- ❖ **Java**

Hardware used: The hardware used is shown in Figure 1.

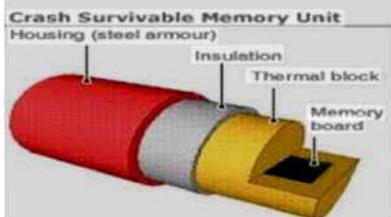


Figure 1(a). Solid state Memory and survivable unit



Figure 1(b) Ultrasonic Sensor



Figure 1(c). 5MP Raspberry Pi 3 Model B Camera r3 Arduino Uno



Figure1(d) Microcontroller



Figure 1(e). Solar panel



Figure 1(f). Microphone



Figure 1(g). IR (Infrared) Obstacle Sensor



Figure 1(h). NodeMCU (ESP8266):



Figure 1(i). 16x2 LCD Display



Figure 1(j). NEO-6M GPS module



Figure 1(k). GSM/GPRS Model



Figure 1(l). ESP32 Board

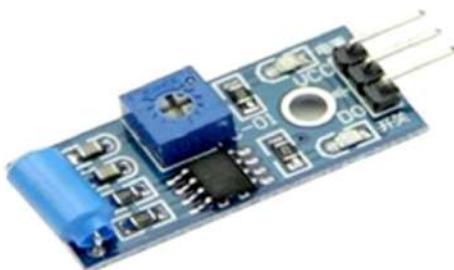


Figure 1(m). Tilt Sensor



Figure 1(n). PIR Sensor

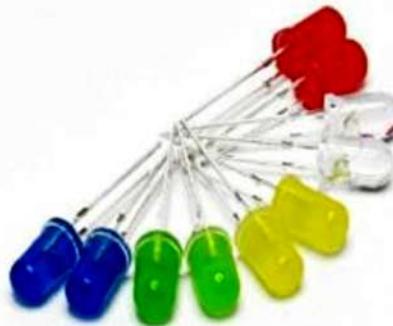


Figure 1(o). LED

Database:

- ❖ Firebase Real time Database: The Firebase Realtime Database is a cloud-hosted database. Data is stored as JSON and synchronized in real-time to every connected client. When you build cross-platform apps with our iOS, Android, and JavaScript SDKs, all your clients share one Realtime Database instance and automatically receive updates with the newest data.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED.

The idea of Smart Black Box popped into my mind by observing the situation in the family itself...! When my uncle was travelling by car then, he was correct at his level. However, just because of the opposite vehicle, he just faced one accident late at night...at that time, there was not any presence of the camera, and as we know, in our country Government can't fix cameras in each Location, Of course, it's a very costly solution to fix the camera in all over India so, if we consider the Legal authorities then also it is difficult to take any action because of missing correct/legal proof.!

Along with the accident issue, we just thought about Women's Safety. We know it's a significant issue in India and even out of India. Because the car can be driven by men or women or even older adults so, for their safety, we decided to add some additional features so that everyone can use it.

Same time my team and I was learning Android Studio IDE and IoT at the primary level, and then we searched a lot on Google. We saw that the model

was created using the same IoT Hardware and Arduino. First, however, we started reading the research paper to know what is in the existing system and what other changes we can bring to our model and implementation.

We read search papers by following:

- 1) The Design of Smart Black Box in Smart Cars.
- 2) Wireless Sensors and Sensor Networks for Structural Health Monitoring, Shock and Vibration Digest.
- 3) EDR System Utilizing Wireless Sensor Network and Ultrasonic Sensor
- 4) Working principle of Arduino and using it as a tool for study and research.
- 5) Real-time Communication Application Based on Android Using Google Firebase.

IV. PROPOSED MODEL/ TOOL

One of the leading causes of fatalities on Indian roadways is traffic accidents. According to media reports, a vehicle accident claims one person's life in India every four minutes. [1] Around the nation, 1.25 million individuals perish in auto accidents every year. Some of them pass away there and then, unfortunately, while others live long enough to receive medical attention. It can be challenging for survivors of drivers or passengers who died in an automobile accident to know where to turn for support. [2]. Thirteen lakh individuals have been killed in traffic accidents in India over the past ten years. [3]. Crash-like events activate some Event Data Recorders, EDR, present in cars. They may continue to record until the accident is over or until the recording period is up. Other EDRs continually record data, overwriting the previous few minutes until a collision stops them. If the brakes were applied, the speed at impact, the steering angle, and if the seat belt circuits indicated "Buckled" or "Unbuckled" at the time of the incident are all possible data components that EDRs may capture. However, EDRs cannot send the necessary notifications for assistance, are ineffective in cases of hit-and-runs and may not be helpful in legal investigations.

A typical EDR's Place is shown in Figure 2.

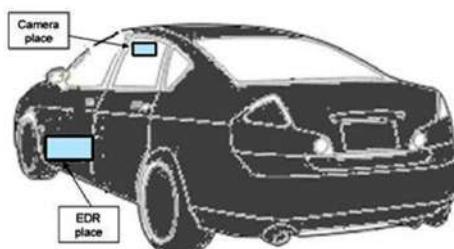


Figure 2. The event data recorder is placed in a car

One remedy is the intelligent black box, which notifies numerous NGOs, hospitals, and police stations when a car meets with an accident or manually if the driver notices suspicious activity by pressing a button. The victim can then receive the appropriate medical attention, and a police investigation can begin as the smart black box has the information essential for it. As a result, the intelligent black box can assist in two ways: one, by dialling the nearest medical assistance, and the other, by aiding in legal proceedings. Therefore, we suggest that the existing ERDs be replaced with intelligent, IoT-based black boxes, providing more benefits as a practical and efficient alternative. The following are some of the proposed model's main advantages:

- A. Automated system. a sealed container mounted on the vehicle's dashboard will contain sensors, a closed-circuit camera, and a microphone; additionally attached to the processor is the GSM/GPS module, etc.
- B. The collected data, including photographs of events occurring in front of the car and from the back of the vehicle, voice recordings, engine-related data, etc., will be continually overridden in solid-state memory and communicated in a compressed manner to the server.
- C. The names on the emergency contact list will be alerted in the event of an accident or when the driver manually presses the button.
- D. Only officials with the necessary authentication can access the chip (solid state memory) using their personal computers.

V. IMPLEMENTATION AND RESULTS

When an automobile meets an accident, this model is helpful in two different ways. First off, from the victim's perspective, they are not in a fit state of mind to intervene or ask for assistance. The suggested methodology will instantly alert the hospitals, non-profit organizations, and family members on the emergency list. Additionally, the police are always involved when accidents happen. Black box data will help investigate purposes. The cameras and microphone gather enough evidence to identify the offender in hit-and-run instances, where the perpetrator often gets away with his crime owing to a lack of evidence, and the case cannot be solved. Table 1 illustrates the difference between the existing EDR and the proposed EDR.

Table 1. Comparison of existing EDR with the proposed EDR

Existing System EDR	Proposed System Smart Black Box
No Security of vehicle	Security of Vehicle because you can see your car with details on Android Applications
It doesn't Record the Location	Records proper Location
The SMS facility is not available	Notifications will be sent through SMS only
Doesn't Record data after accident	Records Data Before the accident, During the Accident and after the Accident
Power Supply through inbuilt Battery	Power Supply Through Solar Chargeable Battery

VI. CONCLUSION

In conclusion, we are providing Smart Blackbox, which can be operated manually or automatically. The Indian Commission may view this specific technology as applying the relevant laws, which mandate the installation of black boxes in all vehicles. Furthermore, the psychological effects of the black box will completely transform traffic safety. Knowing that their every move may be recorded will make drivers more careful, preventing them from lying in the event of an accident.

In addition, an intelligent box can operate manually by pressing a single switch. This feature of a smart Box is essential for automatically safeguarding women's safety. The proposed design will address critical problems that women have recently experienced and will contribute to their resolution. This concept could be used in various security and surveillance applications with additional study and invention. The device can monitor the desired area in real time and accurately identify instances of violence.

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VALOUR OS Operating Software Environment

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Abstract - During the last few years, technology has developed the most to solve various problems related to data storage, communication, the internet, etc., but everything has pros and cons. Technologies were effectively and efficiently helping us in multiple aspects, but on the other hand, user privacy is getting concerned. Even today, we hear that someone leaked a company's private data or anyone's private data was breached. Also, during the COVID-19 pandemic, instead of written exams, online exams were taken, but no practical coding exams were taken because students can directly share or copy the code from the internet or anyone. So, a closed environment allows only authorized users to access the encrypted data stored in the server, and all the activities of the users and admins will be held as an activity log. Administrators will have powers to authorize and give or revoke user privileges. Administrators can have a real-time view of all the activities performed by the user and can ban a user if required. It will have applications like code editor, chat application, steganography tool, paint, AI, browser, etc., developed using the python programming language. In this paper, authors have developed a closed environment that can help administrators to manage their users and access authorization to the server. Users can run various applications like code editor, music player, steganography tool, AI, paint, chat, etc. All users' and administrators' data & passwords are stored in a solid encrypted format which is not easy to crack. So, a secured closed environment that helps the administrators view all users' real-time activities and can give or revoke privileges from users is developed, which doesn't require any high-end hardware & software and doesn't require any implementation cost.

Index Terms - Closed environment, data encryption, password hashing, data privacy, authorization, steganography, code editor, AI

I. INTRODUCTION

Data is facts or information the user creates, and it can be used for further processing. When an unauthorized user shares the private data of a user or a community with another user or uses it for themselves without taking permission from the authorized owner or user of that data is called data leakage, and it's not ethical. The closed environment provides a secured login system where users can register themselves, and as the administrator provides the authorization, they can access the fast setting and use the applications and features. All administrator's and user's passwords are stored in a substantial (SHA-256) hash format with salting. All the other data and chats are stored in

strongly encrypted form, which can be later decrypted to retrieve data and conversations. It also has a steganography tool which helps the users and administrators to communicate secretly by sharing images which will have an encrypted message in them. The encrypted image will look normal but have a hidden message decrypted using the steganography tool. For conducting a practical coding examination or practising, a code editor is also provided in the closed environment where you can execute code of the required programming language if its path is set in the user environment variable. Users can directly share their principles with the administrators in the encrypted format, and no other user can get access to it. Administrators will also be able to see the activity log of all the users, whether the user has switched windows, opened the browser, used any other application, etc. It also has a chat application where users and administrators can communicate with each other, like client-server architecture. The paint application will help you draw anything of different colours per your desire. AI(ROSE) can answer most questions like location, weather, news, etc. A calculator for performing mathematical operations, a calendar to view dates of any year, system information, RAM/CPU usage, a pdf viewer, a browser and a music player are the various other applications provided in the closed environment.

II. LITERATURE REVIEW

"In our daily life in this digital era, information has become essential. Unfortunately, digital crimes such as information theft also develop along with the development of technology and the importance of communication. One way to protect information is with steganography.

Steganography is a technique to insert private data or secret messages into an image. Cryptography is a method for maintaining the confidentiality of information by transforming data into an unreadable format so that only the recipient who has permission can translate it. Cryptography can help secure data by disguising the data into a form that ordinary people cannot read. Still, it can be a double-edged sword because people who understand that it is the result of cryptography will be interested in solving the ciphertext." [11]. As mentioned, using a cryptography tool for data encryption and decryption is secure, but encrypting and decrypting data in a closed environment is more efficient and safe because the salting and fernet key is unique cannot be accessed by any unauthorized users. In the steganography tool, the data or message gets embedded in the image, but it is still vulnerable, and anyone can extract the data or news by using any online tool. So, to overcome that problem, the data is still embedded in the image, but initially, it gets encrypted with a unique fernet key and then embedded, enhancing the data privacy and security.

"This is a basic operating system mock-up made from the python GUI module tkinter. It has a few interactive apps to navigate through. There are two main screens, apart from the various app screens. At first, you're confronted with the

welcome screen, where you're supposed to enter your password within five tries. Then, on login, you enter the app drawer, where you can choose from a grid of apps." - [9]. Marvell OS has interactive apps like a calculator, notepad, image viewer, settings, etc., where user can perform their required operations like calculation, writing text, viewing images, etc. At the same time, Valour OS has a wide variety of applications like a chat application, steganography tool, and notepad, along with code runner, AI, system info, etc., with better UI/UX and security. "The music player GUI project idea tries to emulate the physical music player. This program allows you to play songs, music and all music files on your desktop or laptop. In addition, python has libraries that can play audio files, such as Pygame, which allows you to work with media files in just a few lines of code." - [10].

Valour OS has an mp3 player where users can play mp3 music/audio files. In addition, it has a better UI/UX, and a seek time slider, a pause/resume button, a mute button, and a sliding text animation, which displays the name of the mp3 file.

III. PROPOSED MODEL

For storing user data like passwords, chats, etc. MySQL database is used, and passwords are first hashed and salted by utilizing the hash module and then stored, whereas other user data & chats are encrypted using a cryptography module and stored. When a user or administrator registers, an email will be validated using "isitrealemail" API. They will also receive the recognition email sent using the SMTP module. They can also request for password change, or if they forgot their password, an email with an OTP would be sent to their registered email. After successful registration, administrators will decide whether they have an authorized user or not and as per their desire, they can provide or revoke the authorization to access the closed environment. All the user activities will be audited by various approaches like event-driven programming when the user clicks the button for switching windows, minimizing the windows, opening the browser, etc. Users can also view their profile in the closed environment and create four more user profiles with the same registered email. Users can also view system information, RAM usage, CPU usage, etc., shown using the psutil module. The calendar is displayed using the tkcalendar module, which can display a calendar of any year and month.

The pytsx3 module is used for developing AI and taking voice input from the user; the PyAudio module is also required. The steganography tool is created using the steps module, and the message is encrypted using fernet encryption. Users can also view the weather, location, and IP address displayed using various APIs. Browser is developed using the PyQt5 module and the PyQtWebEngine module. All these applications and other APIs can run concurrently and in real-time using the concepts of multi-threading and multi-processing.

A computer system or a laptop is required to run this software with a good microphone. A stable internet connection is also mandatory for registration and using the closed environment with all its functionality like AI, weather, IP address, etc. The pip install command can install all the required modules from the command prompt. You must install an English Canada voice pack from Windows speech settings if a female voice is needed for AI. It doesn't require any external hardware to run. The code of the necessary programming language should be installed externally in the system and its path must also be set in the environment variables. It also doesn't require any cost to implement it. PDF-Viewer is also provided in the closed environment if the user desires to view a PDF file.

IV. IMPLEMENTATION AND RESULTS

Unlike other closed environments that provide tools to conduct a practical coding examination, this secure environment provides tools that help us achieve a practical exam, and users can directly share their code with their administrators in an encrypted format. In other closed settings, the user cannot use any external module or libraries like the Tkinter library, pymysql module or any other external library, but this closed environment has overcome that problem. It is developed with the idea that inside this fast environment software, users can build their new software and use any library they want. All this is possible because of the use of concepts like multi-threading and multi-processing.

As this closed environment provides a real-time activity log of all the users, administrators can ban users if they do not follow the protocols. Furthermore, in a secure environment, users can view their profile, system information and login activities. Figures 1,2,3 and 4 show the screenshots of the proposed system.



Figure 1. Valour OS on a Computer



Figure 2. Valour OS on a mobile device



Figure 3. Admin panel

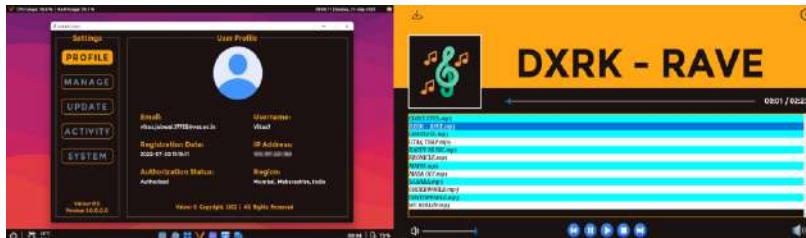


Figure 4. User profile

V. CONCLUSION

A closed environment that helps administrators to maintain the users by providing or revoking the privileges to access the server. Administrators can see the activity log of all the users and can ban any user if caught following the protocols. Chat application helps users and administrators communicate with each other with end-to-end encryption on the local server. Steganography tool that allows users to send hidden secret messages, encrypted and embedded in the image. An AI, whom the user can talk to and get an answer in response. Code Editor that helps users to execute the code and share it with their administrators. Paint application where you can draw anything required and save it in image format. So, a closed environment with all the necessary applications and authorization tools that don't need any high-end hardware or software and is free of cost is developed. This secure environment can run multiple APIs and applications concurrently because of multi-threading and multi-processing techniques. A natural time activity log can generate because of event-driven programming. In future, the authors would like to improve the

optimization of this software. A more enhanced chat application with private chat rooms and file sharing, voice chat, video chat, etc. options is to be developed.

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Smart Electric Wheelchair with Automatic Navigation, Health Monitoring and Intelligent Control Features

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Abstract- The needs of many individuals with disabilities cannot be satisfied with manual wheelchairs, hence smart wheelchairs are provided for the immense impact as they offer mobility with more relative ease. Differently disabled people face many hardships in life, having to be dependent on a third person to move from place to place. Our smart electric-powered wheelchair is an implementation of a low-cost intelligent wheelchair for the disabled to provide them with supporting aid. The invention of the wheelchair is a great boon to them, but it still restricts their motion. This project aims at providing them with a non-polluting and cost-effective solution. A notable feature is 2D mapping which is implemented using SLAM to aid the user automatically navigate indoor places. Various other features such as obstacle detection, edge detection, health monitoring, heart attack detection and various emergency safety features thereby developing a Smart Wheelchair that can reduce the physical, perceptual, and cognitive skills necessary to operate a power wheelchair. This paper describes the design and objective of the smart wheelchair that can serve as a low-cost smart alternative to aid the physically challenged, which has a tremendous potential impact on society.

Index Terms- 2D-mapping, Obstacle detection, Edge detection, Cognitive skills

I. INTRODUCTION

Disability is one of the most important issues in contemporary society, which can limit the scope for individuals to exercise their knowledge, skills, and opportunities to the fullest. From a statistical viewpoint, almost one billion people experience some form of disability, which makes up 15% of the world's population [1]. "About 2.41 per cent of India's male population and 2.01 percent of its female population reports having a disability", and as many as 18 million persons with disabilities (69 per cent of the disabled population) live in rural India, and about eight million (31%) live in urban areas [2]. The World Bank estimates that 20% of the world's poorest people have disability [3]. There are many commercially made electric wheelchairs currently available in the market which are both expensive and lack any smart features. In this day of

advancing technology, a person from India with an average annual income of 2170 \$ [4], cannot afford to avail the expensive electric wheelchair with no smart features, let alone the ones which have even some of them. This brings us to another issue, which is the lack of intelligent features in a wheelchair. Most commercially available wheelchairs use joysticks with a combination of integrated circuits to only make available basic movements to a wheelchair user [5], which in turn costs almost one and a half times more than the average annual income of a developing country. Over the years very little work has been done to modernize wheelchairs with existing technologies and tweaking them to meet the needs of various disabled individuals. Considering various major issues discussed above, in this paper, we present a robust implementation scheme overcoming various limitations of available electric wheelchairs. One of our key goals to the proposed model is to modernize the electric wheelchair with smart features and cost minimization. Features like smart indoor navigation, obstacle detection, emergency safety, health monitoring, etc., have been implemented at a very low cost with a view to enhance the life of each physically challenged person. Further in this paper we discuss our objectives, background study. We will extensively discuss our implementation of our proposed model and its experimental test results and performance.

II. STATEMENT OF THE PROBLEM AND OBJECTIVES

Today the wheelchair is one of the most used assistive devices for enhancing the personal mobility of people with disabilities. Considered a basic human right for people with limited mobility by the WHO, it opens a world of independence and enables participation in social, economic, and cultural life. International Wheelchair Day is a welcome moment both to celebrate the innovative technological advancements which have changed the lives of millions, but also to consider the reality that throughout history – as is still the case today in most developing countries – only the privileged few who need wheelchairs have access to them. “About 15% of the world's population, with up to 190 million (3.8%) people aged 15 years and older having significant difficulties in functioning” [6]. A large population of the world is handicapped who are facing a lot of difficulties and for some medical expenses are affordable while the other half lives with the lack of support, so we have tried to solve this problem by making a cost-effective smart-electric-wheelchair that can navigate itself in each closed environment and can detect obstacles. We also deeply emphasize on the health monitoring and safety of the user by implementing complex systems capable of deep learning of health patterns. Our emergency safety systems will be very strictly defined by complex conditions to not trigger a warning un-necessarily. We will implement deep-machine-learning techniques to analyze such environmental & health patterns. Our main objectives are:

- To develop and design a 2D mapping system using slam for automatic indoor navigation.

- To add various health monitoring systems embedded within the smart wheelchair.
- To add emergency & safety features for improved user safety.
- To reduce cost as much as possible to make it affordable for all sections of people.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED.

Electric wheelchairs have been existing for quite a long time now. They are expensive, heavy and lack any innovative smart features. The ones that have even some useful features are more than twice the price of traditional electric wheelchairs.

In our proposed model we have simultaneously emphasized on the cost reduction of the Wheelchair. Further in this section we will discuss the current technological advances in the field of electric wheelchairs. The virtual mapping concept has been explored by the people who have worked on the paper [7] and they have added the feature that a map of the path would be constructed which the user can follow manually. This is cumbersome for the user with some disabilities. This implements the basic technologies but lacks the proper implementation of the available resources in hand. In fields of safety, there is rarely any work done in this field [8].

Many types of electric wheelchairs are commercially available but none of the wheelchairs emphasize on the user's safety. They lack even basic emergency SOS systems which can be easily added taking in consideration that the required technologies are mostly already present in an electric wheelchair. In fields of obstacle detection, omnidirectional movement is very complex. This results in an unstable system [9].

We will further show our work in this field using more sensors to improve omnidirectional movement functionalities thereby increasing greater stability while navigating in narrow spaces and turning tight corners. Coming to health features, the issue is the same as in fields of safety relating to an electric wheelchair. There is no focus on health features for existing electric wheelchairs [10].

Implementation of health systems are very cheap to implement but data generated are hard to process and properly make available for the user to understand. Power of electric vehicles has been a major issue. Semiconductor markets have advanced more than the energy markets. There have been very few improvements in existing battery technologies [11].

This limits us in terms of wheelchair speeds and reduces the running time of the wheelchair in a single charge. Improvements have been made in fields of solid-state batteries which are both power efficient and of large capacities [12].

But such technologies are only available to mass manufacturers of electric vehicles and are very expensive even if they are available to common users.

This would rather increase the cost of development; therefore, we stick to traditionally available medium efficiency lead-acid batteries. Electric wheelchairs become complex mobile systems when smart features are added to them. They will have many components, which brings us to an issue of malfunctioning of components due to daily wear and tear. Most electric wheelchairs do not have any diagnosis system to detect errors and identify malfunctioning components. We will, in further sections, discuss such smart diagnosis systems. In the next section we have tried to minimize such technology gaps as much as possible. These have been thoroughly tested and the efficiency of the wheelchair is analyzed in the following subsequent sections.

IV. PROPOSED MODEL/ TOOL

The proposed system has been designed, implemented, and tested stage by stage involving significant effort for several months. To implement this model, we have divided the model into parts which are further subdivided into parts. The main parts are *Movement*, *Health Monitoring*, *SLAM and Navigation*, *Emergency and Safety*, *Power*, and *Diagnostic System*. as shown below in Figure 1.

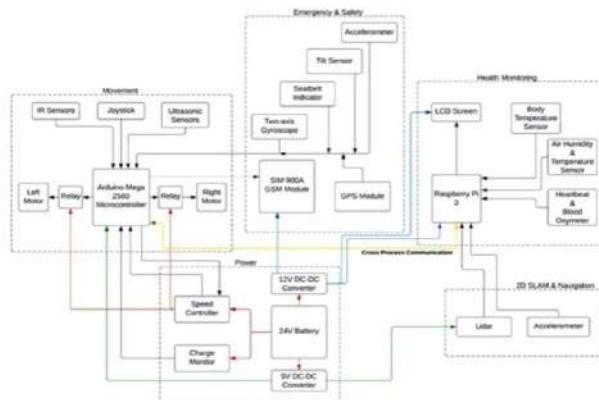


Figure 1. Schematic diagram of the Proposed Model

A) Movement

In this part we demonstrate all the requirements and workings to implement the basic navigation, obstacle avoidance, edge detection, slope detection & rough surface detection. Movement is a very basic part of an electric wheelchair. All components should closely couple to provide unanimous states to better aid free movement. There is a delay of 120ms which the wheelchair takes to execute a command given by the user or automated by the system. Such a delay is very negligible and is caused majorly by the sensors used which take some time this time to receive proper detection results, as they use ultrasonic waves which take some time to reflect from objects and this is analyzed by the sensor and readings are produced. The schematic for this is shown in Figure 2.

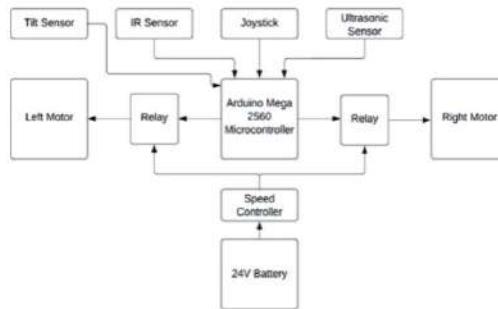


Figure 2. Schematic diagram of movement system

Firstly, speaking about basic navigation, we first must consider the choice of motors. We have chosen to use 24V custom made geared motors as they can move heavy loads, are power efficient and cheap. These motors are controlled by an 8-channel relay module which is driven by the Arduino microcontroller.

Basic navigation is done by taking appropriate readings for a simple two axis pot Joystick. When the joystick is turned to any side, the Arduino microcontroller receives continuous signals which can be logically interpreted as (x, y). x & y being 2D points on a graph which ranges from 0-1023 on each axis. (512,512) being the no motion state.

For obstacle avoidance, we use 6 ultrasonic sensors, 3 being fitted in the front face of the wheelchair, 1 each on both sides, and 1 in the back. We analyze the distance from these sensors in the Arduino microcontroller to intelligently avoid collision with the object, we also programmed the motor control to aid in smooth turning while taking a very sharp bend to avoid the collision with the corner, which was an issue we found during the initial testing phases of the model.

Coming to edge detection we have used 4 IR sensor modules which are fitted at an angle of 34°. 2 of these sensors are fitted below the footrests in the front and 2 at the back face of the wheelchair. We use this as a motor cutoff & brake implementation by taking the readings on the IR sensors. By trigonometry, we can say that an edge can be detected approximately 0.5m before the wheelchair brakes and cuts off motors for safety.

Slope detection is implemented using the tilt sensor. The tilt sensor gives readings in radian to the Arduino microcontroller, which is analyzed, and three outcomes are generated. One, the wheelchair is on a flat surface, the basic navigation is allowed, and no additional steps are taken. Second, the user is climbing a slope, the motor speed is gradually increased to aid in climbing. Third, the user is going down a slope, gradual braking is applied, and speed is reduced, so that the user accidentally is not toppled over. In both the last two cases, the speed is increased and decreased respectively depending on the slope from the ground which is calculated as shown below:

Firstly, the values in radian are converted to degree by using the formula: The degree of inclination can be found using formula (1)

$$\text{Degree of inclination} = 180^\circ / \pi * \text{radians} \quad (1)$$

Now the slope can be calculated by using the formula (2):

$$\text{Slope}(m) = \tan(\theta)$$

Where, θ being the degree of inclination.

Lastly, rough surface detection is implemented by using the 2-axis gyroscope. The gyroscope reading is similar to that of a tilt sensor, but in turn gives a two-axis geometry. This is analyzed and reading fluctuations determine the smoothness of the surface. If the surface is smooth, the readings are fluctuating, in such a case the speed is reduced to increase safety of the user.

B) Health Monitoring

A Raspberry Pi 3 is being used as the choice of microcontroller here as it is efficient and can provide GUI interface to the user to display health statistics. It can also efficiently compare data with generic values to determine a medical emergency such as a heart attack. The body temperature sensor fitted in the right arm handle helps in detecting the body temperature, this reading is aided by using the humidity & temperature sensor, which calculates the outside variables affecting the readings of the body temperature sensor. The pulse rate and oximeter sensor fitted at the same position detects pulse rate and blood oxygen levels of the user. These data are analyzed, and the raspberry pi can detect heart attacks. This is implemented by taking several factors into consideration. This when triggered, executes proper emergency steps. Both the body temperature and heart rate readings are processed by a deep learning algorithm that analyzes the data, which is then used to determine a state of heart attack. This task is very complex and requires only a very powerful microcontroller like the Raspberry Pi 3, which has enough memory to quickly determine and analyze such complex data sets. This process is triggered when the pulse rate falls below 60 bpm or crosses over 110 bpm, an alert is sent to the required people, that the user is in danger of a heart attack [13]. The emergency is further passed to the Arduino microcontroller which controls the GSM and GPS modules which take the proper emergency SOS actions. The schematic of this entire scheme is given in Figure 3.

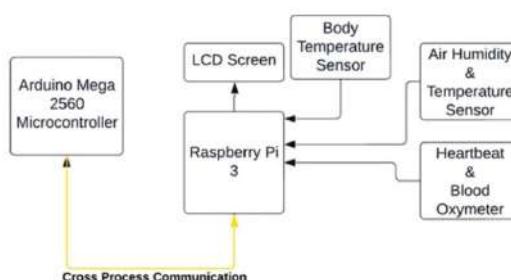


Figure 3. Schematic diagram of health system

C) SLAM & Navigation

SLAM stands for Simultaneous Localization & Mapping. A lidar sensor is used to analyze surroundings dynamically while the wheelchair is in an indoor closed environment. Schematic Shown in Figure 4. The purpose of this entire system is to aid the user to automatically navigate in places like home or office. The lidar dynamically analyzes objects, walls or furniture and plots a 2D map which shows the obstacles shown in Figure 5.

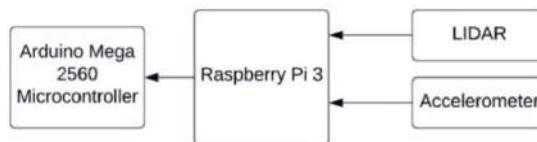


Figure 4. Schematic Diagram of SLAM & Navigation

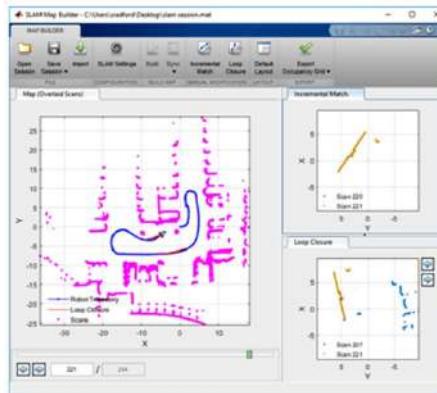


Figure 5. Schematic Diagram of SLAM & Navigation

This 2D map is then converted into a grid. In the grid all movable positions are logically marked with white shown in Figure 6. Then it is further analyzed to determine the path of navigation from the current location and the destination. A path which is left wall oriented and with less turns is analyzed. This is also done using a customized machine learning model which has a large data set of sample conditions. These conditions help the program to determine an even more efficient path. This processing happens on the Raspberry Pi 3, to which the 2D LIDAR sensor is attached. The navigation path is then systematically sent to the Arduino microcontroller to aid the movement to make the navigation complete. Once the navigation is started the accelerometer is used to keep track of the distance covered, as in our initial testing of this system, we have found that GPS navigation indoors is unreliable and inaccurate [14]. All other movement systems remain fully functional to aid this navigation as required due to the dynamically moving real world, to detect and avoid obstacles. When an obstacle is detected, the wheelchair immediately determines the deviation in path and the navigation is continued. The automatic navigation is canceled if

the user moves the joystick in any direction. This acts as a manual override feature in case the user chooses to exit the navigation.

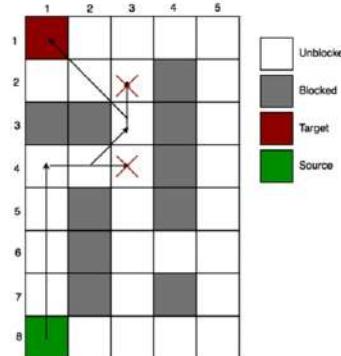


Figure 6. Visualization of the SLAM Grid process

D) Emergency & Safety

Emergency and safety features include seat belt indicator, health emergency protocol and crash detection. Schematic for this section is shown in Figure 7.

Seatbelt indicator is implemented by using a magnetic proximity sensor. The sensor is attached at one end of the seatbelt and the magnetic element is attached at the other end. The wheelchair does not start to function till the seatbelt is properly attached.

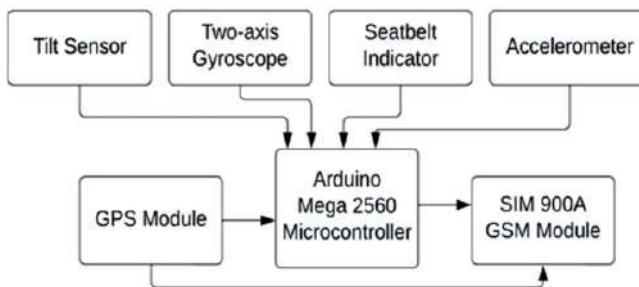


Figure 7. Schematic Diagram of Emergency and Safety System

Health emergency protocol is a set of instructions which are enabled when a health emergency is triggered by the system or the user using a manual trigger. This includes sending a message with GPS location using the SIM900A GSM module and GPS module, to pre-set emergency number(s). The SIM900A will also connect a call to emergency response authorities.

Crash detection is a complex system which identifies when the user has been involved in an accident or crash. This is achieved by taking readings from a set of sensors which includes accelerometer, tilt-sensor, 2-axis gyroscope and a sound-decibel sensor. Only when all the readings are analyzed using a complex

set of conditions, then it is determined as a crash. When this happens, the same steps as health emergency protocol are executed.

E) Power

In this segment, all power related equipment is categorized. This includes the speed controller which controls the speed at which the motor runs depending on the system conditions shown in Figure 8.

Moreover, the system is very complex using different circuits and sensors which mainly uses voltages 3.3V, 5V, 12V and 24V. All these voltage transformations happen in a custom-built circuit which uses LM2596S voltage regulators, inductors, capacitors, transistors, and Zener diodes. This circuit is responsible for powering all the components of the entire system making sure that there is no overflow of current to sensitive components, which can be easily damaged due to any kind of power outage.

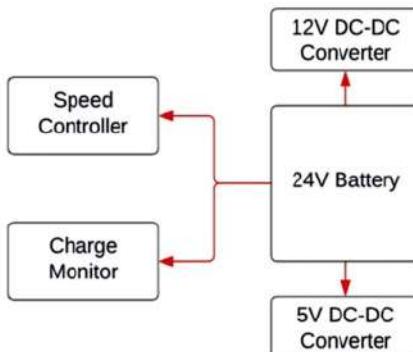


Figure 8: Schematic Diagram of Power System

F) Diagnostic System

This is mainly a software part. Errors and malfunctioning can occur in the wheelchair due to regular use. We use a smart 5-bit cross communication channel between the Raspberry Pi 3 and Arduino Mega 2560 to design such a diagnosis system. In this part we focus on communication and transparency between the main components. This results in smooth detection of the problem, which is shown to the user on the LCD screen. This greatly improves at home repairs if the user chooses to do so using the manuals, otherwise greatly helping required service personnel in error diagnosis and issue resolving.

G) List of parts used for Development

Simultaneously, focus was kept on minimizing the cost of the components as low as possible. All new parts were used. Efforts were made to find the best possible source to gather the parts, by both pricewise and quality-wise. This is shown in Table 1.

Table 1. Price List of Components used

Sl No.	Name of component	Quantity	Price in INR (₹)	Price in USD (\$)
1	Arduino Mega 2560 Microcontroller	1	1650	20.31
2	Raspberry Pi 3	1	2249	27.68
3	Ultrasonic Sensor	6	420	5.17
4	IR Sensor	4	200	2.46
5	Tilt Sensor	1	100	1.23
6	2-axis Gyroscope	1	150	1.85
7	Joystick	1	50	0.62
8	8-channel Relay	1	550	6.77
9	Geared Motor	2	2800	83.70
10	Accelerometer	2	100	1.23
11	Speed Controller	1	250	3.08
12	Charge Monitor Module	1	180	2.22
13	LM2596S Converter Module	3	60	0.74
14	Magnetic Sensor Module	1	40	0.49
15	SIM900A Module	1	600	7.38
16	GPS Module	1	275	3.38
17	24V Lead Acid Battery	1	2800	34.46
18	2D LIDAR	1	560	6.89
19	Pulse Oximeter Sensor	1	400	4.92
20	Temperature & Humidity Sensor	1	80	0.98
21	7" LCD Screen	1	2300	28.31
22	Body Temperature Sensor	1	120	1.48
23	Connecting Wires	1	300	3.69
24	Wheelchair Chassis	1	3500	
25	Miscellaneous	1	1000	12.31
Total			20,734	255.18

Using INR/USD conversion rate as 1 \$ = ₹81.25

By using this calculation, it is possible to develop a wheelchair for under ₹21,000 or 260\$, whereas the commercially available wheelchairs will cost around ₹57,000 or 700\$. Moreover, this cost can be drastically reduced if we use custom integrated circuits. This would result in reduction of cost as the microcontrollers used are general purpose and are very costly.

V. IMPLEMENTATION AND RESULTS

A fully functional prototype of the proposed model of the Wheelchair has been implemented and tested reputedly. All system readings were taken. Users of different weight categories have been made to sit to test the variance in readings. An average reading value for each case is then considered for the below mentioned statistics. Basic specifications as observed are stated below: Overall Size - 108.5 x 67.0 x 93.0 cm

Seat Size - 45 x 43 cm Arm-rest Height - 23 cm

Max Loading Weigh - 120 kg Rear Wheel Diameter - 55.9 cm Front Wheel Diameter - 20.32 cm Motors - 250 W

Battery - 24V/32AH

Max Safe Slope - 6° Obstacle Climbing - 4 cm Degree of protection - IPX3

Tire Pressure - 2 Kgf/m² Ground Clearance - 10 cm

Battery Charger - AC 110-220V 2A 50-60Hz Battery Charge Time - 8 hrs.

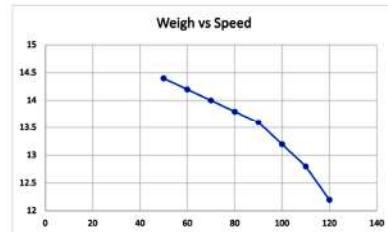
Speed has been tested in standard conditions. Parameters such as slope, edge detection, obstacle detection, crash detection, pulse rate, heart attack monitor, body temperature and LIDAR are repeatedly tested. Various real-life conditions are taken to remove ambiguity as much as possible. These experimental test results are further analyzed below.

A) Speed

The wheelchair speed is tested by different users of different weights. The maximum speed which can be achieved if we take an average weight of 70 kg is 14 km/h. The speeds can be observed below given in Table-2.

Table 2. Weight vs Speed

Weigh (in kg)	Speed (in km/h)
50	14.4
60	14.2
70	14.0
80	13.8
90	13.6
100	13.2
110	12.8

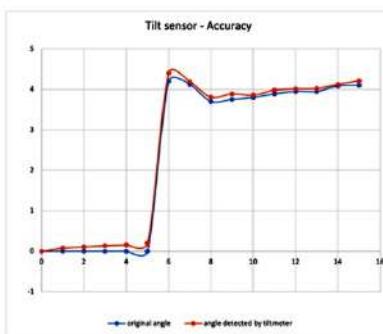


Graph 1. Weight vs Speed

In the above given Graph-1, we can determine that the speed will reduce if the load on the wheelchair increases.

B) Slope Detection

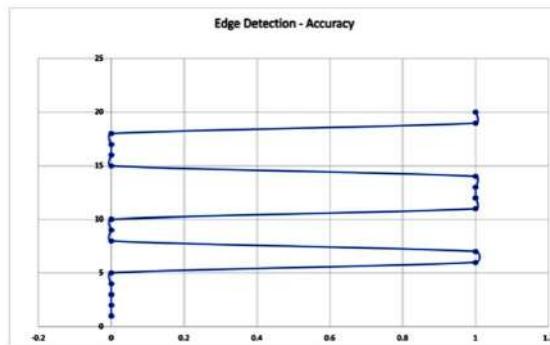
The accuracy of the tilt sensors has been rated at ± 1 radian. This correlates with our testing in a standard environment. We can graphically represent this as shown in Graph 2. We have used a standard 4° slope. We can see the actual readings and the inaccuracy of the tilt sensor plotted in the graph above. This kind of inaccuracy is common in these kinds of sensors and are adjusted in the running code to eliminate even such minor errors. We have further found out the efficiency of such a slope detection system to be 98.5%.



Graph 2. Accuracy of the tiltmeter with the original angle

C) Edge Detection

We have continuously moved the wheelchair in all directions to force an edge. The readings have been taken and plotted. A high peak denoted an edge detection. This type of detection has no error. The plotted graph is shown Graph 3. The accuracy of such detection is 100%.



Graph 3: Edge Detection graph

D) Obstacle detection

The ultrasonic sensors can detect objects at a maximum range of 5m. Beyond that inaccuracy increases by a rate of 18% every 1m. When an obstacle is detected in the range specified, a slight delay is implemented to understand whether the object is moving or not. The sensors are rated, to have an accuracy of 99%, by their manufacturer.

E) Crash detection

A crash is determined by a very complex system. The system already has in store historic data which relates to real crashes. When all the sensors used in crash detection have the values co-relating with the stored values, a crash is determined. The accelerometers are error rated at ± 2 km/h. The tilt sensors have an accuracy of 98.5%. The 2-axis gyroscope has an error rate of ± 1 radian. The error rate of a sound-decibel sensor is ± 5 dB. If all such inaccuracies are mathematically added, it is found that the total efficiency to determine a crash is 87%.

F) Pulse Rate

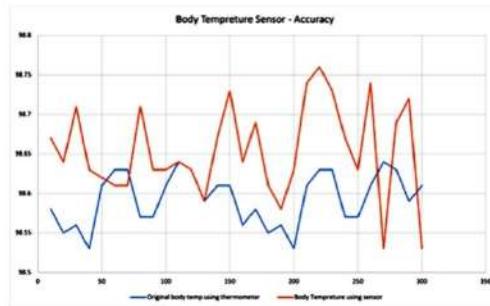
The pulse rate sensor is rated at ± 5 beats/min accuracy. This is found to be true when compared with a commercially available pulse meter which also rated the same as our sensor. The readings correspond with each other and the inaccuracy always being below 5 beats/min. Hence, we can safely say that the pulse rate is accurate to ± 5 beats/min.

G) Heart Attack detection

This is completely dependent on the Pulse rate monitor for deriving its results. The calculated efficiency of the pulse rate readings is 85%. The scientific data which is referred to check the pulse rate to determine a heart attack is found to be 87% correct. This brings us to a total accuracy of the detection to be 86%.

H) Body Temperature

Body temperature sensors are rated at an accuracy of ± 0.4 F. This precisely correlates with readings taken from a digital thermometer which has an accuracy of ± 0.1 F. The statistical relation is shown in Graph 4. When calculated it gives an efficiency of 99.2%.



Graph 4. Accuracy of Body temperature sensor

I) LIDAR

LiDAR sensors can achieve range accuracy of 0.5 to 10mm relative to the sensor and a mapping accuracy of up to 1 cm horizontal (x, y) and 2cm vertical (z). This makes them particularly useful as a remote sensing tool for mobile mapping. The error margin which is there is being eliminated by the navigating software which navigates by keeping a margin of 2 cm in each case. Even if there is an inaccurate mapping, there wouldn't be any collision. Moreover, the ultrasonic sensors aid in this navigation, so the risk of collision is very negligible.

VI. CONCLUSION

The developed smart-electric wheelchair can greatly impact the lives of all physically challenged people. The wheelchair is very cost effective and cheap. Low-cost smart electric wheelchair with destination mapping and intelligent control features. During the development and testing of the design, much feedback was gathered, and necessary improvements were made.

Very satisfactory results were achieved while testing all features which include a high efficiency 2D indoor mapping and navigation system. Health monitoring systems work very efficiently when compared to such commercially available single purpose health testing instruments. Safety features also provide much

needed aid to the user as they have been working very satisfactorily during our testing phase. Lastly, the incorporated diagnostic system helps in easy detection of error and malfunctioning parts throughout the system. This entire system can be developed at a very low cost of ₹21,000 or 260\$. More development and enhancements can be made to make the user experience easier and more reliable. We can add an app interface for intuitive GUI, allowing the user to see health data in a more detailed way. We can also improve the automatic navigation by using a more advanced 3D lidar helping in 3D mapping for more reliability. To conclude, we can say that the developed model is a very smart wheelchair with automatic navigation and smart features which will aid many physically challenged which will have a tremendous impact on society.

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Smart Feeding Bottle for Neonatal

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Abstract - As a new parent, the fear of unintentional accidents with your precious little one can take away the joy of parenthood. Bottle feeding, especially, is always a nervous, unsure activity as one doesn't know if the milk is too hot or too cold. Add to it the busy, demanding lifestyles where one is trying to juggle between caring for the baby to running for work. The Smart Bottle a handy tool for mothers during their maternity stage (bottle feeding). It warms and sterilizes the milk/formula. Ensures that the contents of the bottle are not too hot. if it is too hot, the indicator on the graduation mark will turn white. The ideal feeding temperature corresponds to a body temperature of 37 °C. The very soft silicone teat with a shape and groove like the mother's nipple, adapts perfectly to the child's palate for sensation closer to breastfeeding, leaving enough space for the baby's tongue and jaw for its suction movements. When the milk is filled in the bottle, the temperature sensor in base detects and measures the hotness or coldness of the milk. Then the Arduino Uno converts this digital value into temperature in degree Celsius. This output is fed to LCD which displays the temperature on its screen.

Index Terms – Smart Bottle, Maternity, Feeding, Arduino Uno

I. INTRODUCTION

Bottle feeding, especially, is always a nervous, unsure activity as one doesn't know if the milk is too hot or too cold. Specially formulas for babies that are born with metabolic conditions, pre-mature formulas, lactose-free formulas. Depends on the infant's gestational age and overall health. Moderate temperature should be maintained, for safe feeding. The Smart Bottle is a handy tool for mothers during their maternity stage (bottle feeding). Ensures that the contents of the bottle are not too hot. It indicates the temperature of the content. The ideal feeding temperature corresponds to a body temperature of 37 °C. By monitoring the temperature, it ensures your baby gets their feed safely and conveniently. The smart bottle provides coaching for both the child and the parent to ensure comfortable feeding. The smart feeding bottle is a bottle with a smart body. When the milk is filled in the bottle, the temperature sensor in base detects and measures the hotness or coldness of the milk. Then the Arduino Uno converts this digital value into temperature in degree Celsius. This output is fed to LCD which displays the temperature on its screen.

II. BASIC CONCEPTS/ TECHNOLOGY USED

The smart feeding bottle is a bottle with a smart body. When the milk is filled in the bottle, the temperature sensor in base detects and measures the hotness or coldness of the milk. Then the Arduino Uno converts this digital value into temperature in degree Celsius. This output is fed to LCD which displays the temperature on its screen.

Software Requirement

- **Arduino IDE:** The Arduino integrated development environment (IDE) is a cross-platform application (for Microsoft Windows, mac OS, and Linux) that is written in the Java programming language. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one clicks mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main () into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. From version 1.8.12, Arduino IDE windows compiler supports only Windows 7 or newer OS. On Windows Vista or older one gets "Unrecognized Win32 application" error when trying to verify/upload program. To run IDE on older machines, users can either use version 1.8.11, or copy "Arduino-builder" executable from version 11 to their current install folder as it's independent from IDE.

Hardware Components

- **Temperature Sensor (DS18B20):** The below Figure 1 shows **DS18B20** temperature sensor which is a 1-wire programmable Temperature sensor from maxim integrated. It is widely used to measure temperature in hard environments like in chemical solutions, mines or soil etc. The construction of the sensor is rugged and can be purchased with a waterproof option making the mounting process easy. It can measure a wide range of temperature from **-55°C to +125°** with a decent accuracy of $\pm 5^{\circ}\text{C}$. Each sensor has a unique address and requires only one pin of the MCU to transfer data so it a very good choice for measuring temperature at multiple points without compromising much of your digital pins on the microcontroller.



Figure 1. DS18B20 Temperature Sensor

- **Arduino Uno:** The Figure 2 shows the Arduino UNO which is an open-source microcontroller board based on MicrochipATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. The board has 14 digital I/O pins (six capable of PWM, 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB Cable It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is like the Arduino Nano and Leonardo.



Figure 2. Arduino Uno

- **LCD Display (16x2):** The below Figure 3 represents LCD Display. The term LCD stands for liquid Crystal Display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light emitting diode and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.



Figure 3. LCD display

- Feeding bottle

III. LITERATURE REVIEW

We have developed such a system to record feeding times, volumes, and other data using a microcontroller-controlled sensor array and enclosure that attaches to the base of an infant bottle. The details of the “Smart Bottle” device hardware are not discussed here, but as part of the data-collection algorithm it is necessary to identify two key states:

- i) Feeding state, when the bottle is being used
 - ii) Post-feeding state, when the bottle has been set down and formula volume data should be recorded
- Jiajun Guan, Robert Brewster, Javier De La Fuente, Alison K. Ventura, Benjamin, G. Hawkins

IV. PROPOSED MODEL

The below Figure 4 shows the overview of Smart feeding bottle. The working of the project starts with the DSB18B20 sensor that senses the change in temperature of the milk and uses that temperature difference to produce a voltage signal which is processed by the Arduino to give a digital output displaying the temperature of the milk.

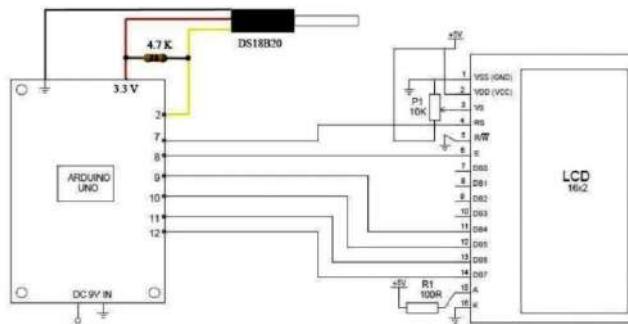


Figure 4. Overview of Smart feeding bottle

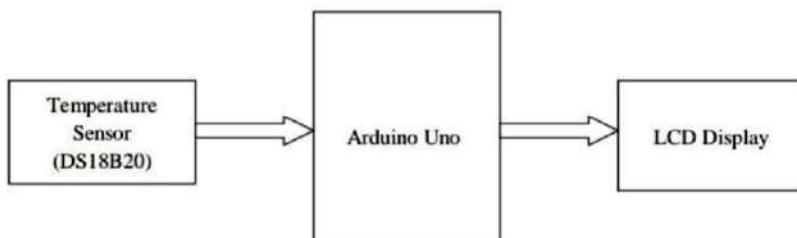


Figure 5. Block diagram of smart feeding bottle

The above Figure 5 represents the schematic diagram of smart feeding bottle. When the milk is filled in the bottle , the temperature sensor in base detects and

measures the hotness or coldness of the milk. Then the Arduino Uno converts this digital value into temperature in degree Celsius. This temperature is converted into ASCII form which is suitable for displaying. This ASCII values fed to LCD which displays the temperature on its screen.

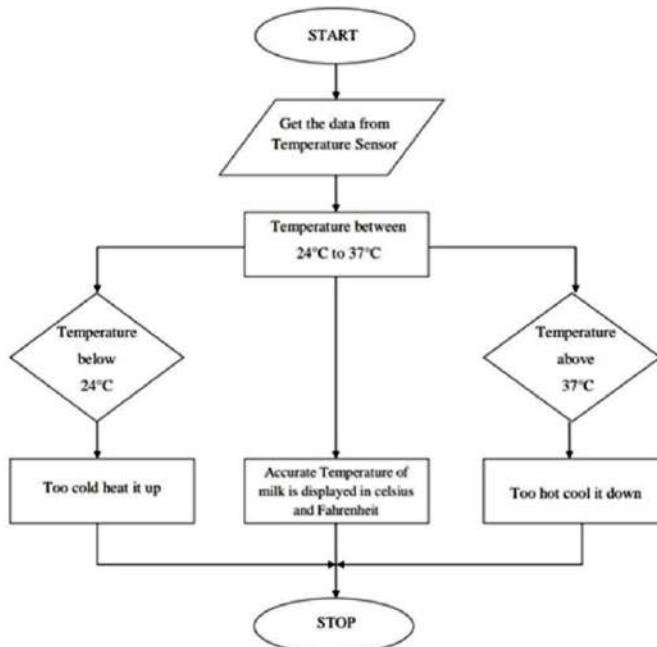


Figure 6. Flow chart of the proposed model

The above flowchart, as shown in figure 6. Represents the basic working principle of the proposed model.

IV. IMPLEMENTATION AND RESULTS

Figure 7 shows the proposed model of “Smart Feeding Bottle” in which the bottle is attached to a smart body. When the milk is filled in the bottle, the temperature sensor in base detects and measures the hotness or coldness of the milk. Then the Arduino Uno converts this digital value into temperature in degree Celsius. This temperature is converted into ASCII form which is suitable for displaying. This ASCII values fed to LCD which displays the temperature on its screen.



Figure 7. Implementation of proposed model

Table 1. Experimental results

Types of water	Explanation	Display
Trial 1 : Hot water	If the temperature is greater than 37°C, it will display the water is too hot.	
Trial 2 : Normal water	If the temperature is greater than 37°C, it will display the water is too hot..	
Trial 3 : Cold water	If the temperature is lesser than 24°C, it will display the water is too cold.	

VI. CONCLUSION

After witnessing the struggles of parenting children with feeding issues the smart feeding bottle design came to exist. The Smart Bottle a handy tool for mothers during their maternity stage (bottle feeding). Ensures that the contents of the bottle are not too hot. It indicates the temperature of the content. The ideal feeding temperature corresponds to a body temperature of 37 °C. By monitoring the temperature, it ensures your baby gets their feed safely and conveniently. The smart bottle provides coaching for both the child and the parent to ensure comfortable feeding. The smart bottle can be implemented with the wireless technology modules and higher-bandwidth connectivity

ranges using Bluetooth and Wi-Fi modules. The automatic feeding log feature will help the parent to check the baby's lactation term record feeding time and improve patters. Could be implemented in such a way that it can keep track of the amount of milk consumed by the baby. We have demonstrated the implementation of readily available technology that can be used to quantify the direct impact of any intervention on actual sucking performance. In doing so, we can individualize care to support skill development and improve outcomes for infants at risk for ongoing feeding challenges. In future we can implement this project like, we can mix milk powder and water automatically with certain amount of milk powder and water

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Cryffiti: A Rising NFT Platform

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Abstract: In our country, many talented artists are found unemployed, and their financial condition could be better. They need a systematic platform to showcase their talent. There are around 2 million unemployed artists, and there needs to be a platform to sell their art to the targeted audience. People are very interested in the digital art form in India, and there is a huge demand in those fields like NFT (Non-Fungible Token). on the high craze for those kinds of stuff, there is no platform such as India, so there is a massive gap in this sector. A non-fungible token (NFT) is a unique digital identifier that cannot be copied, substituted, or subdivided, recorded in a blockchain, and used to certify authenticity and ownership. The ownership of an NFT is recorded in the Blockchain and can be transferred by the owner, allowing NFTs to be sold and traded. NFTs can be created by anybody and require few or no coding skills.

NFTs typically reference digital files such as photos, videos, and audio. Because NFTs are uniquely identifiable assets, they differ from cryptocurrencies, which are fungible. Our whole project is based on the MERN stack, i.e. MongoDB, Express.js, React.js, and Node.js. Furthermore, our website is based on Blockchain, so we have used Ethenium and Polygion blockchain. We aim to make NFT trading more accessible and efficient and bring the trend of NFT into INDIA.

Index Terms: Non-fungible token, Blockchain, Cryptocurrency

I. INTRODUCTION

Like brain drain, there is also a wave of art drain in the country. Artists are bound to sell their artworks abroad because of the low value and less recognition of their work in the country, so there needs to be a platform to attract the country's youth and help the artist get the actual value for their artwork.

According to some statistics, India is leading among the countries with high piracy issues. Having a copyright for non-digital artwork is difficult in our country. The cause of this difficulty is that these copyrights are certified by the government and non-government organizations. The average public needs to know who the actual copyright holder is. Hence, we need to decentralize the processes and ride over blockchains where billions of systems certify an artist's artwork simultaneously.

In our country, many talented artists are found unemployed, and their financial condition is terrible. They need a systematic platform to showcase their talent. Around 2 million unemployed artists need an outlet to sell their art to the targeted audience. People are very interested in the digital art form in India, and there is a huge demand in those fields like NFT (Non-Fungible Token). on the high craze for those kinds of stuff, there is no platform such as India, so there is a massive gap in this sector.

II. BASIC CONCEPTS/ TECHNOLOGY USED.

Our project is based on the MERN stack, i.e., MongoDB, Express.js, React.js, and Node.js. Moreover, our website is based on Blockchain, so we have used Ethenium and Polygion blockchains. We aim to make NFT trading more accessible and efficient and bring the trend of NFT into INDIA.

WHAT IS NFT?

NFT means non-fungible tokens (NFTs), which are generally created using the same type of programming used for cryptocurrencies. In simple terms, these cryptographic assets are based on blockchain technology. They cannot be exchanged or traded equivalently like other cryptographic assets. Like Bitcoin or Ethereum.

WHAT IS ETHENIUM, AND WHY ETHENIUM?

Ethereum is a decentralized blockchain platform that establishes a peer-to-peer network that securely executes and verifies application code, called smart contracts. Smart contracts allow participants to transact with each other without a trusted central authority. Transaction records are immutable, verifiable, and securely distributed across the network, giving participants full ownership and visibility into transaction data. Transactions are sent from and received by user-created Ethereum accounts. A sender must sign transactions and spend Ether, Ethereum's native cryptocurrency, as a cost of processing transactions on the network.

Ethereum offers a highly flexible platform to build decentralized applications using the native Solidity scripting language and Ethereum Virtual Machine. Decentralized application developers who deploy smart contracts on Ethereum benefit from the rich ecosystem of developer tooling and establish best practices that have come with the maturity of the protocol.

This maturity also extends into the quality of user experience for the average user of Ethereum applications, with wallets like MetaMask, Argent, Rainbow and more offering simple interfaces through which to interact with the Ethereum blockchain smart contracts deployed there. In addition, Ethereum's large user base encourages developers to deploy their applications on the network, reinforcing Ethereum as the primary home for decentralized applications like DeFi and NFTs. In the future, the backwards-compatible Ethereum 2.0 protocol, currently under development, will provide a more

scalable network to build decentralized applications requiring higher transaction throughput.

III. STUDY OF SIMILAR PROJECTS OR TECHNOLOGY/ LITERATURE REVIEW

1. OpenSea is used for buying, selling, and NFTs, using intelligent contracts since it is a decentralized, blockchain-based platform. Smart contracts are programmed to ensure no cheating on the forum, and creators can sell their tokens at whatever price they deem fit—image Compression using Autoencoders in Keras, Ahmed Fawzy Gad, and Naval Ravikant(CEO).
2. BinaryX is the GameFi platform behind the play-to-earn games CyberDragon and CyberArena, which run on BNB Chain. BinaryX began as a decentralized derivative trading system. Kevin McCoy and Anil Dash (Founder and Co-founder)

Those mentioned above are some classic websites where NFT trading is being done and make such a complex job related to Blockchain easy for everyone. As we know, Blockchain is the future, and NFT is a rising trend, platforms like this help people to catch up with the trend.

IV. PROPOSED MODEL/TOOL

NFTs are individual tokens with valuable information stored in them. Because they hold a value primarily set by the market and demand, they can be bought and sold just like other physical types of art. Moreover, NFTs' unique data makes it easy to verify and validate their ownership and the transfer of tokens between owners. Our sole motive is to make this digital art easy and approachable to a wide range of people and break the stereotype that NFT and Blockchain are too complex because people avoid these things even after knowing how profitable they are. Apart from this, our motive is also to provide reach to small creators through our live-streaming platform. The encoder and decoder of the proposed model are shown in Figure 1., whereas an overview of the proposed model is depicted in Figure 2.

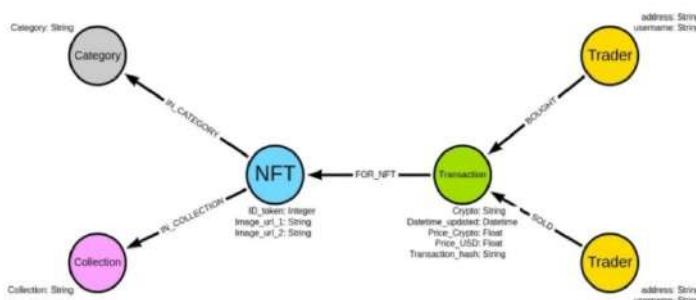


Figure 1. Block diagram of Encoder and Decoder

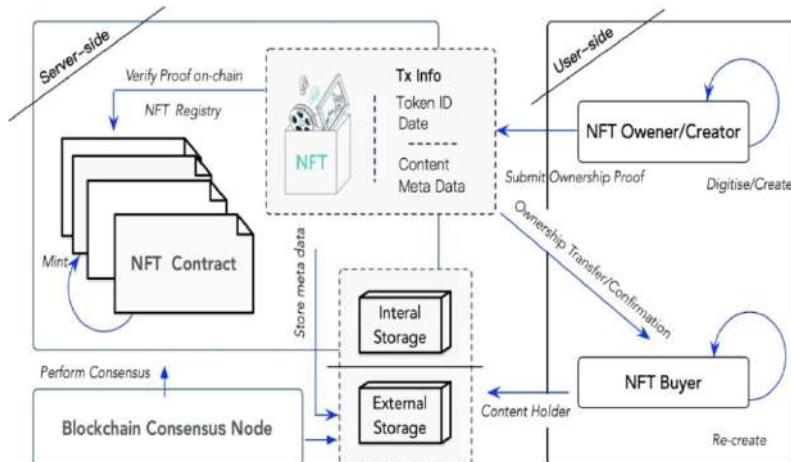


Figure 2. An overview of the proposed model

NFT Digitize. An NFT owner checks that the file, title, and description are completely accurate. The owner then digitizes the raw data into a proper format.

NFT Store. An NFT owner stores the raw data in an external database outside the Blockchain. Note that the owner can also keep the raw data inside a blockchain.

NFT Signing. The NFT owner signs a transaction, including the hash of NFT data, and sends the transaction to a smart contract.

NFT Mint & Trade. After the smart contract receives the transaction with the NFT data, the minting and trading process begins. The primary mechanism behind NFTs is the logic of the Token Standard ERC721.

NFT Confirmation. Once a transaction is confirmed, the minting process is completed. With this approach, NFTs will forever link to a unique blockchain address as their persistent evidence.

Verifiability. The NFT, with its token metadata and ownership, can be publicly verified.

Transparent Execution. The activities of NFTs, including minting, selling, and purchasing, are now publicly accessible.

Availability. The NFT system running on the distributed network will never shut down like an accident in a centralized system. Therefore, all the tokens and issued NFTs are always available to sell and buy.

Tamper-resistance. The NFT metadata and its trading records are persistently stored and cannot be manipulated once the transactions are confirmed.

Usability. Every NFT has the most up-to-date ownership information, which is user-friendly and manageable.

Atomicity. Trading NFTs should be completed in one atomic, consistent, isolated, and durable (ACID) transaction.

Tradability. Every NFT and its related products can be arbitrarily traded and exchanged.

V. CONCLUSION

Our application aims to give an upliftment to the NFT and blockchain community. Our live streaming feature will help creators show their talent and educate by giving them a good idea of making suitable NFT. Others will get inspired by watching those live streams, and gradually a community will be established on NFT and Blockchain. Buying and selling NFTs will be more straightforward. Our app's sole motive is to make NFT trading easy, as it is very profitable for everyone. Many artists can pursue their passion for art and earn from it. This has already been a trend in many countries, and we want to bring it to India and educate people about Blockchain and its application.

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Automation and Monitoring System for Mushroom Cultivation using Mobile Application and Esp-32

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Abstract: In India, the cultivation of button mushrooms and oyster mushrooms hold a profit share of 73% and 16% respectively. If we see the conversion rates of these mushrooms is about 25%. The conversion rate is very low as maintaining the ideal conditions for the mushrooms to grow is not maintained properly. So, we have designed a device that can help in maintaining the ideal conditions for button and oyster mushrooms to grow in a closed environment. Our device uses various sensors like humidity sensor, moisture sensor, CO₂ sensor, and temperature sensor. These sensors measure the conditions of closed environment and relate to AC applications like air cooler, humidifiers, water pump, and exhaust fans. All these AC applications help the farmer to grow the mushrooms in ideal conditions which increases the conversion rates, that ultimately increases the yield and hence the profit. It also helps to produce healthy and chemical free mushrooms. Our proposed device enables the farmers to grow various vegetables in closed and ideal environment automatically. Automated cultivation reduces the effort of farmers, as this proposed device focuses on increasing the conversion rate. Our experiments suggested that the proposed device enhances the existing conversion rate by 6%.

Index terms: Automated cultivation, Mushroom, Sensor, AC application

I. INTRODUCTION

In India, farmers have been failing due to the losses that occur in cultivation. When it comes to mushrooms, there have been a lot of sales and an increase in the economy, but the conversion rate and the rate of cultivating a mushroom are high. The public who has been consuming mushrooms mainly focus on button mushrooms as well as oyster mushrooms. The exploitation that happens in nearly every field hasn't occurred in the field of mushroom selling. The main reason for this happening is the low-level conversion rate of mushrooms. Mushrooms are quite delicious and have a lot of medicinal and nutritional value. Proteins, dietary fibre, vitamins, and minerals are all abundant in

mushrooms. Different types of mushrooms range from 26 to 82 percent carbs to 12 to 35 percent protein by dry weight. The high K:Na ratio, unsaturated fatty acids, amino acids, and presence of vitamins B and C make it the perfect food for heart patients, expectant mothers, kids, and people with illnesses. Mushroom production has the apparent benefit of allowing farmers to utilise agricultural waste and requires less land. As mentioned, the cultivation of mushrooms is declining as the economy for converting them for a lower price has not yet been established. The main reasons for the lower cultivation are tough cultivating conditions and the high price for a small amount of cultivation. From a study conducted in 2010, there is a large portion of the population that doesn't care about tasting mushrooms and using them in their daily recipes. But time has passed since then and there has been growth in every aspect of life. The growth of mushrooms and their usage have increased rapidly throughout India as well as all over the world. The production of around 5 metric tonnes of mushrooms has increased, and the yield has been making a lot of money in recent times. There are a variety of ways to make your mushroom harvest more fruitful, more efficient, and more profitable. One of the ways of making it more profitable is by maintaining the ideal parameters for the growth of mushrooms. Smart farming is one of the methods where we don't have to manually do anything, which makes the cultivation a lot simpler. Smart farming has been blooming in the industry and is being used in almost every cultivation. Mushroom cultivation is a process that must be done in a closed environment and without light. The parameters which are taken care of are temperature, humidity, and CO₂, which mostly affect the growth of mushrooms in the grow area. Growing mushrooms is a very nutrient-dense and high value vegetable that is being used in almost every part of India right now, it is known for its taste and nutritious value. An effective way to grow mushrooms is through the automation of the cultivation and monitoring with the help of current technologies. If they are cultivated with proper conditions and a proper conversion rate is achieved, the prices will drop, and people will start to think about buying mushrooms as a vegetable that's being used in our daily lives. Normally, it takes around 30 days to grow the mushrooms if they are cultivated in a closed environment with ideal parameters maintained. Maintaining the parameters is a hectic job when done manually. But if they are automated with a monitoring system built in, it makes the farmers' job a lot easier. Paying electricity bills will be the only thing a farmer has to do when everything in the room is automated and monitored with a live camera. Currently, the mushroom cultivating industry has a growth rate of 70.105 tonnes of mushrooms exported from India over a year. If we continue automating a small room space, over 45 days, 100kg of mushrooms can be cultivated.

II. METHOD OF PRACTICE

In practice, mushroom cultivation is done manually and has been dying out at the export rate. Many agricultural wastes go to waste when they could be used

to make mushroom manure. Mushroom farming requires ideal conditions for best development and yield. The cultivation of numerous types of mushrooms necessitates a variety of environmental conditions. Several species of mushrooms are farmed in the mushroom industry. Oyster mushrooms, for example, are grown for commercial purposes (*Pleurotus spp.*), which are easily grown in the lowlands and sold in markets, while in this area, shiitake (*Lentinus encodes*) and button mushrooms (*Agaricus spp.*) are grown in the highlands and the chilly climate (Mahari et al., 2020). There are three types of mushrooms in the mushroom industry: edible mushrooms, medical mushroom products, and wild mushrooms. Chang, S. T. (2006). The World Society for Mushroom Biology and Mushroom Products (WSMBMP), the International Society of Mushroom Science (ISMS), the International Workshops on Edible Mycorrhizal Mushrooms, and the World Society for Mushroom Science (ISMS) have all developed international bodies/forums that have assisted in bringing these sectors of the mushroom industry to the forefront of global attention. The three worldwide bodies/forums have done a lot to promote each of their professions, including bringing scientists together for good talks, stimulating research, and disseminating useful information, to name a few things. Many of the known mushroom species have a promising future. Mushroom production has been continuously expanding around the world, owing mostly to contributions from developing countries such as China, India, Poland, and Vietnam. Experimentally based evidence is also growing to back up centuries of observations about mushrooms' nutritional and therapeutic benefits. A. Compost Beds Composting is done outside as the initial stage in cultivating mushrooms. On pristine, raised concrete platforms, a compost yard is created to produce button mushrooms. They must be lifted to prevent runoff water from gathering at the heap. Even though the composting is done outside, a cover is required to keep out the rain. Natural and artificial compost are the two types of prepared compost. Trays measuring 100 x 50 x 15 cm are used to prepare the compost. Wheat straw, rice or wheat bran, urea, gypsum, calcium ammonium nitrate, or ammonium sulphate are the components of synthetic compost. The straw is then thoroughly wetted with water by showering it. The remaining materials, including gypsum, urea, bran, and calcium nitrate, must be combined with the wet straw before being piled together. You can use a stick or your hands to pile things up. Though the straw should be crushed, take care not to do so tightly. B. Ventilated Rooms Brick and soil foundations need to be erected to nurture the mushrooms on raised platforms. It must be strong enough to support the weight of the bed and slightly larger in size than the bedding. The foundation is covered with a bamboo frame that is the same size as the foundation. On the frame are four bundles made of the sopped straw. Four more bundles are put in position, but this time the loose ends are facing the other way. Together, these eight bundles make up the top layer of the bedding. The grain spawn is dispersed around 12 cm from the top layer. When using straw spawn, place little pieces (about the size of your thumb) 10-15 cm from the edges and 4-6cm deep. The spawn is covered in a fine dusting of wheat/rice

bran or powdered gramme. After every layer, another two layers of eight straw bundles are added on top of the original one. The fourth and final layer of straw bundles is put in position and gently pushed. Then a clear plastic covering is placed over the entire bed. Care must be taken to prevent the sheet from touching the bed, though. The straw is covered with a plastic sheet and left undisturbed for a week. At 350C, it takes nearly a week for the mycelium to completely penetrate the straw. If dryness is noted, sprinkle water on the bed's surface once daily. C. Polyethene bags the paddy straw is cut into tiny pieces measuring 5 cm in length. It is then soaked in water for eight hours, after which the water is squeezed out. The paddy is put into polythene bags with perforations that are 45 cm long and 30 cm in diameter. In these polythene bags, 5–6 kg of straw is combined with around 200 grammes of grain spawn. Up to two thirds of the bags are used for spawning, and the mouth is tied. The bags are then put on shelves in the growing room, which is kept between 24 and 26 °C and has a humidity level of 85%. D. Rectangular Blocks For this use, bottomless hardwood trays of 50 X 33 X 15 cm are required. A transparent polythene sheet is placed on the tray's bottom so that it becomes the tray's bottom and covers the inner side from the sides. The tray's frayed edges protrude from it. The tray is filled with wet, chopped paddy straw until it is 5 cm thick, and the spawn is evenly distributed throughout. Repeat the spawning process after every layer of straw, adding another two layers. The last straw layer is added and tightly squeezed. For two blocks, about 200 grammes of spawn are required.

III. PROPOSED METHODOLOGY

The circuit of the product is displayed in Figure 1. It consists of a microcontroller ESP32-V1 to be the brain of the system. It is compact and can be considered one of the microcontrollers that are used in industry. It has a Wi-Fi module which is one of the most important features we use to convert the data collected to firebase and application. The microcontroller is connected to a temperature sensor. DHT-22 is a temperature sensor used to calculate the temperature and humidity of the surrounding. The DHT11 has a temperature range of 0-50 degrees which is perfectly suitable for checking the parameters of a closed room environment in India. Four relays of 5V are used to automate the various appliances used in the room to maintain the parameters. The appliances used in a room are an air cooler, humidifier, exhaust fan, and water pump. The working of the ac appliances is based on the condition, the inputs received from the temperature sensor are used to control the signals for the relays with the help of ESP-32. There are a total of 5 conditions in which the relays will be switched ON and OFF. They are as follows 1) Temperature >28 and Humidity>75 - Air Cooler, Exhaust are ON. The pump and Humidifier are OFF.2) Temperature<28 and Humidity<75 -Pump and Humidifier are ON. Air Cooler and Exhaust are OFF.3) Temperature > 23 and Temperature < 25 - Exhaust is ON. Air Cooler, Pump, and Sprinkler are OFF.4) Temperature >28 and Humidity <75-Humidifier, Air Cooler, Pump, and Exhaust Fan are ON.5)

Temperature <23 and Humidity >85- Exhaust is ON. Air Cooler, Pump, and Sprinkler are OFF

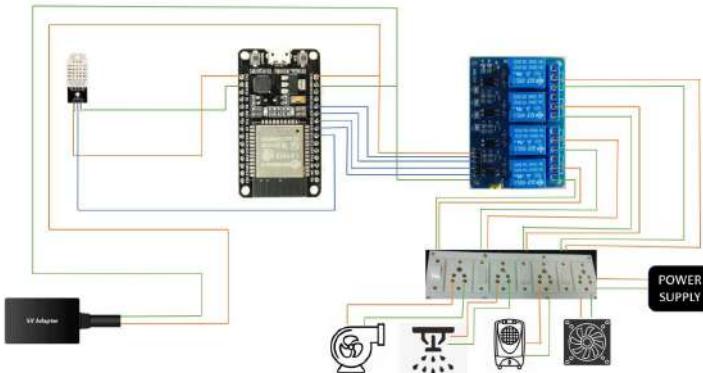


Figure 1. Circuit diagram

A. ESP-32 Espressif Systems developed the ESP32 using several inexpensive, low-power SoC (System on a Chip) and modules. The ESP32 is the popular ESP8266's replacement. In addition to WiFi, ESP32 also includes Bluetooth and Bluetooth Low Energy built in. It has an operating frequency of up to 240 MHz. Additionally, it uses extremely little power thanks to power-saving features including clock synchronization and numerous operating modes. The ESP32 chip is the best option for your battery-powered projects or Internet of Things applications because its quiescent current is less than 5 A. B. Temperature Sensor DHT22 A straightforward, inexpensive digital temperature and humidity sensor is the DHT22. It measures the humidity in the air using a thermistor and a capacitive humidity sensor, and it outputs a digital signal on the data pin (no analogue input pins are needed). Although reasonably easy to operate, data collection requires precise timing. As a result, while utilising our library, sensor readings can reach a maximum of 2 degrees per second. The only true drawback of this sensor is that you can only collect new data from it once every 2 seconds. C. Four Channel Relay Module A microcontroller or sensor can be easily interfaced with using the four-channel relay module's four 5V relays and the related switching and isolating components with the fewest possible parts and connections. Two relays share each of the two terminal blocks, each of which has six terminals. Because the terminals are screw type, connecting to mains wiring is simple and flexible. The four relays on the module are rated for 5V, thus when there is roughly 5V across the coil, the relay turns on. Each relay's contacts are marked on the body with the specifications for 250VAC, 30VDC, and 10A in each case. The switching transistors serve as a buffer between the low-current inputs and the high-current relay coils in relay systems. They boost the input signal to drive the coils and turn on the relays. Given that the coils represent an inductive load when the relay is turned off, the freewheeling diodes avoid voltage spikes across the transistors. When the coil of a particular relay is activated, the indicator LEDs

light to show that the relay is active. The optocoupler creates an additional barrier of isolation between the inputs and the load being switched. The VCC selector jumper can be used to select the isolation, which is an optional feature. The primary VCC, GND, and input pins are located on the input jumper allowing simple connection using female jumper wires.

D. App Development

Due to its increasingly significant role in everyone's lives, the mobile application market has grown rapidly throughout the world in recent years, giving developers a huge and confusing array of options. Customers are moving to smartphone mobile devices that can connect to the internet for work, entertainment, and most crucially, communication with friends, family, and co-workers. There are many different platforms, technologies, and architectural options included in the Mobiletware technology. As a result, it makes creating mobile applications simpler and more cost-effective. When determining which platforms to support, application developers must take both technical and business considerations into account. Developers can create applications for more than a dozen different platforms. Google's Android and Apple's iOS are the subjects of research (short for iPhone Operating System). Application developers will be surveyed as part of the research to better understand their workflows, choose the platform (or platforms) for which they would like to create applications, and gain knowledge of the development procedures. This study seeks to understand how and why mobile developers select the platform(s) for which they wish to create applications and acquire knowledge of the development procedures. Individuals interested in the development of mobile applications are seeking a solution to their issue. Keeping track of the different highs and lows of mobile application development has become difficult for any mobile application developer because the key characteristics of the mobile business have changed so quickly. Web-based mobile application development and native mobile application development are the two distinct categories into which mobile software development and mobile application development have split their development efforts. Additionally, it presents a problem for both customers and engineers. Due to the variety of mobile platforms, estimating the risks of projects implementing mobile technology can be difficult. Customers and developers are challenged by the differences between mobile and desktop applications because of a variety of factors, ranging from user design to implementation and spanning PCs and mobile devices. Mobile devices don't support large photos or large app sizes; thus, UI design and app size are additional obstacles. In addition, there aren't many original development environments. Besides, there is a lack of unique development environments. But that's again about multiple platforms and the difficulty in providing interoperability. Nevertheless, the creation of mobile applications is expanding. Mobile app developers now have access to a comparable market model thanks to the success of the App Store as a new business model in the marketplace. The market for mobile applications is being expanded through research in the Google Play and Apple App stores.

IV. IMPLEMENTATION & RESULTS

The app UI is shown in Figure 2.

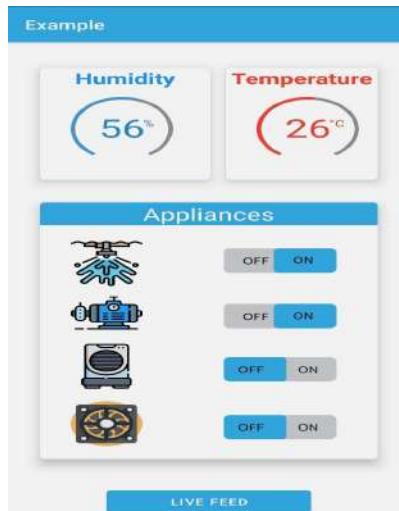


Figure 2. App UI design

App UI Design shows the UI design of the application. It displays the real-time readings from the cultivation rooms. The proposed system solves the difficulty in maintaining proper conditions for the cultivation process. It reduces the amount of manpower required for the process. It also increases the profit margin for the farmers. The prototype view of the proposed device is shown in Figure 3.



Prototype Top View (Closed)

Prototype Top View (Open)



Prototype Side View

Figure 3. Prototype of the proposed device

The above figures represent the prototype model of the controller system. It is enclosed in a splashproof container to avoid water damage and it is printed using an 3D printer. It controls the entire system.

V. CONCLUSION

As the conversion rate of these farming products is increased, the growth of farming products and agricultural products are increased thereby helping our country's economy on the agricultural side. The automation on the agricultural side has been a boon to agricultural development thereby helping our farmers. This product is one of the finds that will help many farmers in cultivation

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WeConnect

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Abstract. Email, discussion forums, Instant Messaging, and blogs are among the services accessible to us to promote e-collaborative endeavours. The low cost and relative ease of installation and usage of these resources are the primary reasons for their widespread availability and utilization. If we were to embark on a journey to promote more adequate e-collaborative technologies, we would begin by emphasizing the benefits of their proper deployment. One of the themes we like to focus on is that online collaboration fosters the development of solid ideas and approaches. Because current collaboration platforms do not allow for profile management, it is challenging to locate experts. Almost all tech interviews have gone remote because of Covid-19. This requires a website with collaborative features such as a collaborative notepad, a drawing canvas, profile sharing, an inbuilt compiler, and video-conferencing tools. Hence, we came up with this project as a solution to this problem. Built using Agile methodology, WeConnect is a collaborative aggregator aimed to make tech interviews hassle-free. WeConnect is an integrated interface that allows recruiters to conduct remote interviews while interviewees display their skills more efficiently. It's a web-based video conferencing tool that may be used for one-on-one video calls, group video calls, or interviews with collaborative capabilities such as Notepad and whiteboard. Mute audio/video and a built-in chat window are included in the video call.

Index Terms: Agile, Collaborative, real-time, video-communication, web application

I. INTRODUCTION

Email, discussion forums, Instant Messaging, and blogs are among the services accessible to us to promote e-collaborative endeavours. The low cost and relative ease of installation and usage of these resources are the primary reasons for their widespread availability and utilization. If we were to embark on a journey to promote more adequate e-collaborative technologies, we would begin by emphasizing the benefits of their proper deployment. One of the themes we like to focus on is that online collaboration fosters the development of solid ideas and approaches. However, because current collaboration platforms do not allow for profile management, it is challenging to locate experts.

Almost all tech interviews have gone remote because of Covid-19. This requires a website with collaborative features such as a collaborative notepad, a

drawing canvas, profile sharing, an inbuilt compiler, and video-conferencing tools. WeConnect is a collaborative aggregator aimed exclusively at making tech interviews hassle-free. WeConnect is an integrated interface that allows recruiters to conduct remote interviews while interviewees display their skills more efficiently. In addition, it's a web-based video conferencing tool that may be used for one-on-one video calls, group video calls, or interviews with collaborative capabilities such as Notepad and whiteboard.

Mute audio/video and a built-in chat window are included in the video call. The future version of this application will also include features like an online compiler and profile-sharing options for various coding platforms. Continuous planning, learning, improvement, team collaboration, evolutionary development, and early delivery are all terms used to describe agile software development methodologies. It will be most helpful for interviewers and potential candidates who are going through the hiring process. Although it is designed primarily for remote hiring, it can be used by anyone. It may be used by working professionals, instructors, students, friends, or family because it offers most of the features of a typical video conferencing application, such as audio/video sharing and chatting. Virtual hiring means recruiting and targeting applicants via online interviews. Because online recruitment is more accessible and saves time for both the applicants and the organization, and because the Internet is widely used, job applications will reach a more extensive and diverse range of applicants.

Another benefit is that it saves the company money and is also better for the applicants because it allows them to access information about the organization and the job description online. In technical interviews, the interviewer must give links to other collaborative tools such as an online compiler for coding in a language, a whiteboard or Notepad for describing their method of solving a problem, all while using a video-conferencing application. Toggling all these links and navigating between two or more platforms while sharing your screen makes the interview process inefficient and messy. As a result, we created "WeConnect," a project combining all of the above elements with standard video conferencing application features to make remote interviews hassle-free for both the interviewer and the interviewee.

II. STATEMENT OF THE PROBLEM AND OBJECTIVES

This document outlines the project plan for developing "WeConnect", a web-based video-conferencing application. Since it increases adaptability in response to change, Agile methodology was used to make progress in this project [8]. As a result, the whole project was broken down into five sprints spanning over two months, as shown in figure 1.

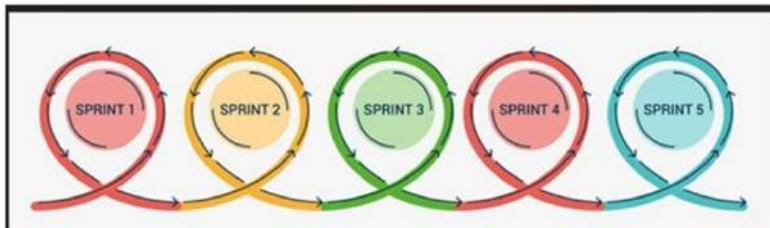


Figure 1. Agile Methodology

The intended readers for this document are the present and prospective "WeConnect" users or developers and the project's sponsors. A summary of the system functionality, the scope of the project from the perspective of the "WeConnect" team (our team and mentor), scheduling and delivery estimates, project risks and how those risks will be mitigated, the process by which we will develop the project, and metrics and measurements that will be recorded throughout the project will all be included in this report. The primary functions that the User must perform to get access to the website's resources are:

- Users will either join a meeting or create a room for an appointment.
- They will have the option to toggle on/off their audio and video.
- The User can share the meet code with other people to invite them to the created room.
- All the participants can chat using the chat box.
- The User can switch to the collaborative Notepad to write notes or work on documents with other users. Moreover, they can download the notes in pdf format.
- The User can also switch to the collaborative whiteboard to draw their plans/ ideas with other users. They can download the drawn images in jpeg format.
- The User can switch to the compiler to code in any language and run/compile their programs.
- The User can share their coding profile with the interviewers.

Frontend:

- HTML5 (hypertext markup language):- HTML5 is the most recent and improved version of HTML. HTML, rather than a programming language, is a markup language that helps the web browser display and format text, images and graphics for our web pages [5].
- CSS: - CSS, or Cascading Style Sheets, is a simple design language designed to make the process of making the user interface of web pages more attractive and easier to navigate [6]
- JavaScript: - It's a scripting language for web pages to make applications more dynamic and interactive. It has basic syntax and semantics, making it easier to learn in a short period. [9]
- Bootstrap: - A popular CSS framework that makes styling web pages faster. It provides a simple and consistent way of creating a developer

interface by coming up with many attractive and practical built-in components that are easy to personalize. [3]

Backend:

- Node.js (open source, a server-side script):- most excellent tool for building real-time web applications in JavaScript. It is built on JavaScript's V8 engine and is generally used to make applications which are I/O Intensive.
- Socket.IO - Socket.IO offers bidirectional event-based communication in real-time. It's compatible with any platform, browser, or device and prioritizes dependability and speed. Socket.IO is based on Node.js and the WebSockets API (client side). [1]
- WebRTC (Web Real-Time Communication) is a technology that allows Web apps and sites to record and selectively broadcast audio and video material and transmit arbitrary data between browsers without the need for an intermediary. WebRTC makes it simple to establish peer-to-peer connections with other web browsers. To create such an app from the ground up, you'd need a slew of frameworks and tools to cope with concerns like data loss, connection loss, etc. WebRTC has several interconnected APIs and protocols that work together to achieve this goal. There are no plugins or third-party software requirements for this technology. [2]
- Peer.Js:- WebRTC framework which abstracts and simplifies peer-to-peer connection API. [7]
- CKEditor5:- It's an API made using modern JavaScript to incorporate a text editor in our application. [4]

III. PROPOSED MODEL / TOOL

This document outlines the project plan for developing "WeConnect", a web-based video-conferencing application. The intended readers for this document are the present and prospective "WeConnect" users or developers and the project's sponsors. A summary of the system functionality, the scope of the project from the perspective of the "WeConnect" team (our team and mentor), scheduling and delivery estimates, project risks and how those risks will be mitigated, the process by which we will develop the project, and metrics and measurements that will be recorded throughout the project will all be included in this report.

Document Conventions

Main Section Titles

Font: Times New Roman Face: Bold Size: 18

Sub Section Titles

Font: Times New Roman Face: Bold Size: 14

Other text explanations

Font: Times New Roman Face: Normal Size: 11

Intended Audience and Reading Suggestions

Developers: Project developers can utilize this as a resource to quickly grasp the methodology involved in building the product.

Policy Makers: The policymakers can see this document as a tool to develop video conferencing products further.

Marketing Staff: The marketing team can use this resource to analyze the product's benefits and plan the marketing strategy for the target audience.

The developers will suggest that the clients review the requirements before installing the software. Then, policymakers and developers can use this document to update the records further.

Product Scope

It will be most helpful for interviewers and potential candidates who are going through the hiring process. Although it is designed primarily for remote hiring, it can be used by anyone. It may be used by working professionals, instructors, students, friends, or family because it offers most of the features of a typical video conferencing application, such as audio/video sharing and chatting.

Overall Description

- Product Perspective:** Virtual hiring means recruiting and targeting applicants via online interviews. Because online recruitment is more accessible and saves time for both the applicants and the organization, and because the Internet is widely used, job applications will reach a more extensive and diverse range of applicants. Another benefit is that it saves the company money and is also better for the applicants because it allows them to access information about the organization and the job description online. In technical interviews, the interviewer must give links to other collaborative tools such as an online compiler for coding in a language, a whiteboard or Notepad for describing their method of solving a problem, all while using a video-conferencing application. Toggling all these links and navigating between two or more platforms while sharing your screen makes the interview process inefficient and messy. As a result, we created "WeConnect," a project combining all of the collaboration elements mentioned earlier with standard video conferencing application features to make remote interviews hassle-free for both the interviewer and the interviewee.

Product Functions

The primary functions that the User must perform to get access to the website's resources are:

- Users will either join a meeting or create a room for an appointment.
- They will have the option to toggle on/off their audio and video.
- The User can share the meet code with others to invite them to the created room.

- All the participants can chat using the chat box.
- The User can switch to the collaborative Notepad to write notes or work on documents with other users. In addition, they can download the notes in pdf format.
- The User can also switch to the collaborative whiteboard to draw their plans/ ideas with other users. They can download the drawn images in .jpeg format.
- The User can switch to the compiler to code in any language and run/compile their programs.
- The User can share their coding profile with the interviewers.

Note: - Italic functions are to be incorporated later.

- **User Classes and Characteristics:** User classes:
 - Interviewers - Interviewers can share the meet link and conduct online interviews.
 - Technical job aspirants - Individuals seeking technical jobs can use this platform for giving interviews.
 - Other Users: Working professionals, Instructors, friends, and family can use this platform for meetings.

Users should be familiar with using the Internet.

- **Operating Environment**
 - Distributed database
 - Operating system: Windows, Linux
 - Platform: .NET/C#
- **Design and Implementation Constraints:** Every User initiating a meeting is allotted a distinct Room ID which other participants will use to log into the room for the meeting. Users must allow media permissions before entering the meeting. Internet stability should be maintained.
- **User Documentation:** To explain the user documentation, the product requires a fully functional prototype. After the prototype has been designed and implemented, online user manuals can be provided. In addition, users can get online help through a support link on the homepage.
- **Assumptions and Dependencies:** Each User should join with a name; otherwise, the default name is given to the User. Users must have a webcam and headphones or audio options on their devices. Internet connection should be constant and stable.

External Interface Requirements

- **User Interfaces**
 - Home Page: This page allows the User to create a meeting or join a call by pasting the meet code.

- Pre-Call Screen: This enables the users to allow audio/video permissions, enter their name, and mute/unmute audio and video. The User then can join the call.
- In-Call Screen: This page shows all the participant videos and other features for use while in a meeting.
- **Hardware Interfaces**
- Windows O.S.
- A virtual or physical mouse/keyboard
- CPU
- RAM minimum: 4GB
- **Software Interfaces:** This video conferencing website is a multi-user, multi-tasking environment. It uses JavaScript for the front end, Node.Js for the back end, and some APIs and libraries like WebRTC, Peerjs, and Socket.IO for effective connection.
- **Communications Interfaces:** Users on the Internet will be using the HTTP/HTTPS protocol.
Users on Intranet will be using TCP/IP protocol.

IV. IMPLEMENTATION AND RESULTS

System Features

Create a Call

- Description and Priority: This utility can be used by users to create a meeting room. They are then directed to the pre-call screen described below.
- Stimulus/Response Sequences: The response/stimulus for different classes of users are:
 - a) Users will click on the 'create a call' button and then be directed to allow media permissions and their names.
- Functional Requirements:

REQ 1: When a new user clicks on 'Create a Call', they must have a good internet connection to allow navigation to the Pre-Call Screen.

Join a Call

- Description and Priority: This utility can be used by users to join a meeting by pasting the Meet ID shared by either the host or other participants. They are then directed to the pre-call screen described below.
- Stimulus/Response Sequence: The response/stimulus for different classes of users are:
 - a) Users will click on the 'Join a Call' button and then be directed to allow media permissions and their names.
 - b) Wrong meet I.D., if entered, causes a new room to be allotted to the User.
- Functional Requirements
- REQ-1: When a new user clicks on 'Join a Call', they must have a good internet connection to allow navigation to the Pre-Call Screen.

- REQ-2: Users must enter a valid Room ID to join a meeting initiated by a host.

R.1.1:

Input – Correct meeting I.D. entered.

Output – The User is taken to the Pre-Call Screen.

R.1.1:

Input - Incorrect meeting I.D. entered.

Output – A room with the meeting I.D. is made, and the User is taken to the Pre-call. Screen.

Pre-Call Area

- Description and Priority: This utility asks for media permissions (access to the camera and microphone of the User). The User is requested to enter the name they want to use in the meeting, and they can see a preview of themselves before entering the forum with options of muting their video and audio.
- Stimulus/Response Sequences: The response/stimulus for the different classes of users are:

Users: Can enter the meeting, engage with other participants and use the collaborative features of Notepad and Whiteboard.

- Functional Requirements

- REQ 1: All users must allow access to their camera and microphone and enter the call by clicking the 'enter call' button.

R.1.1:

Input – Allow media permissions.

Output – Our camera and microphone are enabled for use by the application.

We can see our video. If not enabled, the User is redirected to the homepage.

R.1.2:

Input – Username

Output – When entering the call, users can see their names displayed when chatting. The default name of 'A user' name given when no username is joined.

R.1.3:

Input – Click the 'Enter Call' button.

Output – The User joins the meeting and engages with the participants.

R.1.4:

Input – Click the 'Mute' button.

Output – The User's microphone is muted.

R.1.5:

Input – Click the 'Turn off Video' button.

Output – The User's camera is turned off.

In-Call Screen

- Description and Priority: This section shows the meeting in progress. All the participants can interact via audio/video and chatting. They can also toggle to the whiteboard or Notepad, leave the meeting, and mute/unmute.
- Stimulus/Response Sequences: The response/stimulus for different classes of users are:
 - User – Host or attend a web conference/meeting/interview.
- Functional Requirements:
 - REQ-1: The User can select or use it in the meeting according to their requirements.

R.1.1:

Input - Share option selected.

Output – Meeting ID provided for copying to clipboard for sharing with other participants.

R.1.2:

Input – Options button selected.

Output – option to choose the feature we want to use from participant views, whiteboard and Notepad.

Processing: The User is directed to the chosen option.

R.1.3:

Input - The User selects the whiteboard option.

Output – A collaborative Whiteboard can be used for drawing. We have options to choose the pen colour, erase our pictures and download drawing in .jpeg format.

R.1.4:

Input - The User selects the Notepad option.

Output – A collaborative Notepad can be used to take notes of the meeting or work together on the same document. We have several options to change the font –style, including tables and other standard features that come with an editor. We can also download a copy in .pdf format.

R.1.5:

Input - The user types in the chat box.

Output – You can see their text under their name and the other chats from other participants.

R.1.6:

Input – Click the 'Mute' button.

Output – The User's microphone is muted.

R.1.7:

Input – Click the 'Turn off Video' button.

Output – The User's camera is turned off.

R.1.8:

Input – Click the 'leave meeting' button.

Output – The User is redirected to the Pre-Call Area.

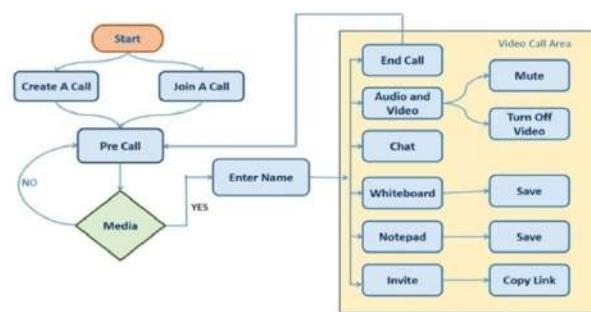


Figure 2. User Flow Diagram

Other Non-functional Requirements

- Performance Requirements: The application should be able to operate on all major web browsers with all of its fundamental functions.
- Safety Requirements: A reliable and uninterrupted internet connection is vital. If any technical glitches occur on the User's end, the User should be able to refresh the page and rejoin the meeting.
- Security Requirements: The system should provide a secure login to the users by using advanced fast login algorithms and provide access to authorized users. The User's I.D. and password should not be shared with anyone. If the User needs to remember their password, an OTP will be sent to the registered email address to reset the password.
- Business Rules: All users must have an associated user Id with a valid email address.

P.S. Italic point's features will be inculcated later.

Screenshots

The screenshots of WeConnect after implementation have been depicted in Figures 3 to 11.



Figure 3. Landing page

WeConnect



Figure 4. Join a Call

WeConnect

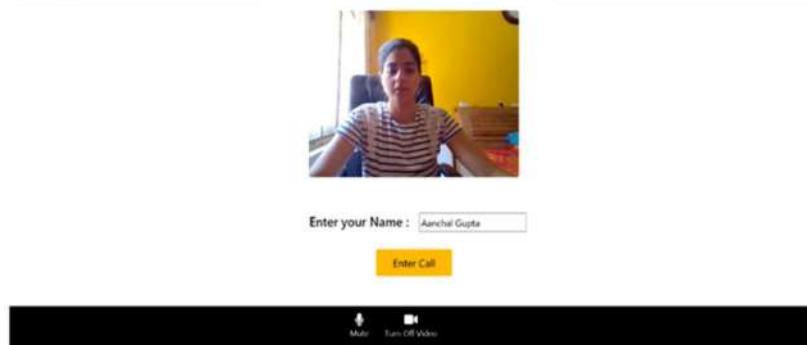


Figure 5. Pre-call area

WeConnect

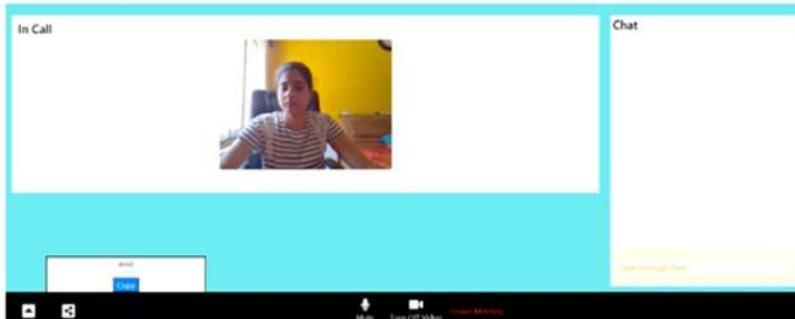


Figure 6. Meeting code share button



Figure 7. Other participants join



Figure 8. Chatbox



Figure 9. Other options

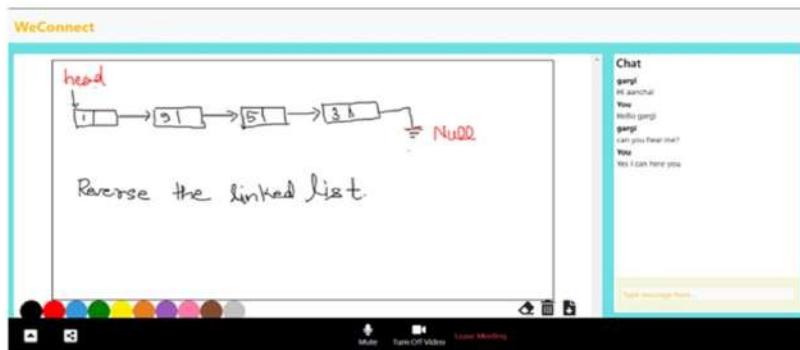


Figure 10. Collaborative whiteboard



Figure 11. Collaborative Notepad

V. CONCLUSION

WeConnect is a collaborative aggregator aimed exclusively at making tech interviews hassle-free. WeConnect is an integrated interface that allows recruiters to conduct remote interviews while interviewees display their skills more efficiently. It's a web-based video conferencing tool that may be used for one-on-one video calls, group video calls, or interviews with collaborative capabilities such as Notepad and whiteboard. Mute audio/video and a built-in chat window are included in the video call. It will be most helpful for interviewers and potential candidates who are going through the hiring process.

Although it is designed primarily for remote hiring, it can be used by anyone. It may be used by working professionals, instructors, students, friends, or family because it offers most of the features of a typical video conferencing application, such as audio/video sharing and chatting. We learned about agile development and functional and non-functional requirements through this project. To begin, we studied how to plan and outline our problem statement. Then, we learned how to design and develop it from scratch after clearly understanding the problem. In this process, we came across various new technologies and libraries and learned how to implement them. Finally, we created functional prototypes in the later sprints, which were tested before

deployment. The future version of this application will also include features like an online compiler and profile-sharing options for various coding platforms. Continuous planning, learning, improvement, team collaboration, evolutionary development, and early delivery are all terms used to describe agile software development methodologies.

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NIDAR: A SAFETY INITIATIVE

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Abstract - In the present times, the use of mobile phones has excessively increased, resulting in higher use of mobile applications. Looking at the current scenario, the authors have developed an application named 'NIDAR' that focuses on everyone's safety. The heinous incidents in the country have forced everyone to take appropriate actions to ensure their safety—keeping in mind the current situation, and authors have come up with an app that not only focuses on the protection of women but also gives utmost priority to the safety of men and children. The main features of this application include sending emergency messages to the registered contacts along with the live location. In this application, authors have tried to develop a system that benefits society by reducing the concerns related to their safety.

Index Terms - Safety, Live Location, Siren, Emergency, Smart Phone, Voice Recognition, Android

I. INTRODUCTION

In today's world, people have been following different career paths for a common cause. Safety issues are a significant hindrance to an individual's career growth. The best way to minimize the chances of being a victim of violent crimes is to ask for help from your close ones. When we are in trouble and cannot see a way out of the situation, having an app such as 'Nidar' helps in reducing the risk and will help in ensuring the safety of the individual.

Walter Dill Scott stated, "The future of the safety movement is not so much dependent upon the invention of safety devices as on the improvement of methods of educating people to the ideal of caution and safety." "United Nations General Assembly defines "violence against women" as any act of gender-based violence that results in, or is likely to result in, physical, sexual, or mental harm or suffering to women, including threats of such acts, coercion, or arbitrary deprivation of liberty, whether occurring in public or private life." [1] "According to the reports of WHO, NCRB-social government organization, 35% Women all over the world are facing much unethical physical harassment in public places such as railway, bus stands, footpaths etc." [2] "National Crime Records Bureau of India, reported incidents of crime against women increased 6.4% during 2012, and a crime against a woman is committed every three minutes. Along with Women's Safety, we also need to focus on Male Victimization." [3] "Male victimization is a significant public health problem,

according to estimates in the National Intimate Partner and Sexual Violence Survey (NISVS). Nearly a quarter of men reported some form of contact sexual violence in their lifetime.

Approximately 1 in 10 men experienced contact sexual violence, physical violence, and stalking by an intimate partner during their lifetime and reported some form of IPV-related impact. Commonly reported IPV-related crashes among male victims were fear, concern for safety, and symptoms of post-traumatic stress disorder, among others." To reduce the number of crimes happening to men, women and children, apps such as 'Nidar' are a great help as these apps can diminish the risk and bring assistance whenever required.

II. BASIC CONCEPTS/TECHNOLOGY USED

The basic concept in developing this Android Application is to avoid heinous crimes that happen to men, women and children. To do this project, the authors have used an IDE.

a) **Android Studio:**

Android Studio is an IDE used for developing Android Applications. Android Studio is the official integrated development environment (IDE) for Android application development. It is based on the IntelliJ IDEA, a Java-integrated development environment for software, and incorporates its code editing and developer tools.

b) **Language and Framework used:**

Programming Language – DART

Framework – Flutter

c) **Database:**

Firebase Real-time Database – Firebase is a cloud-based database storing the value in JSON format. It helps in the proper synchronization of data with every connected client.

III. LITERATURE REVIEW

The idea to develop an application that focuses on safety without being gender biased popped up during one of the group discussions conducted in our class, where concerns about men's safety were raised. The thought that there are plenty of apps available to protect women and children but no such app that focuses on everyone's safety struck a chord in our mind. This is how authors started thinking more about it and learning the technologies required to develop the application successfully. After going through several research papers and similar existing applications, the authors found out that there was no such application that consists of all the essential features inside one single app and because of this reason we decided to come up with an app that consists of all the vital elements and helps the society in a best possible manner. Our comparative study of similar applications included [9] FEMSAPP: It is an android application focusing only on Women's Safety. It consists of the feature of sending live locations and images. These are the only two features available

in the app. [10] Naari: It is a women's safety application with features such as Sending Live locations, Playing the Siren sound. These features have been incorporated into the app, making it practical for women's safety.[11] My Safetipin: It is a Women's safety android application with features like sending live locations and finding the safest route to travel. [12]

Raksha: Women Safety App: It is an android application which mainly focuses on sending a message with a click, Calling the police at the tap of a button; other features include information about various laws related to the safety of women and an explanation of self-defence techniques that can be used in times of need. [13] Women's Security: It is an android application with critical features such as: Sending live location on clicking a widget and recording the voice of the surrounding for 45 seconds, and sending it along with the live site to the user's emergency contacts. The authors studied 15 apps, out of which five have been mentioned here.

The overall gist of the comparative study is demonstrated in Table 1.

Table 1. Literature Review

Papers	Performance	Satisfaction	Usability
Paper1: FEMSAPP- Shubham Nikam, Jay Hiray, Kalpesh Gaikwad, Sanket Patil, Prof. Smita K Thakare [9]	✓	The app consists of only two features which need to be sufficient to ensure the complete safety of an individual.	✗
Paper 2: Shreya Chakraborty, Debabrata Singh, Anil Kumar Biswal [10]	✗	The app takes a lot to send live locations and sometimes needs accurate live sites.	✗
Paper 3: Sharique Hassan Manazir, Madhav Govind, Rubina [11]	✗	The app sends the live location to the emergency only if they have the app on their mobile phone. Otherwise, it sends a link to download the app. The authors also encountered a glitch in the tracking feature as well as in the safest route feature.	✗
Paper 4: Bharti Sahu, Ayushi Chandrakar, Teshu Gaurav Singh [12]	✓	When the user wants to send an emergency message to her contacts, the app redirects her to the SMS app, where an auto-typed text is generated, but it is only sent once and unless the user clicks on the send button present beside the text field.	✗
Paper 5: WOMEN'S SECURITY [13]	✓	This particular app works up to the mark.	✓

Based on the study of various applications related to safety, the authors concluded that no apps focus on everyone's safety without being gender biased. Furthermore, there were hardly any applications consisting of the necessary features required for overall safety inside one app. Hence, it was the need of the

hour to come up with an application that focuses on everyone's safety by trying to incorporate all the essential features in one application.

SYSTEM ANALYSIS

1. This safety app is designed to ensure the safety of women, kids and men. At any given time and anywhere.
2. We intend to provide you with the fastest and most straightforward way to contact your close ones and the emergency helpline.
3. When there is an emergency, it gets difficult for a person to think about possible solutions. Our parents and friends must be notified that we are in danger, so they can trace the exact location and help us during this crucial time.
4. If the user cannot unlock the phone, it means the user won't be able to access the app and its functionalities. To overcome this drawback, the authors have added two features of voice recognition: sending live location and messages by shaking the phone thrice. The voice recognition will recognize the user's voice if they are screaming for help and send the live site and message to emergency contacts without accessing the app.

IV. PROPOSED MODEL

The block diagram of the Nidar app is shown in Figure 1.

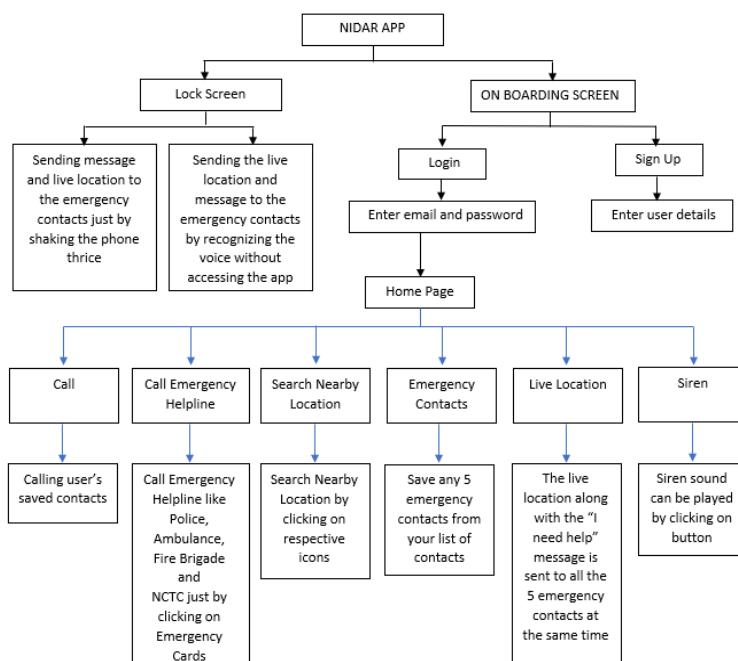


Figure 1. Block diagram of NIDAR app

V. IMPLEMENTATION AND RESULTS

The implementational result of the proposed model is shown below in the Figures.



Figure 2. On-Boarding Screen



Figure 3. Login screen



Figure 4. On-Boarding Screen-2



Figure 5. Register screen

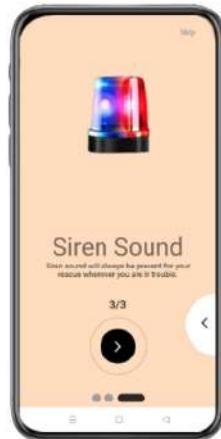


Figure 6. On-Boarding Screen-3



Figure 7. Home page



Figure 8. Contact Screen



Figure 9. Emergency Contact



Figure 10. Siren page

The application includes features such as On Tap Calling Emergency Helpline numbers and On Tap searching nearby locations, calling your close ones whenever needed, sending Live Location along with a message to all the five saved emergency contacts simultaneously just by a button click. Another essential feature includes playing the Siren Sound in case of emergency. Other features include sending the live location and message to the emergency contacts by voice recognition and shaking the phone thrice. So that in extreme conditions, if the user shouts for help, the app will detect the voice and send the live location along with a message to the emergency contacts. Similarly, shaking the phone thrice will also send the message and live area without needing to unlock the phone.

VI. CONCLUSION

Our application solves everyone's safety concerns by helping them in the best possible manner. This application ensures the safety of an individual by providing features such as simultaneously sending live location and message to all five emergency contacts either by clicking on the button or shaking the

phone thrice, or shouting for help which will lead to voice recognition. Other features include On Tap calling Helpline numbers, on Tap searching nearby locations, Playing Siren sounds etc. Furthermore, the authors have planned to incorporate a few additional features, such as using the app in offline mode, allowing the users to access the app in multiple languages, and allowing the users to add more than five emergency contacts; authors will also try to incorporate the features required for the app being efficiently used by the visually impaired in the future. In this way, authors have been attempting to develop an application that helps every section of society in the best possible way.

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Self Defense Unit for Disabled Women

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Abstract - The situations faced by women in India that can lead to physical and sexual assault (groping, rape, stalking, and other forms of physical violence) and investigates the physical features of a self-defense device that can deter these attacks. The self-defense devices with advanced features are required for easily reachable and portable device that could effectively deter or protect the person from sexual and physical attacks. For example, pepper sprays inside a handbag are difficult to access under distress/emergency. Designers of the devices on the market have not yet adequately understood and responded to the complexity of physical and sexual assaults on women. The proposed system consists of mini launcher gun that consist mini compressed cylinder that temporarily blinds the eyes of the culprits which makes easy to use taser module for injecting the shock. The taser module consist of voltage booster circuit for generating electric shock that disables the movement of culprits which makes a disabled women to escape easily from the critical situation. The sos emergency cloud computing software will sends the current location of the disabled women to the listed friends and family. Based on the location received we can easily safely guard the disabled women as soon as possible.

Index Terms – IoT, Taser module, Mini launcher gun

I. INTRODUCTION

The increased rate in sex crimes against women in India is alarming. The most recent and much talked about Delhi gang-rape case is one of the many brutal and disturbing incidents which drew our attention towards the necessity of safety devices for women in India the development of a self-defense device for disabled women which will protect them and give them a better chance of defending against sexual assaults such as groping, molestation, and rape. The crimes against women in India have been rapidly increasing, and the response from the law is deteriorating day-by-day. Thus, the safety and security environment for women in India presents a grim scenario requiring immediate attention. Table 1 provides the details of the crimes against women in India. Most of the reported cases suggest that the problem occurs mainly because of the criminal instincts in the minds of frustrated youth, poor personality development, and a difficult social background. The attitude towards woman is made worse by the objectification of women in the media, film, and fashion

industries. The lack of strict laws and poor implementation of existing laws for the safety of women are other issues which need immediate attention.

II. BASIC CONCEPTS/TECHNOLOGY USED

An IoT cloud is a massive network that supports IoT devices and applications. This includes the underlying infrastructure, servers, and storage, needed for real-time operations and processing.

An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of endpoint IoT (Internet of things) applications. It is referred to as a standalone wireless transceiver, available at a very low price. It is used to enable the internet connection to various applications of embedded systems. The ESP8266 Wi-Fi module is highly integrated with RF balun, power modules, RF transmitter and receiver, analog transmitter and receiver, amplifiers, filters, digital baseband, power modules, external circuitry, and other necessary components. The ESP8266 Wi-Fi module is a microchip. Google Cloud offers services for compute, storage, networking, big data, machine learning and IoT, as well as cloud management, security, and developer tools. A printed circuit board (PCB) is an electronic assembly that uses copper conductors to create electrical connections between components. Printed circuit boards provide mechanical support for electronic components so that a device can be mounted in an enclosure. A printed circuit board design must include a specific set of steps that aligns with the manufacturing process, integrated circuit packaging, and the structure of the bare circuit board. Figure 1. Shows the basic setup of the above-mentioned device.

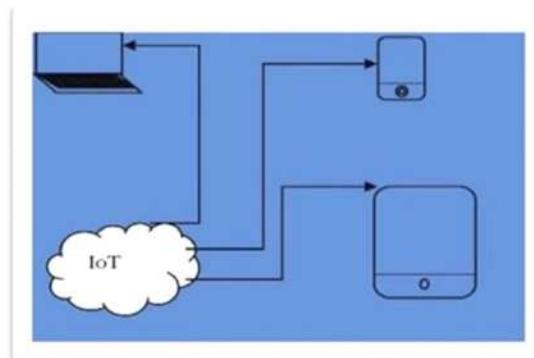


Figure 1. Internet of Things

III. LITERATURE REVIEW

[1] Shreyas R.S, Varun. B. C, Shiva Kumar. H. K, Punith have proposed Design and development of women self-defense smart. The system operates self-defense and alert features for women's like a smart watch. The main objective of this paper is to help by the technologies that are embedded into the smart watch. The smart watch comprises three sub-modules namely, Sensing

Module, Control Module, Transmission Module. In a Sensing Module consists of Emergency key and Voice Recognition Module in it. In a Control Module consists of ATMEGA328 Microcontroller and Power Supply unit in it. In a Transmission Module consists of LCD Module, GSM Module and GPS Module in it. These three sub-modules combined to track the user's location in an emergency and then send an emergency alert to their registered contacts. So that the smart watch would be helpful to reduce the crime rate against the women.

[2] Shraddha Chavan, Yojana Mokal, Payal Jha, Pournima have surveyed on Smart Gadget for Women's Safety. The system is designed for women are less secure they face many problems in their daily life. So, the main aim of this paper is women are freely moved out of their house in an odd hour without considering their security. So, they proposed a gadget for women safety.

[3] The gadget comprises GPS Module, GSM Module, 8051 Microcontroller, Panic Button, Sensors. Whenever the microcontroller receives the sensor value as well as emergency alert it sends an emergency message their registered contacts using by using GSM Module. And also, the system tracks the location of the victim by using the GPS module, the system also sends the location of the victim by using GSM Module. So that, the proposed system can solve women's problem in technologically with sound equipment and their idea.

[4] Kavita Sharma Anand More have proposed Advance Woman Security System Based On Android. The system is operating for This paper suggests an android based smart phone with an integrated feature. Whenever women's are in trouble they just simply hold the volume key button of their smart phone, which send an alert message to the registered contacts as well as it also send an voice call for first contact " I AM IN TROUBLE. PLEASE HELP ME." Here they use JAVA Platform. It has two components (1) JVM (2) JAVA API. It helps to increase the women's security.

IV. PROPOSED MODEL

The proposed work is implemented for women's self-defense unit is a mobile handy device to protect women from harassers and abusers, it can prevent mugging, thievery, sexual abuse, and many other illegal activities. Pressure loaded mini blinding device. This is a small blinding agent launcher that can blind and temporarily disable the abuser, taser for self-defense. A high volt 10,000V generator to stun and temporarily disable harasser, sos gps unit for sending alerts in the vanity bag, with a click of a button.

Table 1. Component details of the proposed tool

Components	Features	Image
ESP866 Wi-Fi module	<ul style="list-style-type: none"> • Low cost, compact and powerful Wi-Fi Module. • Power Supply: +3.3V only. • Current Consumption: 100mA. • I/O Voltage: 3.6V (max) • I/O source current: 12mA (max) • Built-in low power 32-bit MCU @ 80MHz. • 512kB Flash Memory. 	
Push Button	<ul style="list-style-type: none"> • A push button switch is a mechanical device used to control an electrical circuit in which the operator manually presses a button to actuate an internal switching mechanism. • They come in a variety of shapes, sizes, and configurations, depending on the design requirements. 	
Voltage booster	<ul style="list-style-type: none"> • The boost converter is used to "step-up" an input voltage to some higher level, required by a load. • This unique capability is achieved by storing energy in an inductor and releasing it to the load at a higher voltage. 	
PCB	<ul style="list-style-type: none"> • 25-micron nominal hole plating as per IPC class 3 • No track welding or open circuit repair. • Cleanliness requirements beyond those of IPC. • Tight control on age of specific finishes. • Internationally known base materials used – no 'local' or unknown brands allowed 	
Battery	<ul style="list-style-type: none"> • Used for power supply. 	

V. IMPLEMENTATION AND RESULTS

1. Pressure loaded mini blinding device: This is a small blinding agent launcher that can blind and temporarily disable the abuser
2. Taser for self-defense: A high volt 10,000V generator to stun and temporarily disable harasser
3. sos gps unit for sending alerts in the vanity bag, with a click of a button.

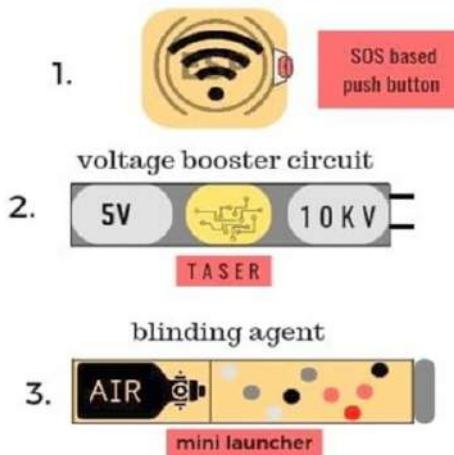


Figure 2. Self-defense unit

VI. CONCLUSION

The safety for disabled women and women in dangerous situation can self-protect themselves by using the defense unit which consists of mini launcher gun, taser module which is used to temporarily blind and inject a shock to the culprit and sos emergency cloud computing software which is used to send the location for listed friends and family members.

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EyeNetram - Fundus Image Classification using Deep Learning

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Abstract: For most people, sight is the most practical sense. It enables you to comprehend and navigate the environment. As a result, taking appropriate care of your eyes is critical. Unfortunately, most people occasionally encounter eye issues; visual problems typically worsen as people age. However, some severe eye conditions can significantly harm the eyes, resulting in permanent vision loss. The primary cause of vision loss that can be treated is the late identification of eye problems. We aim to develop a technology that fills this gap and protects vision. We introduce "EyeNetram," a tool that helps ophthalmologists quickly identify retinal abnormalities by classifying them from the input image.

Index Terms: Eye, Ophthalmologists, Retinal

I. INTRODUCTION

Eye infections are a significant cause of vision loss in adults and the elderly. It isn't easy to envision a regular life without eyes, but we often take them for granted. Symptoms such as redness, watery eyes, blurred vision, and dry eyes are often ignored as minor problems and aren't taken seriously. This ignorance could lead to serious complications ranging from blindness to death. Advances in medicine are significantly capable of eye disease detection and classification in time to save from any severe damage. This project aims to develop the retinal disease classification system "EyeNetram", which will assist ophthalmologists to timely detect eye disorders.

It uses image processing and deep learning techniques to predict eye infections. This system classifies the specified fundus image into infected and non-infected eyes. If the fundus image is infected, it will further be classified into glaucoma, age-related macular degeneration (AMD), and diabetic retinopathy. Glaucoma is a progressive eye disease caused by damage to the optic nerve, resulting in loss of vision. It can occur at any age but is more common in older people. Age-related macular degeneration (AMD) is a common condition affecting the vision's central portion. People in their 50s and 60s are usually the first to be involved. It does not lead to complete blindness. However, daily

activities such as reading and facial recognition can become difficult. Diabetic retinopathy is caused by damage to blood vessels in the retinal tissue. Diabetic patients are susceptible to diabetic retinopathy infection. It is commonly found in adults ranging from 20-74 years of age.

Following is a glimpse of fundus images of the mentioned eye disorders from the dataset.

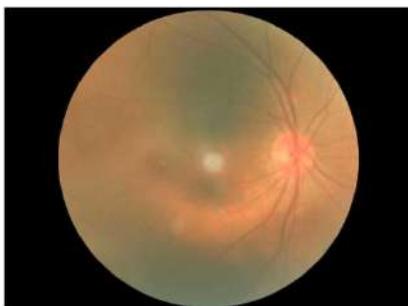


Figure 1. Normal fundus



Figure 2. Diabetic Retinopathy fundus

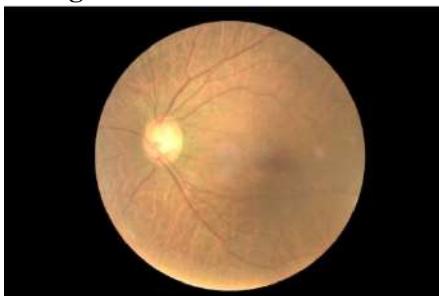


Figure 3. Glaucoma fundus

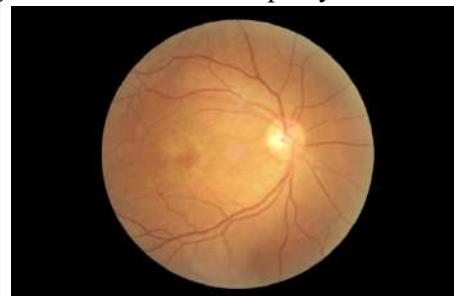


Figure 4. AMD fundus

II. BASIC CONCEPTS/ TECHNOLOGY USED.

Retinal images, which will serve as the input for our system, are a vital component of EyeNetram. These input images come from the dataset. Thus, some of it is utilized for training, and some of it is used for testing. Deep learning and machine learning models will be used to train the system. The Ocular Disease Intelligent Recognition (ODIR) dataset [7] used for building this system is taken from Kaggle which includes a structured ophthalmic database of 5,000 patients with age, colour fundus images from left and right eyes, and doctors' diagnostic keywords. The first step is extracting the required infected input images from the dataset, so the acquired dataset consists of about 4784 fundus eye images. The CSV file of the dataset contains ID, Patient age, left fundus image, right fundus image, left diagnostic key, right diagnostic key, and a few binary descriptive attributes in the form of zeroes and ones.

Eye images are of different types based on devices used to capture the photo, such as slit lamp images, retro illumination images, ultrasonic images, fundus images, digital camera images, Anterior Segment optical coherence

tomography (ASOCT) images, etc. EyeNetram uses Fundus images to process the disease classification. These are the images captured using a fundus camera. A fundus camera is a special low-magnification microscope with an attached camera designed to photograph the microscopic appearance of the inner surface of the eye, including the retina, retinal vasculature, optic disc, macula, and posterior pole.

These fundus images further use image processing to improve the quality of the photos. This includes three levels of image processing- low-level, mid-level, and high-level. The low level includes image acquisition which is the first step of the entire process which captures or obtains the desired image using image sensors such as a camera. The next step includes image preprocessing which includes resizing, colour corrections, correcting geometric distortions correction, etc. Another step to be followed is image enhancement, wherein pictures are manipulated to make them more knowledgeable. Then the next step is image restoration. Image restoration involves restoring or evaluating an image degraded by some deterministic and stochastic phenomenon. These were all low-level image processing stages.

Further mid-level image processing is required. It includes image transformation and image segmentation. Image transformation involves transforming images to transform domains such as 2D DFT, 2D Discrete Cosine Transform (DCT), or 2D Discrete Wavelet Transform (DWT).

A transform domain exhibits some valuable properties of an image that cannot usually be set in the spatial domain. For example, image segmentation is a popular image processing and analysis technique to segment an image into parts or regions based on the pixel characteristics of the picture.

High-level image processing must follow mid-level image processing. Image analysis and computer vision are included, which include segmentation, feature extraction, and classification/recognition. The most useful features are then extracted from the segmented target. An overview of image processing is shown in Figure 5.

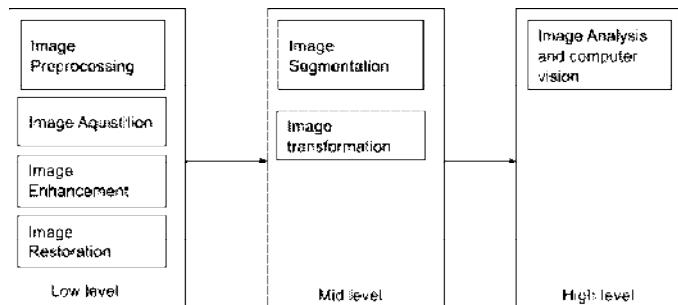


Figure 5. Block diagram of image processing

The obtained dataset can be trained using machine learning. In ML methods, features are obtained, followed by categorizing them. Prior to classification is the feature extraction stage. Retinal disease can be classified by applying solid techniques such as support vector machines (SVM). SVM achieves a classifying hyperplane based on data points from the training dataset. Another ML technique that can be applied here is Linear Regression, yet another supervised learning technique. K-nearest neighbours can also be used for classification. However, these techniques need to achieve greater accuracy. Accuracy can be improved by ensemble learning. It uses multiple machine-learning algorithms for classification. Several ensemble learning approaches are employed to improve performance, but deep learning techniques outperform them.

There are many deep learning techniques ranging from the artificial neural network (ANN), multilayer perceptron (MLP) neural network, backpropagation neural network (BPNN), convolutional neural network (CNN), and recurrent neural network (RNN) provide various solutions to image classification kind of problems. However, CNN can be considered suitable for EyeNetram wherein the Convolutional layer extracts features. The block diagram of CNN is shown in Figure 6. The convolutional layer applies the convolutional operation to the output of the previous step. The activation function is used for production. That activation function can be ReLu, softmax, sigmoid, etc. In ReLu, if the input value is positive then the result of a neuron is the activation value, while if the input value is negative then the output of a neuron is 0. Softmax changes the outcome to basic distribution probability. Max-pooling or average pooling is used to reduce the matrix size. The output matrix has smaller dimensions than the original matrix. The next step in CNN is dropout regulation. In this step, neurons are randomly discarded. This is done to avoid overfitting. The optimizer is used to improve the accuracy of the model. Adam's method is one of the ways to find optimizing parameters. Finally, the loss function is applied to the model to check whether the model is good enough or not.

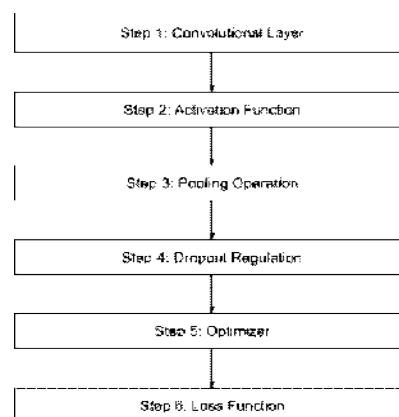


Figure 6. Block diagram of CNN

III. STUDY OF SIMILAR PROJECTS OR TECHNOLOGY/ LITERATURE REVIEW

A Lot of work has already been done to classify and detect eye disorders from fundus images. Many researchers are working in the retinal disease domain to increase the accuracy of the model as it becomes crucial. The VGGNet architecture was implemented by Ting et al. [1] to categorize Glaucoma, AMD, and Diabetic Retinopathy. The work achieved 93% AUC, 91.6% specificity, and 90.5% sensitivity for the dataset acquired.

The detection of diabetic retinopathy was accomplished by Abramoff et al. [2] using a CNN model built on AlexNet and random forests classifier. The work could get a negative predictive value - of 99.0%, an area under the curve - of 98.0%, a sensitivity - of 96.8%, and a specificity - of 87.0% using the Messidor-2 dataset [3]. This dataset contains a collection of 1748 diabetic retinopathy-infected fundus images.

Felix Grassmann et al. [4] developed a model for detecting AMD. The dataset has 120656 manually graded coloured fundus images of participants with ages more than 55. The convolution deep learning architectures that identified 84.2% of fundus images were trained. A total of 3,312 photos totalled by Phan et al. [5] were subjected to the deep convolutional neural network analysis, containing 369 photographs of Glaucoma infected eye images (256 images infected and 2687 normal) to get 90% area under the curve.

Researchers have concluded that deep learning and machine learning can achieve better model performance. The improved model parameters would assure accurate disorder detection and classification, which could stop terrible effects and help with infection control. One of the case studies of using machine learning and deep learning combinedly is a model built by Al-Bander et al. [6] using support vector machines and CNN to classify glaucoma with an accuracy - 88.2%, specificity - 90.8%, and sensitivity - 85%.

IV. PROPOSED TOOL

The input fundus image will be classified into infected and non-infected eyes by a two-layered architecture, as shown in Figure 7. If the result obtained is an infected eye, it is further classified into age-related macular degeneration, diabetic retinopathy, and glaucoma. The disease will be predicted using a convolutional neural network based on the fundus image. To improve the quality, image preprocessing and image augmentation are used. The Transfer learning approach can be used to achieve optimal performance as it uses the knowledge of previously trained models. A CNN architecture with 17 layers was created using the Caffe framework. The achieved accuracy was 79%. The accuracy can be increased by adding more layers, but the model requires more processing power.

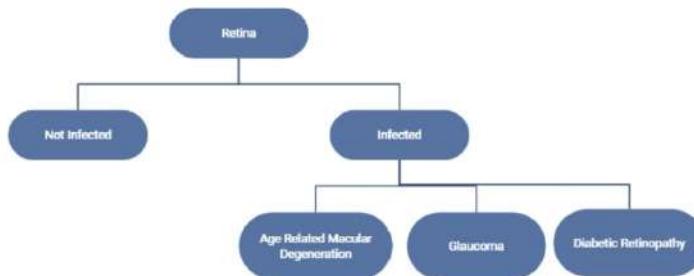


Figure 7. Two-layered architecture for classification

Researchers discovered that accuracy could be enhanced by combining DL and ML algorithms. Ensembled learning improves accuracy. Accuracy can reach up to 98.7%. According to research, DL algorithms outperform traditional ML algorithms in terms of accuracy. In addition, shallow classifiers, such as SVM, can be used to improve DL approaches. Our proposed model consists of 8 layered sequential models such that four convolutional layers are used with 64 and 128 neurons, two max-pooling layers are present, and two dense layers.

V. IMPLEMENTATION AND RESULTS

1. Available Dataset:

The dataset contains images of various infected eyes. This is shown in Figure 8. The dataset needs to be modified as we concentrate on eye images infected with glaucoma, age-related macular disease, and diabetic retinopathy. As shown in Figure 9, the modified dataset will contain the filename and the label. The filename consists of the image file, and the title will indicate the disease.

ID	Patient Age	Patient Sex	Left-Fundus	Right-Fundus	Left-Diagnostic Keywords	Right-Diagnostic Keywords	N D G C A H M O						filepath	labels	target	filename		
							N	D	G	C	A	H	M	O				
0 0	69	Female	0_left.jpg	0_right.jpg	cataract	normal fundus	0	0	0	1	0	0	0	0	./input/ocular-disease-recognition-odir5k/ODL...	[N]	[1, 0, 0, 0, 0, 0, 0, 0, 0]	0_right.jpg
1 1	57	Male	1_left.jpg	1_right.jpg	normal fundus	normal fundus	1	0	0	0	0	0	0	0	./input/ocular-disease-recognition-odir5k/ODL...	[N]	[1, 0, 0, 0, 0, 0, 0, 0, 0]	1_right.jpg
2 2	42	Male	2_left.jpg	2_right.jpg	laser spot, moderate non proliferative retinopathy	moderate non proliferative retinopathy	0	1	0	0	0	0	0	1	./input/ocular-disease-recognition-odir5k/ODL...	[D]	[0, 1, 0, 0, 0, 0, 0, 0, 0]	2_right.jpg
3 4	53	Male	4_left.jpg	4_right.jpg	macular epiretinal membrane	mild nonproliferative retinopathy	0	1	0	0	0	0	0	1	./input/ocular-disease-recognition-odir5k/ODL...	[D]	[0, 1, 0, 0, 0, 0, 0, 0, 0]	4_right.jpg
4 5	50	Female	5_left.jpg	5_right.jpg	moderate non proliferative retinopathy	moderate non proliferative retinopathy	0	1	0	0	0	0	0	0	./input/ocular-disease-recognition-odir5k/ODL...	[D]	[0, 1, 0, 0, 0, 0, 0, 0, 0]	5_right.jpg

Figure 8. Unmodified dataset

filename	label
0 1318_right.jpg	glaucoma
1 719_right.jpg	age-related-macular-disease
2 1967_left.jpg	glaucoma
3 946_left.jpg	normal
4 2807_left.jpg	normal
...	...
2135 1248_right.jpg	glaucoma
2136 3228_left.jpg	normal
2137 1886_right.jpg	age-related-macular-disease
2138 313_left.jpg	normal
2139 870_right.jpg	age-related-macular-disease

Figure 9. Modified dataset

2. **Preprocessing:** We have created a CSV file to handle our whole dataset. First, our dataset is extracted using the pandas' library. Next, we used the Keras library to preprocess the images and add parameters that will perform some adjustments to the photos. Image preprocessing includes rescale, horizontal and vertical flip, rotation, and brightness.

3. **Data Analysis and Visualization:** Our dataset contains 4784 images with eight labels of different eye diseases. We are only using three tags for our system; hence we have used 2140 images for building the model. In addition, we split the dataset, so training images contain 80% of the data. Table 1. Represents data analysis.

Table 1. Data Analysis

Label	No of images
AMD-infected fundus	526
Glaucoma-infected fundus	494
Diabetic retinopathy-infected fundus	50
Normal fundus	1070

1. **Model Development:** Out of various Deep learning architectures, we implemented Sequential Convolutional neural networks.

We chose the Sequential CNN architecture because it is appropriate for a plain stack of layers where each layer has exactly one input and output. We preprocessed the images by normalizing them. Our model consisted of 4 Conv2D, 2 Max Pooling 2D, and Dense layers. The outcome of our model includes predicted results. We used Adam optimizer with batch size set to 32 and trained for 30 epochs. Activation functions used were ReLu and softmax.

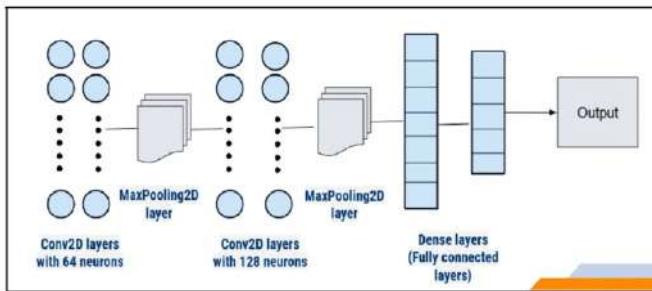


Figure 10. Sequential model

Model: "sequential_9"		
Layer (type)	Output Shape	Param #
conv2d_16 (Conv2D)	(None, 222, 222, 64)	1792
conv2d_17 (Conv2D)	(None, 220, 220, 64)	36928
max_pooling2d_2 (MaxPooling 2D)	(None, 110, 110, 64)	0
dropout_3 (Dropout)	(None, 110, 110, 64)	0
conv2d_18 (Conv2D)	(None, 108, 108, 128)	73856
conv2d_19 (Conv2D)	(None, 106, 106, 128)	147584
max_pooling2d_3 (MaxPooling 2D)	(None, 53, 53, 128)	0
dropout_4 (Dropout)	(None, 53, 53, 128)	0
flatten_1 (Flatten)	(None, 359552)	0
dense_1 (Dense)	(None, 128)	46022784
dropout_5 (Dropout)	(None, 128)	0
dense_2 (Dense)	(None, 4)	516

Figure 11. A sequential model with layers and respective output shape

There is yet another sequential model, which is VGG-16. VGG stands for visual geometry group and 16 because it has 16 weighted layers (mainly convolutional and dense ones). VGG-16 is another version of the sequential model. It has convolutional layers of 64, 128, 256, and 512 neurons. Apart from that, it has three dense layers. It is like an 8-layered convolutional model. Its implementation of VGG-16 is very much like eight layered sequential models. Only the number of layers is more in the VGG-16 model. Thus the 8-sequential model is less time-consuming than VGG-16 during the training phase of the model.

2. Website Development:

Backend: EyeNetram accepts a fundus image in jpeg format and returns the predicted results.

Frontend: Our website is designed using react as it is best suited for developing interactive and efficient web applications. A prototype of our website is shown below.

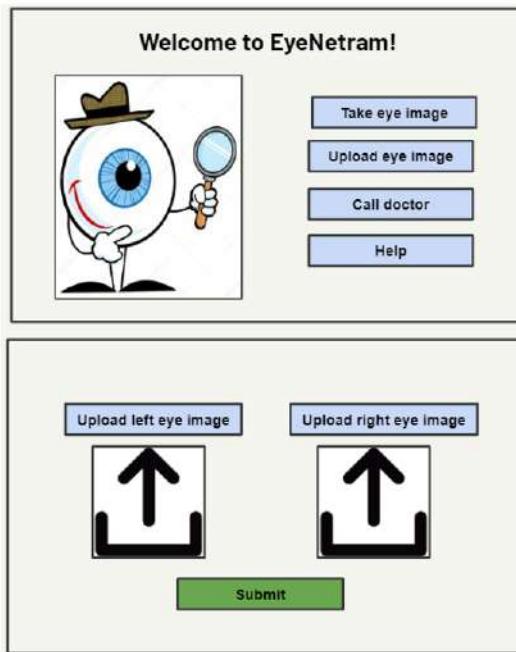


Figure 12. Prototype of EyeNetram

3. **Website Deployment:** To host our website, we chose EC2 Windows free tier instance by Amazon Web services with 8 GB RAM and Intel Core i5.

We analyzed two models, eight layered sequential model and the VGG-16 model, to compare our results. Both models are of sequential type. Table 2. shows a comparison of VGG16 and the sequential model.

Table 2: Comparison of VGG16 and sequential model

8-layered sequential model	VGG-16 model
8-layered	16 layered
have convolutional layers of 64 and 128 neurons	have convolutional layers of 64, 128, 256, 512 neurons.
have two dense layers	have three dense layers
Keras is used	Keras is used
Activation function used: ReLu and softmax	Activation function used: ReLu and softmax
Layers in the model: Conv2d, max pooling, and dense.	Layers in the model: Conv2d, max pooling, and dense.

The 8-layered sequential model has eight weighted layers, whereas VGG-16 has 16. Eight-layered sequential models have convolutional layers of 64 and 128 neurons, whereas VGG-16 has convolutional layers of 64, 128, 256, and 512 neurons. The 8-layered sequential model has two dense layers, whereas VGG-16 has three thick layers. Both use the Keras library. Activation functions

used in both models are the same, and they are honest and softmax. Both models have the same kind of layers, i.e., Conv2d, max pooling, and dense, as stated in Table 1. Since VGG-16 has 16 layers to be trained and the number of layers gets reduced to half in 8-layered sequential models, training 8-layered sequential models is less time-consuming.

VI. CONCLUSION

Researchers have discovered that combining deep learning and machine learning produces results with better parameters than either deep learning or machine learning alone. These criteria include sensitivity, specificity, and accuracy. EyeNetram was created to assist ophthalmologists in identifying and classifying retinal disorders. Preventing or controlling retinal infections will aid in their early detection. To expedite the process, ophthalmologists might utilize EyeNetram as the first filter to remove damaged eyes. Only diseased patients can be treated by ophthalmologists, easing the burden on them, and assistant doctors and technicians can be educated to take out reports using this technique. The future scope for this system includes making it simple and practical for people to check their eyes before visiting an ophthalmologist. We are currently building the model using sequential and VGG16 architecture. Utilizing the transfer learning strategy, which focuses on storing knowledge gained while resolving one problem and applying it to another that is unrelated, will be the next step in this process. It is not recommended to use a smaller dataset because the model might need to be more effectively trained. To artificially increase the amount of data, we are exploring using data augmentation, which would generate new data points from existing data.

EyeNetram will be helpful in places where access to ophthalmologists is limited, such as rural areas and health check-up camps. A high-quality fundus picture is required for precise disease categorization. However, the algorithm has difficulty classifying unfocused fundus images because of information loss brought on by pixel distortion. As technology advances daily, cell phone cameras will have the high-resolution capability to take good photographs of the fundus.

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Vehicle Platooning using Open Computer Vision

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Abstract- Vehicle platooning is one of several features used by autonomous vehicles. A platoon is a collection of vehicles that can move swiftly and safely in close quarters. Each vehicle in the platoon can communicate with the others. All following cars react to the lead vehicle's movement, which controls the speed and direction. Our suggested framework for the Internet of Things combines ideas and methods from several mechatronics and computer science disciplines, including computer vision, artificial intelligence, sensor technology, control systems and Vehicle infrastructure integration technology. Computer vision highlights the information from the camera, such as zebra crossing lines, traffic lights, and road borders. Artificial intelligence can detect the semantics of highlighted information. For example, the location, size, speed, and direction of barriers are all given via sensors and information about their distance and movement. The use of communication technology facilitates information sharing between cars. The suggested method enables vehicles to execute self-positioning with other vehicles in a specific range to enhance their safety and stability because cars have a greater likelihood of experiencing accidents in crowded areas.

Index Terms- Vehicle Platooning, Open Computer Vision, Intelligent Transport System, Shared Automated Vehicles, Coordinated Formation of Vehicles

I. INTRODUCTION

Recent developments in vehicle automation, monitoring, and communications have made it possible for mobility agents to establish a variety of cooperative tactics targeted at enhancing traffic flow, boosting safety, and lessening the impact on the environment.[1] Before being allowed to operate in the actual world, autonomous or self-driving vehicles are often taught offline. Regardless matter how large the training dataset is, a car is guaranteed to encounter unforeseen scenarios (such as an accident) where it needs to rush (steer, brake, etc.). Additionally, a detecting device without a penetration capability cannot pick up things that are blocked by other cars. As a result, there are still blind spots where things cannot be seen.^[3] Due to this restriction, autonomous vehicles are unable to manage emergency circumstances. The current car will have more time to react if future information can be gathered from a trustworthy source, such as another vehicle travelling the same road in front of it, a drone, or a satellite. The number of cars on the road has significantly

increased over the past few decades, and the popularity of electric vehicles is also seen.^[4] However, because of a lack of funding and other constraints, the growing infrastructure needs to keep up with demand—increasing issues with effective traffic management. IoT and Cyber-Physical Systems, two cutting-edge technology mashups, are being investigated to offer a solution for autonomous, trustworthy, and effective traffic management, which gave rise to (ITS).^[5]

Under ITS, several methods are developed and put to the test to improve the overall performance of the current transportation systems in terms of lowering carbon emissions, enhancing driver safety, and maximizing the use of fuel and roads. Platooning is the most affordable and easily implementable solution, ranging from Electric Autonomous Vehicles to New Transport Mediums (Hyperloop).^[6] The study of aerodynamic drafting in naturally idling birds gave rise to platooning. We watch the birds perform particular behaviours. To lessen air resistance, Trucks in Platoons arrange themselves in a pattern. This allows for energy conservation, extending flight time. Similar improvements in fuel efficiency have been seen with truck platooning [7]. Platooning in vehicles necessitates the establishment of a virtual link between the platoon leader vehicle (PLV) and platoon follower vehicle (PFV). Both centralized and decentralized techniques can be used to accomplish it on large scales. PFVs and PLVs must be constantly connected to a central server for decision-making when using centralized techniques. In contrast, a decentralized approach creates an ad hoc network to help with communication and decision-making within the network.

II. BASIC CONCEPTS AND TECHNIQUES USED.

This work uses a camera combined with high-definition mapping and localization algorithms to detect the master vehicle and correct the following vehicle course. Furthermore, classification and recognition are made possible via Open Computer Vision. The suggested system enables vehicles to travel, exchange discovered information, and execute platoon-wide self-positioning using wireless devices. Our suggested car following technique is predicated on the notion that every follower vehicle will be furnished with a similar camera style devoid of a zoom. The Focal Length, Area of Lens, and Curvature parameters can be used to indirectly correlate distance with the overall approach, which is distance agnostic. Pre-processing is done by the follower vehicle as it takes a picture of the QR code that is visible on the back of the leader vehicle. The captured image is converted to grayscale during pre-processing and then binarized. The binarized image is passed via edge detection, and the output is then delivered to corner detection for QR codes. When a QR code is found, its overall size is determined, along with the ratio of the QR code screen to the screen size.

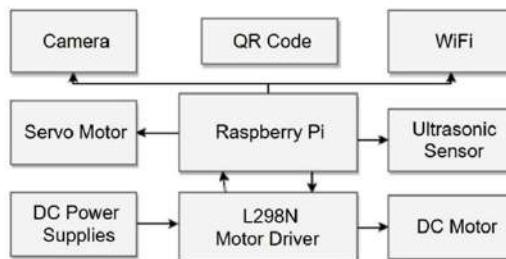


Figure 1. Block diagram

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED.

Based on funding from the U.S. Federal Highway Administration, a team from Ohio State University led by Dr Robert E. Fenton conducted the initial research on AHS. Their first automated vehicle, which is thought to be the first land vehicle to include a computer, was created in 1962. The onboard electronics, which took up most of the front of the passenger side, the trunk, and the back seat, were used to steer, brake, and regulate speed. OSU conducted research until the early 1980s when federal funding was reduced. Another project funded by the European Commission, SARTRE (Safe Road Trains for the Environment), is looking into platooning on unaltered European highways. Vehicle platooning, as defined by the SARTRE project, is a convoy of vehicles in which a skilled driver in the lead vehicle directs a line of closely trailing vehicles. The project started in September 2009 and is still ongoing. Autonomously measuring the distance, speed, and direction from the car in front, each following vehicle adjusts. Once in the platoon, drivers can engage in other activities as it moves toward their long-distance destination. Every car is detached from the procession and free to leave anytime. Lane detection was employed in lane-keeping assist systems in 2012 to support lane departure warnings for drivers and strengthen the driver's heading control. Systems with adaptive cruise control use the detection and tracking of vehicles moving ahead to maintain a safe and comfortable distance. Also developed were pre-crash systems, which, if a motorist reacted slowly, would apply full braking force to lessen the damage. Mercedes-Benz successfully displayed a demonstration on a Class S 500 in 2014 that used sensor technology that was nearly ready for production and entirely relied on vision and radar sensors in conjunction with precise digital maps to get a thorough grasp of complex traffic conditions.

IV. PROPOSED MODEL / TOOL

The suggested architecture is represented in Figure. 2. The Raspberry Pi Zero W and Raspberry Pi 4 will be utilized in this application to process data from sensors, manage actuators, and transmit data over the network. The next car will be authenticated using a QR code, and the following manoeuvres will be made more accessible. A platoon server will track the platoon's statistics and keep track of the host's or leader's whereabouts.

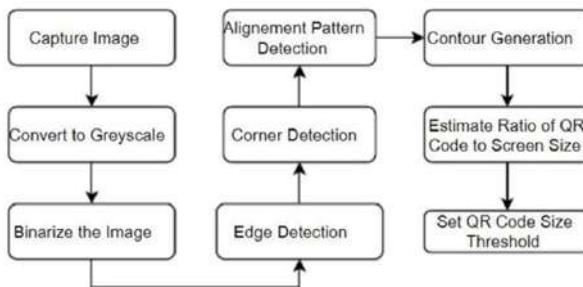


Figure 2. Proposed model

V. IMPLEMENTATION AND RESULTS

In our project, factors such as angle of view, distance, code size, and others that affect the deconstruction of QR codes are studied in detail. The information needed for choosing the size of the QR codes in our suggested work is provided by this study. In addition, the discussion paper includes other significant works that assisted in estimating the distance between a QR code and a camera. While Cam Mirror uses a single camera with custom mirrors to measure the distance of any object from the image, we used experimental evaluation to determine the maximum length for accurate decoding of QR codes. These works served as the basis for our methodology for comparing the resolution of QR Codes to screens.

VI. CONCLUSION

Vehicle platooning has become a topic of considerable interest in modern transportation systems. It is anticipated that recent developments in automated vehicle technology will turn roads into productive spaces and bring about remarkable changes in the world. Platooning, one of the computerized driving services is specifically anticipated to increase traffic mobility and safety. Platooning technology is improving as the market for automated vehicles expands, and 5G and C-ITS infrastructures become commercially viable.

This project used basic computer vision techniques to create an experimental study of platooning as a service. The "Follower Vehicle" of the proposed system was implemented using open-source OpenCV library software and inexpensive hardware. It was found that the computational delay causes the proposed method to perform better at slow speeds. However, the system was found to be vulnerable to visual disturbances because it relies on online sight (LOS) principles. The system can be strengthened by incorporating strategies for turning QR codes. An adaptive distancing algorithm that adapts to changing speed can also be added to the system to improve it. Additionally, it can be expanded to operate in a non-LOS environment. This gives us reliability and lowers the cost of maintaining the infrastructure.

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Tudo Farm (E-commerce Platform for Agricultural Products)

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Abstract- By erasing conventional time and geographic limitations, emerging technologies have reshaped the enterprise. The information revolution introduces a fresh produce marketing e-commerce application. Most individuals can purchase products online. E-commerce not only develops a new virtual community of buyers, sellers, and suppliers linked by the need for goods and services, but it also aids in increasing the effectiveness of agricultural products' distribution. Customers can utilize search engines to uncover thousands of similar websites by searching e-commerce websites. It not only lowers the cost of distribution but also makes it possible for agricultural products to be distributed faster, safer, more conveniently, and more effectively to a larger area. The producer-consumer model (BPCM) proposed in this study is based on blockchain technology. It enables farmers to sell their products directly to customers while prohibiting intermediaries from exploiting farmers using smart contracts.

Index Terms- E-commerce, Marketing, Blockchain

I. INTRODUCTION

The main difficulty farmers face today is not only the production and the yield of agricultural products but also the environment or the place to promote and sell their products for the desired price. Nowadays, many farmers need help to continue agriculture because of the financial burdens and less profit in their sector. Our idea is to make a platform where the farmers can promote their products and sell them to their customers. Our vision is to create a web application where the producers and the consumers can connect. This web application is an open platform where anyone can promote their products to their customers. This web application will improve the agricultural sector and the upcoming small business sector. This application uses Blockchain technology to record transactions. Blockchain technology is very safe and secure.

The main motive of this idea is to develop the agriculture and small business sector. This application will create an environment for the farmers. The application will contain all the information about the product. Some of them are listed below:

1. Information about the producer.
2. Information about materials used for producing or manufacturing the product.
3. The quality of the product.
4. The way by which the product has been produced etc.

II. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED.

It took the Internet several decades to transform from a network primarily used for communication purposes at and between military and educational institutions into a technological platform that hosts and realizes commercial applications (Mueller, 2002). However, after the introduction of the World Wide Web (Berners-Lee et al., 1994), it took only a few more years before commercial websites were soaring(Mukhopadhyay et al., 2008; Tian and Stewart, 2006) and e-commerce became a worldwide business model, with retail e-commerce sales amounting to 4.89tn US dollars in 2021 with an expected growth of up to 6.39tn US dollars by 2024 (Statista, 2021b), which has been amplified by the global COVID-19 outbreak as indicated by early research(Hasanat et al., 2020). In comparison, the total market capitalization of cryptocurrencies amounted to 566.26bn US dollars in 2017, 128.78bnUS dollars in 2018, 237.1bn US dollars in 2019 and 758.06bn US dollars in 2020 (Statista, 2021a), showing a substantial decline after the 2017 types, but also a rapid recovery and growth afterwards. Payments with cryptocurrencies only have a 2% share of digital payment transactions but are growing in importance (Markham, 2019). The following sections briefly describe the advent of e-commerce and highlight several important research topics. Next, a summary of relevant developments in the blockchain space has surpassed the speed of the e-commerce era regarding expectations and, in some cases, market acceptance. The focus of discussion This is primarily due to the nature of Blockchain. It can have a significant impact on e-commerce. It also makes smart irrigation possible, in which water pumps are turned on and off in response to temperature and humidity sensors placed on the soil. These technologies also help farmers discover weeds and plant diseases in their crops. Drones are used to apply nutrients to produce in the correct quantity, protecting them from injury. Blockchain is a technology stack that impacts e-commerce via technological, legal, organizational, and quality issues, as well as consumer issues. It opens new opportunities by offering unprecedented technical possibilities. Still, at the same time, it necessitates a critical evaluation of current business processes, such as practices that involve sensitive customer data or the design of communication channels along the supply chain. Technological issues related to the handling of data, privacy and security issues, development, implementation and the creation of the underlying system, as well as the potential impact of novel technologies, such as the Internet of

Things (IoT), big data, cloud computing, artificial intelligence (AI) and machine-to-machine (M2M) communication.

III. PROPOSED MODEL / TOOL

The proposed Blockchain-based Producer-Consumer model is shown in Figure 1.

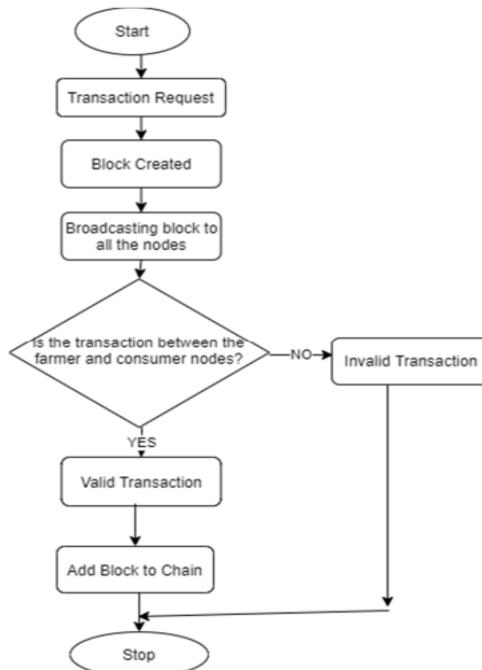


Figure 1. Proposed Model

When the producer updates the product, the product details are sent to every customer in the application; if the customer is interested in the development, then the customer can chat with the producer/dealer. Once the order is confirmed, the allotted commission amount is charged from both the dealer and customer sides. The details about the transactions are recorded using blockchain technology which is more secure than the other available technology.

Advantages of the application

1. Simple to use.
2. Secure transaction.
3. Promoting products.
4. Overhead is low.

Due to its immutability and traceability, Blockchain is most frequently used in the agricultural sector for supply chain management use cases. Another useful

application of Blockchain involves crop insurance claims, in which farmers and insurers agree on terms. It includes inadequate agricultural water supplies and flooding.[1] Farmers can sign up for a blockchain-based agricultural insurance program. The customer login module and the producer login module of the proposed modules are shown in Figures 2 and 3, respectively.

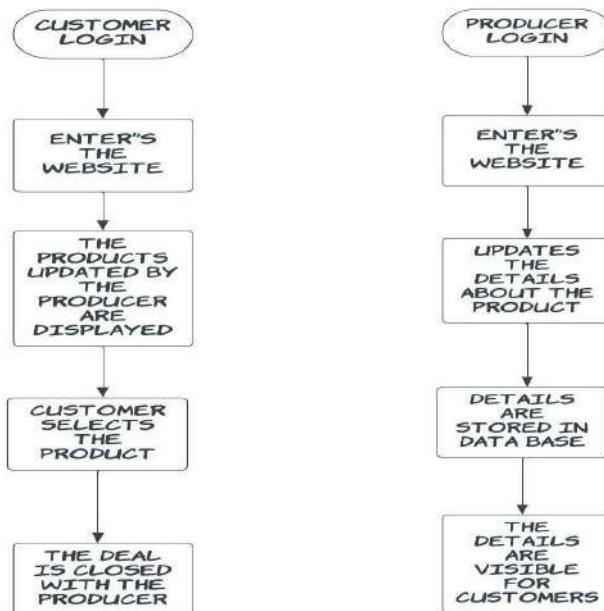


Figure 2. Customer Login

Figure 3. Producer Login

IV. IMPLEMENTATION AND RESULTS

By promoting the abundance of digital technologies in agriculture, our government is taking several steps to improve farmers' economic situation. Security and flexibility are the two main concerns that must be addressed in adopting the technologies. Farmers will benefit significantly from the proposed Blockchain-based Producer-Consumer Model, as shown in Figure 3. since it will eliminate the current disconnect between farmers and customers. Using smart contracts, this model removes transactions between consumers and consumers and authenticates transactions between farmers and consumers, eliminating intermediaries—agents that operate in the place of consumers—from taking advantage of farmers.

1. Website Development:

Our website is a development of a WordPress tool in which all the plugins are inserted into a single form of the way both in the front and back end.

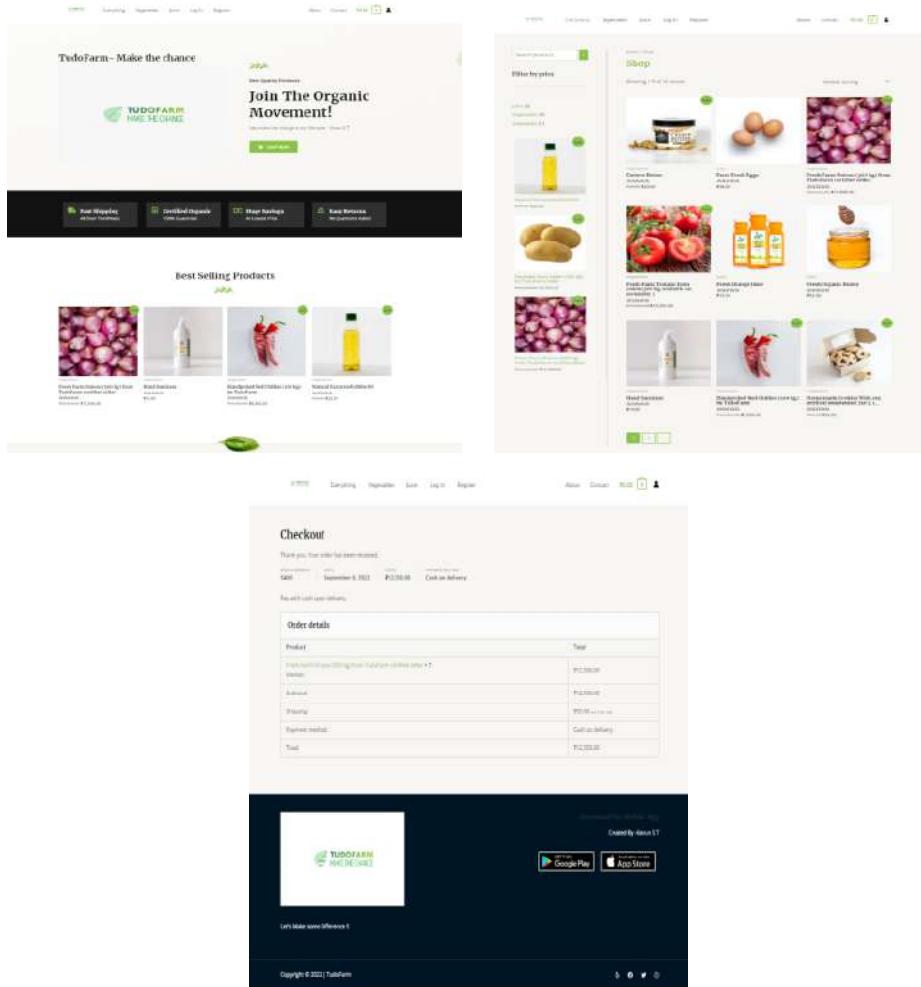


Figure 4. Website of the Blockchain-based Producer consumer model

V. CONCLUSION

If crop damage results from a natural disaster like a flood or other extreme weather, the insurer will automatically deposit the claim amount to farmers with the help of a third party's monitoring report (meteorological stations) and intelligent contract validation[2]. To protect fish farmers' data from manipulation, this article suggests a secure blockchain and Internet of Things (IoT) based fish farm platform. This article presents numerous blockchain application cases in supply chain management, healthcare, agriculture, and education. This essay examines how blockchains protect networks from Sybil attacks[4]. In many different nations, the ministries have launched numerous social programs to implement blockchain technology[5]. Farmers can now monitor their crops from a distance thanks to the development of precision agriculture.

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BLOOD BUDDIES

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Abstract - This project aims to create a system for managing blood donors and blood banks that may be used to donate blood. The Blood Bank Management System can be used to obtain information about nearby blood donors who belong to the same blood group to assist those who require blood in an emergency. People interested in donating blood can register on the blood donor website with the aid of Blood Donor. The Website displays the location of the nearby Blood camp so that the Donor can quickly get there. There are two main elements to the Blood Bank Management System: NGO and Hospital. First, the software may be used to register the camp's NGOs. Then, they may add information about the base, such as its location and the number of seats available. The information about the command run by an NGO is available on the blood donor webpage. The Hospital that needs blood may quickly register with software, acquire the blood donor's information from the blood donor webpage, and request blood from an NGO. The blood bank management system creates a link between the Hospital and NGO. They are interconnected in a way that makes it easy to complete our assignment as soon as possible.

Index Terms – Blood Bank, NGO, Blood Bank Management System

I. INTRODUCTION

In modern medicine's age, patients' care depends heavily on blood [1]. Nearly 13 crore units of blood are needed in India each year. But the blood is drawn, and the required blood is entirely out of balance. Poor blood management system causes several problems, including shortages, non-availability, and last-minute panic among those in need of blood [2]. Today's primary concern for hospitals and blood centres is patient safety [3]. The blood Bank Management System was created from the views of an NGO and a hospital. Java programming language and MySQL are both used to develop the software. The NGO has information about the camp, including the name, seats, date, and time as well as addresses, including the state, city, and precise location of the centre. The authors also have donor feedback regarding the camp facility; the NGO can maintain staff information and add staff. The NGO also has information about the blood types that are available at the camp. The NGO's primary goal is to organize the centre and provide blood to the accredited Hospital, saving the patient's life. This method makes finding the available blood simple and takes a

lot less time than the manual approach. The Hospital can manage employees and may request blood from all the registered NGOs, so there won't be any trouble locating the blood. Improved communication is made possible by the system [4]. The software is developed in a manner that is manageable, time effective, flexible, and hassle-free blood bank would improve the effectiveness of the blood bank management system [5].

II. BASIC CONCEPTS/TECHNOLOGY USED

As more people become aware of the need to donate blood for those in need, the percentage of individuals donating blood rises daily. However, the blood must be carefully maintained to prevent any detrimental consequences on the recipient after receiving blood. It was discovered from the observations collected during the user requirements phase that there needs to be a communication channel for the general public to notify their blood donation schedule. The public is often made aware of the blood donation campaign period by advertising the blood donation event calendar. However, only the nurses and staff at the blood home unit are notified about the blood donation schedule for each month since it is written on a whiteboard there.

Therefore, they are manually notifying the timetable. When there is enough space, a problem occurs. The whiteboard is the medium used to communicate the staff's monthly schedule, and the whiteboard marker is used to write it. As a result, the writing frequently needs to be clarified. Blood donation was not well known by the public. The BBMS interface will be built to accommodate the NGO staff posting about the blood donation activities to manage these. The public may access these facts so they are aware and can plan a time to go and give blood. The NGO staff will have access to a form to fill out the specifics and a list of the locations for each month's blood donation activities, ensuring that everyone is aware of the schedule. Due to the existence of this feature in the BBMS, it is simpler for the staff to amend any inaccurate information. And make the necessary adjustments if the provided location or date is altered.

Blood Buddies website:

- Html
- Tailwind CSS
- React Js
- Express Js

Blood Bank Management System:

- Java
- Database: MySQL

III. LITERATURE REVIEW

People who need blood are becoming more numerous every day [6]. Since there are eight distinct ABO/Rhesus blood types (A+, A, B+, B, AB+, AB, O+, and O), managing blood inventory is even more difficult [6]. The authors

learned about various techniques for keeping data on blood types and blood donors from the research study. Most approaches could be more user-friendly. The authors introduce Blood buddies as the best cloud-based system solution. The challenge for us will be to design a user interface that is both simple and effective. Authors are creating a website and building software. Thus, that will be fundamental. It will be designed efficiently to manage activities that contain a large amount of data.

Drawbacks of the existing system:

- The availability of valid information needs to be improved.
- There are many chances to misplace data using manual data entry and security to manual data entry is less.

METHODOLOGY:

The Blood Buddies is the one that will be created. This is a web-based application solution that donors can use. This system overcomes the shortcomings of the existing system. The following are some characteristics of the suggested system:

- Registered users/donors locate the nearest blood camp.
- It provides security for users using usernames and passwords.
- GPS systems are used to track the nearest location of the blood camp.

Health care services is an area with strict requirements as it refers To human life [7]. Blood Donor is a website-based solution to store, process, retrieve, and analyze information. The Website enables users to save donation information there. A unique identifying number is immediately provided to the Donor as soon as they register. At the time of the donor details, the physical and medical information of the Donor is stored. The Donor can check the neighbouring camp on the internet. On the webpage, the camp location is shown using Google Maps. Registration is also finished at the blood camp to prevent having to do it again at the donation camps. The Donor gets access to all information about the base and can edit his user profile since the history of his camp registration is also shown.

Additionally, the Authors provide a support system where the Donor may turn if they have any inquiries concerning the blood camp. The ranking system on the Website ranges from 1 to 10. Therefore, blood donation frequency can enhance the level, which might lead to intense competitiveness among young people.

IV. PROPOSED MODEL

Blood Buddies will be the Website that is created. Donors can utilize this web-based platform. The location of the closest blood camp is shown, and the Donor can enter new or updated information. The webpage has a user-friendly

dashboard where they can see statistical information. The perspectives of a Hospital and an NGO were used to construct the Blood Bank Management System. NGO and Hospital can both register, and the NGO can manage staff and conduct a camp that will be displayed on Blood Buddies. In addition, the Hospital can request blood. The landing page of the proposed system is shown in Figure 1.



Figure 1. Landing page



Figure 2. Blood bank management system

V. IMPLEMENTATION AND RESULTS

The implementational result of the proposed model is shown below in the Figures.

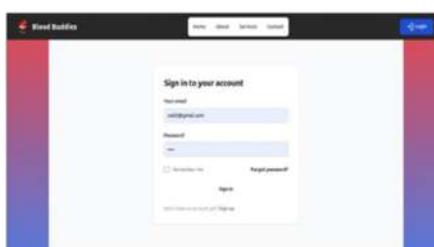


Figure 3. Sign-in page

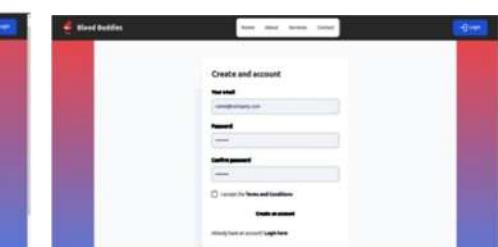


Figure 4. Create account



Figure 5. Blood camp information



Figure 6. Blood camp address information



Figure 7. Selection page



Figure 8. Sign up page for NGO



Figure 9. NGO navigation page

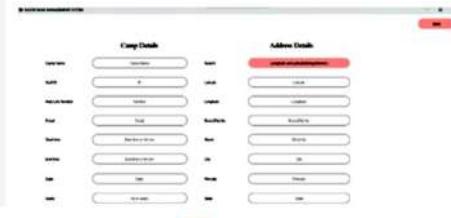


Figure 10. NGO camp handling page



Figure 11. Hospital sign-up page



Figure 12. Hospital navigation bar



Figure 13. Feedback page

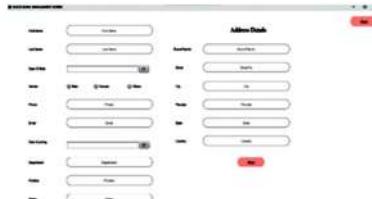


Figure 14. Hospital staff addition page

VI. CONCLUSION

The proposed Blood Bank Management System provides a trustworthy platform for donors and acceptors. A web-based program called "Blood Buddies" helps reduce human mistakes and data redundancy issues. The data

entered will be followed to ensure increasing the likelihood that someone's life may be saved. As a result, it is a quick and effective way to communicate without security risks. Additionally, it is easier to discover the closest blood camp thanks to a location-based system, such as Google Maps. This paper proposes a Blood Bank Management System and Blood donor website, which Authors believe will bring remarkable change. Support for numerous regional languages to accommodate the increasing number. The authors will create a portable, customized Blood donor-based Android application over the next phase.

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Smart RO Water Dispenser

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Abstract: The current existing RO water vending machines are popularly known as RO water ATM's. These vending machines seems to be great useful for public such as small street venders, shopping malls, Railway Stations etc....Hence the current existing system is coin based system which makes of 1rupee or 5-rupee coin to dispense the water. This also serves a purpose of eliminating the scarcity of coins and limited dispensing of water. Hence, we have come out of a prototype which gives flexible dispensing of water using app-based system and coin-based payment according to the requirement of the consumer. Our project is designed to apply internet of things system with Arduino and Bluetooth. The device is built using Arduino Microcontroller, Blynk app, sensors etc. and Arduino is used as a controlling unit. When the user enters the required quantity of water, Arduino turns on the water pump and measures the quantity of water dispensed using flow rate sensor. As soon as the required quantity of water is dispensed the water pump will stop automatically. Here the quality of the dispensing water is measured and tested using TDS sensor. Therefore, the major advantage of this project is, it will be more helpful for the people who are travelling, and it avoids the use of plastic which is harmful for the environment and reuse of the containers available, it also avoids the scarcity of coins. Most importantly it avoids the wastage of Water.

Index Terms: TDS sensors, Blynk app, QR code

I. INTRODUCTION

The present water dispensers are low efficiency and time costs. So, these disadvantages can be improved by this project. As the former problem, it can be clearly seen that the water vending machines are available and operated on only one coin, but our aim is to design water vending machine which is operated on different coins. We also present the option of QR code scanner for cashless dispensing of water.

II. STATEMENT OF THE PROBLEM AND OBJECTIVES

- **PROBLEM STATEMENT:**

Approximately 100 million plastic bottles are used discarded everyday with 80% of them are simply becoming non-biodegradable litter. Hence if we have a system that gives water as much as our container can hold enough of water, by this way we may reduce the use of plastic water bottles.

- **OBJECTIVES**

1. To design and implement App based automatic water dispenser with low cost.
2. To integrate the system with blynk app for operating water dispenser.
3. To integrate coin box to water dispenser and allow user to dispense water by inserting Coin to Coin box.

III. PROPOSED MODEL



Figure 1: Proposed Model



Figure 2: Displayed results

The project is designed to apply an Internet of thing system with Arduino and Bluetooth objective to build an IoT mobile app-based water dispenser system. Mobile app is used to identify person account, and account recharge can be done using mobile app. Person can use mobile app to draw required quantity of water from dispenser. Device is built using Arduino micro-controller. When user enter the required quantity of water, Arduino turn on the water pump and measures the quantity of water dispensed using flow rate sensor. We constantly measuring the Total dissolved solids (TDS) in water along with the temperature. As soon as the required quantity of water dispensed, the water pump will stop. The Arduino Uno is programmed using Arduino IDE software.

The proposed model of Smart RO Water Dispenser as shown in Figure 1. The Displayed Result is shown in LCD Figure 2. Currently the coin box sensor accepts three different coins i.e., 1, 2 and 5. When user insert coin through the coinbox sensor, the coinbox sensor sends signal to the Arduino, it sends control to the water pump via relay. Water flow sensor measure the required amount of water to be dispensed, and it will be displayed in the LCD display.

IV. IMPLEMENTATION AND RESULTS



Figure 3. Block Diagram of implemented prototype

The block diagram of “Smart RO Water Dispenser”. The power from the DC12v Adaptor is given to the microcontroller (Arduino UNO) which controls the functioning of the device to operate it automatically. The machine uses Multi Coin Acceptor sensor, which detects the multi coins that are programmed. When Coin is inserted, it will send a signal to Arduino dispense the amount of water. Arduino will turn on relay module which it switches on the water pump. When the water flows through the water flow sensor it will measure the quantity of water dispensed. When the required amount of water is dispensed the Arduino will shut off the relay and water pump. The temperature sensor and TDS sensor will continuously monitor the temperature and Total dissolved solids in water and displayed on LCD. The Bluetooth module is connected to the android app and amount is received it will dispense the water based on it.

Arduino Uno

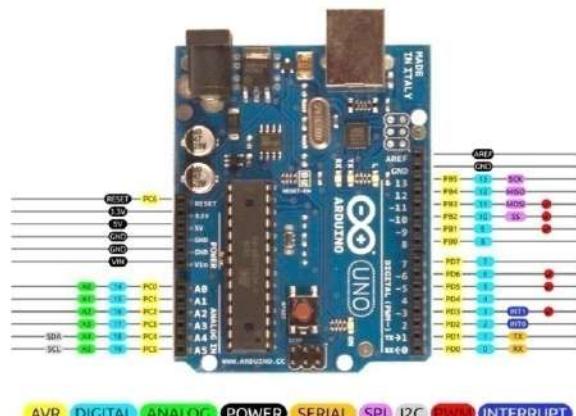


Figure 4: Arduino Uno

Table 1. Arduino Uno Technical Specifications

Microcontroller	ATmega328 – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

Water Flow Measurement Sensor

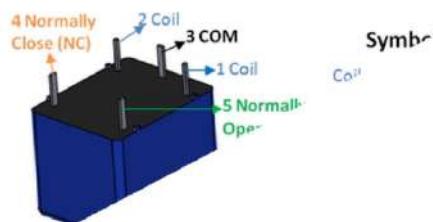
**Figure 5.** Water Flow Measurement Sensor

The Figure 5 shows YF-S201 is a water flow measurement sensor with high-grade quality sealing property. It works on the Hall effect principle and with a flow rate range of 1~30L/min. The module has three pins: Power, Ground, and the Analog output. YF-S201 consumes very little current and can work with an allowing pressure of $\leq 1.75\text{MPa}$.

Table 2. Pin configuration of YF-S201 Water Flow Measurement sensor

Colour	Pin type	Function
Red	Power	To provide power to the module
Black	Ground	Connected to the ground terminal
Yellow	Signal	Analog output from the sensor

12V Relay Switch

**Figure 6.** 12V Relay Switch

The Figure 6 shows 12V Relay, they are most used switching device in electronics. There are two important parameters of relay, first is the Trigger Voltage, this is the voltage required to turn on the relay that is to change the

contact from Common → NC to Common → NO. The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC, NO or Common terminal of the relay could withstand, in our case for DC it is maximum of 30V and 10A. Make sure the load you are using falls into this range.8

Multi Coin Acceptor



Figure 7. Multi Coin Acceptor

The Figure 7 shows the multi coin acceptor machine is compatible to be best fit in water dispensing.

● **STANDARDS AND OPERATING INSTRUCTIONS:**

- ❖ Apply to coin's diameter = 18mm ~ 29mm
 - ❖ Apply to coin's thickness = 1.2mm ~ 3.2mm
 - ❖ Work voltage = DC12V±20%
 - ❖ Temperature = -20°C ~ 50°C
1. When the coin acceptor is used, the COIN SETTING SWITCH (SW7) needs to be set correctly according to the coin that was selected.
 2. COIN VALUE ADJUSTION SWITCH: to adjust the value need in setting signal output unit and coin value parameter.
 3. SENSITIVE SWITCH: to test the coin's sensitive degree, it detects the difference between real/fake coins, when inserted.

TDS Sensor

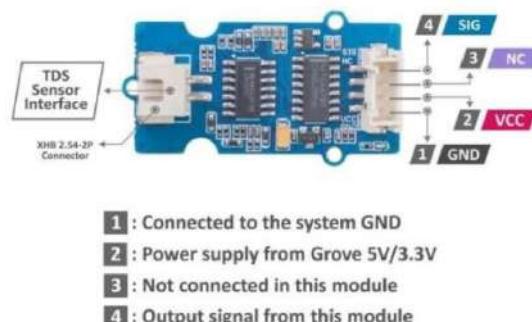


Figure 8. TDS Sensor

The Figure 8 shows TDS (Total Dissolved Solids), it is indicating how many milligrams of soluble solids are dissolved in one litre of water. In general, the higher the TDS value, the more soluble solids are dissolved in water, and the less clean the water is. Therefore, the TDS value can be used as one reference point for reflecting the cleanliness of the water. This can be applied to domestic water, hydroponic and other fields of water quality testing and monitoring.

The materials that constitute dissolved solids in water include materials such as minerals, salts, anionic and cationic substances. They can also include pollutants such as heavy metals, and other substances such as organic materials that may have leaked into your water supply system. The materials that constitute dissolved solids in water include materials such as minerals, salts, anionic and cationic substances. They can also include pollutants such as heavy metals, and other substances such as organic materials that may have leaked into your water supply system.

Bluetooth Module

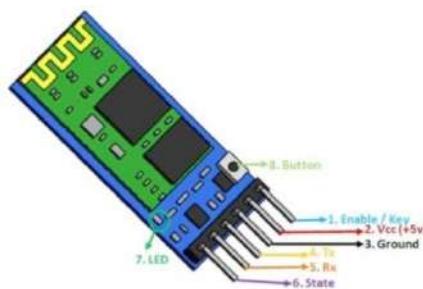


Figure 9. HC-05 Bluetooth Module

The Figure 9 shows **HC-05**, it is a popular module which can add two-way (full-duplex) wireless functionality to your projects. You can use this module to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop. There are

many android applications that are already available which makes this process a lot easier. The module communicates with the help of USART at 9600 baud rates hence it is easy to interface with any microcontroller that supports USART. We can also configure the default values of the module by using the command mode. So if you looking for a Wireless module that could transfer data from your computer or mobile phone to microcontroller or vice versa then this module might be the right choice for you. However, do not expect this module to transfer multimedia like photos or songs; you might have to look into the CSR8645 module for that.

SPST ON-OFF Rocker Switch (Non-illuminated)

SPST ON-OFF Rocker Switch. **SDDJE series** comes with the electrical ratings of 10A 250V AC. They have Operating temperature range of -10°C to $+55^{\circ}\text{C}$. This series of rocker switches have the operating life 10,000 cycles. SPST (single-pole, single-throw) **Rocker ON-OFF switch** comes with two states of operation, either ON state or OFF state. They come with no marking or various marking on it indicating it's ON and OFF states. There is **H mark** made at the input side terminal indicating "high" state at the bottom surface. **SDDJE11200** comes with horizontal IO Marking on it. At the I terminal input is given through the SPST rocker switch and output is connected at the O terminal of the switch. There are Illuminated Rocker switch, When the switch is ON the switch gets lighted up

Temperature Sensor - DS18B20

Temperature sensor **DS18B20** is a 1-wire programmable Temperature sensor from maxim integrated. It is widely used to measure temperature in hard environments like in chemical solutions, mines, or soil etc. The construction of the sensor is rugged and also can be purchased with a waterproof option making the mounting process easy. It can measure a wide range of temperature from **-55°C to +125°** with a decent accuracy of $\pm 5^{\circ}\text{C}$. Each sensor has a unique address and requires only one pin of the MCU to transfer data so it a very good choice for measuring temperature at multiple points without compromising much of your digital pins on the microcontroller.

RESULTS

The proposed model of Smart RO Water Dispenser as shown in figure 1.1. The Displayed Result is shown in LCD figure 1.2. Currently the coin box sensor accepts three different coins i.e., 1, 2 and 5. When user insert coin through the coinbox sensor, the coinbox sensor sends signal to the Arduino and it sends control to the water pump via relay. Water flow sensor measure the required amount of water to be dispensed, and it will be displayed in the LCD display.

An added advantage of this proposed model is that whenever the purity of the water is checked by the device and if the water is not suitable to consume the

relay automatically turns off the water pump. Hence it helps the consumers to consume pure water.

TDS sensor in the system check the purity of the water. Temperature sensor is used to get the accurate TDS sensor value. when user scan the QR code via the application, user will connect to the water dispenser via the Bluetooth. then input will be given to the dispenser via app. as soon as dispenser receive the input, equivalent amount of water measured and dispensed via flow sensor.

The TDS Water Purity Analysis. the TDS value between 0 to 50 indicates that ideal drinking water from reverse osmosis, deionization, microfiltration, distillation. the TDS value between 50 to 170 indicates that carbon filtration, mountain springs. 170 indicate Hard water. TDS value between 200 to 300 indicates marginally acceptable drinking water. TDS value between 300 to 400 indicates high TDS water from the tap or mineral springs. Above 500+ TDS value shows maximum contamination level.

The water flow will be measured in Water flow sensor which are required by the user. When input is given to the dispenser from the user, the equivalent amount of water to the input with accuracy is shown.

Table 3. Result analysis

No:	Coin Value in rupees	Equivalent water in liters	Expected water in liters	Accuracy in %
1	1rs	1	1	96%
2	2rs	2	2	96%
3	5rs	5	5	96%

Table 4. TDS Water Purity Analysis

No:	Water Measured	Quality Measured value	Water Purity
1	Rain Water	05 -10	Very High Purity
2	Filter Water	25-50	Very High Purity
3	Kaveri Water	100-120	Purity General
4	Bore Well Water	750-800	Poor Taste

V. CONCLUSION:

The RO water dispensing machine which operates on multi coin reader and Bluetooth app based system. Various devices like a regulated power supply, water sensor, coin sensor water pump etc., are embodied to design an efficient dispensing system. The system can be programmed for different types of coin (also for more than one coin with the help of multi coin acceptor) and Bluetooth app based for certain duration with the help of algorithm and programming in Arduino. The dispenser can be installed on roads (highways), railway stations and other public places to provide water to people at low cost.

We will replace the wired network installed in the machine by a wireless network to remove the complex indoor wiring and provide the easy installation of sensor. We will install more sensors such as humidity, dust, turbidity, pH

sensor and smell. Increase in diameter of the Water pump and pipes would increase the flow rate. Hence, taking lesser time to fill in the tumbler. The whole product can be redesigned for it to be aesthetically pleasing and for its better usability. It can be used for other beverages and drinks also like coffee, tea, soft drinks, fruit juices, Snacks etc. Cashless payments and contactless transactions via distance selection technology enable consumers to select and pay for their goods seamlessly with low to no contact. Telemetry system can be installed which allows real time access to your sales, stock, and performance, boosting efficiency of restocking and machine maintenance

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Deep Learning Based Facial Recognition with Quadcopter

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Abstract- This work depicts the design and improvement of a drone which is made to connect to a remote computer and through this setup we have tried to achieve face recognition of known faces to serve society up to some extent by fighting against security threats. This is achieved by capturing video and photos from the drone and passing it through the written code which results in activating the webcam of the laptop for recognition of the face. We have achieved this by using concepts of deep learning and with the help of Opencv, dlib, cMake, and Numpy packages. The model that supports our code is the CNN model. Many approaches were made earlier also to make this similar kind of project, but we have tried to reach a different domain in our method the drone can be used as a decoy in revealing an unknown person's identity as it is highly mobile and can be controlled by skilled hands.

Index Terms- Drone, OpenCv, CNN

I. INTRODUCTION

Facial recognition is a way of identifying or confirming an individual's identity using their face. Facial recognition systems can be used to identify people in photos, videos, or in real-time. Facial recognition is a category of biometric security. Other forms of biometric software include voice recognition, fingerprint recognition, and eye retina or iris recognition. The technology is mostly used for security and law enforcement, though there is increasing interest in other areas of use. In contrast, a decentralized approach creates an ad hoc network to help with communication and decision-making within the network. Deep learning (also known as deep structured learning) is part of a broader family of machine learning methods based on artificial neural networks with representation learning. Learning can be supervised, semi-supervised or unsupervised. Deep-learning architectures such as deep neural networks, deep belief networks, deep reinforcement learning, recurrent neural networks, convolutional neural networks and Transformers have been applied to fields including computer vision, speech recognition, natural language processing, machine translation, bioinformatics, drug design, medical image analysis, climate science, material inspection and board game programs, where they

have produced results comparable to and in some cases surpassing human expert performance.

II. BASIC CONCEPTS AND TECHNOLOGY USED

The software uses deep learning algorithms to compare a live photo or video to the stored faceprint to verify an individual's identity. In our paper, we have made improvements to add to this excellent software. Our proposed work consists of a drone fully equipped camera and wifi. The camera is well-defined to record people's faces with ease and great precision. The Wi-Fi used connects the drone to our remote computer. The data received from the drone is passed on simultaneously to a well-defined face recognition module which is developed using python. In computer vision, one essential problem we are trying to figure out is to automatically detect objects in an image without human intervention. Face detection can be thought of as a problem where we detect human faces in an image. There may be slight differences in the faces of humans but overall, it is safe to say that there are certain features that are associated with all human faces.

Face detection is usually the first step towards many face-related technologies, such as face recognition or verification. However, face detection can have very useful applications. The most successful application of face detection would probably be photo taking. When we take a photo of our friends, the face detection algorithm built into our digital camera detects where the faces are and adjusts the focus accordingly. Face recognition is a method of identifying or verifying the identity of an individual using their face. Various algorithms can do face recognition, but their accuracy might vary. Here we are going to describe how we do face recognition using deep learning. So, now let us understand how we recognize faces. We make use of face embedding in which each face is converted into a vector and this technique is called deep metric learning.

Let me further divide this process into three simple steps for easy understanding:

The very first task we perform is detecting faces in the image or video stream. Now that we know the exact location/coordinates of the face, we extract this face for further processing ahead.

Now that we have cropped the face out of the image, we extract features from it. Here we are going to use face embeddings to extract the features of the face. A neural network takes an image of the person's face as input and outputs a vector which represents the most important features of a face.

Our project is beneficial for the society in many ways such as for security purposes and can further be modified to deal with some real-life problems.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED

In this paper, we have used a Wi-Fi camera drone to capture faces so that they can be passed through our code to obtain the desired output whether it is a known person or not. We have also made a folder which contains the images of people which we want our drone to capture and recognize. Many have tried and implemented face recognition projects, but our approach differs from others. In our method, the drone can be used as a decoy in revealing an unknown person's identity as it is highly mobile and can be controlled by skilled hands. According to the authors [6], our method can find applications in areas where there is a need for high security like banks, military in any patrolling activities and in detecting a criminal from a large mass of crowded people since the criminal's identity has been taken into consideration. This makes our project unique in terms of great mobility, precision, and applications. Our face recognition python code connected to a Wi-Fi camera drone and when it was operated in the windows and captured the images when the drone was flying in the air nearly about forty meters in height, and then we passed the video in the code to get the desired output. After passing the captured video in the code, when we ran the code then the output window was activated and it found a match so what we did was, we tried to portray it with a rectangle or a square or that green color line that we see and then it wrote the name, and this happened dynamically and it ran throughout the video and every character that was added went through the same cycle and this kept repeating until there were no frames left and if it didn't find a match it showed 'unknown' at the output window. We plan to apply more modifications to our project by which normal people can be benefitted like drone delivery and home security etc. We can also fit our drone with instruments to neutralize enemies. Thus, this project proves to be a great help in every field.

Input and output

In this work, we propose a drone to fight against the security threats. Our drone can collect the video and passing the information to a remote computer through a Wi-Fi-capable device. Our remote device will identify and recognize the person accordingly.

IV. PROPOSED MODEL / TOOL

The proposed model is depicted in Figure 1 as below:

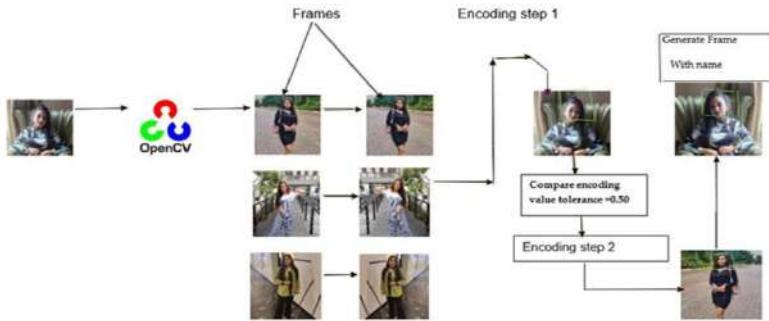


Figure 1. Overview of the working model

While streaming a live cam we may know the character in the frames but our system or algorithm which works on deep learning and neural network, although it is very smart it does not know the person in the frames. So, we take the images of the persons we want our code to be familiar with. In the third step, we feed these images to the facial recognition algorithm that uses the d-lib to encode these images. And using the d-lib facial recognition network we generate the output feature as a term i.e., a set of 128 real-valued numbers that will be used to quantify the face. The default value of tolerance level is 0.6 but if we go low the stricter the recognition gets, and the process becomes a bit slow. Based on the posture, the face angle, and the expression of the face the encoding algorithm will generate facial points and compare them with the reference encoding values so that if any one of them matches with these encodings it will tell the faces are similar. So, here using open-cv and python we render the input video file with video capture and then we read and generate every frame until there are no frames left. OpenCV-Python makes use of NumPy, which is a highly optimized library for numerical operations which is the fundamental package for scientific computing in Python. It also uses CMake which is an open-source software tool for managing the build process of software. Dlib is one of the most powerful and easy-to- go *open-source library* consisting of a machine learning libraries and various tools for creating software. For each frame, we repeat the encoding process using face recognition and generate the facial points and then we take the encoded frame and compare it with the encoded frame that we have generated based on the desired tolerance value and if there is a match, we create a frame and name below it. This happens dynamically and it runs throughout the video. Every character we add will go through the same cycle and this will keep on repeating until there are no frames left.

V. IMPLEMENTATION AND RESULTS

The quadcopter maintains stability, direction, and motion using four rotors: two rotate clockwise and the other two counterclockwise. A mounted camera is set at the center to take photos and record videos. The main principle behind this is Newton's Third Law of motion, which states that for every action there's

an equal and opposite reaction. A drone's propellers push air downwards. This causes an opposite reaction called thrust that pushes it upwards against gravity. When the propellers rotate (for example clockwise), the quadcopter will tend to rotate anti-clockwise. Rotational force is called torque. A drone solves this by driving two diagonal propellers clockwise and the other two anti-clockwise.

In our work according to paper no. 7. We have used a CNN model i.e. (a convolutional neural network). This is precisely what the hidden layers in a CNN do – find features in the image. The convolutional neural network can be broken down into two parts: When we start streaming our cam the convolution layer works and Extracts features from the connected convolutional layers. Images are fed into the input layer in the form of numbers. These numerical values denote the intensity of pixels in the image. The neurons in the hidden layers apply a few mathematical operations to these values. To perform these mathematical operations, certain parameter values are randomly initialized. Post these mathematical operations at the hidden layer, the result is sent to the output layer which generates the final prediction.

By Loading the input in a variable (say X), We randomly initialize a filter matrix. f is filtered constantly. Images are convolved with the filter as mentioned in Equation 1.

$$Z1 = X * f \quad (1)$$

By applying the Sigmoid activation function to the result, we randomly initialize the weight and bias matrix as mentioned in Equation 2.

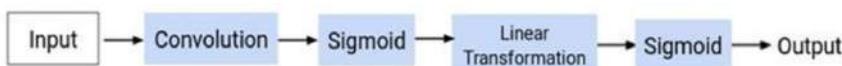
$$A = \text{sigmoid}(Z1) \quad (2)$$

Apply linear transformation on the values to obtain Z2 as in Equation 3.

$$Z2 = WT \cdot A + b \quad (3)$$

By applying the Sigmoid function on the data. This will be the final output as in Equation 4.

$$O = \text{sigmoid}(Z2) \quad (4)$$



$$\text{Input} = X \quad Z1 = X * f \quad A1 = \text{sigmoid}(Z1) \quad Z2 = W^T \cdot A1 + b \quad \text{Output} = \text{sigmoid}(Z2)$$

Figure 2. Full convolution process

The CNN model treats these values as parameters, which are randomly initialized and learned during the training process. For the backward propagation convolution layer, we had the filter matrix as our parameter. During the forward propagation process, we randomly initialized the filter matrix. We will now update these values using the following equation:

$$\begin{aligned} \text{new_parameter} &= \text{old_parameter} - \\ &\quad (\text{learning_rate} * \text{gradient_of_parameter}) \end{aligned}$$

$$\partial E / \partial f = \partial E / \partial O \cdot \partial O / \partial Z2 \cdot \partial Z2 / \partial A1 \cdot \partial A1 / \partial Z1 \cdot \partial Z1 / \partial f$$

We have already determined the values for $\partial E / \partial O$ and $\partial O / \partial Z2$. Let us find the values for the remaining derivatives. For finding the value for $\partial Z2 / \partial A1$, we need to have the equation for $Z2$ in terms of $A1$ as obtained in Equation 6.

$$Z2 = WT \cdot A1 + b \quad (6)$$

On differentiating the above Equation concerning $A1$, we get W^T as the result as in Equation 7.

$$\partial Z2 / \partial A1 = WT \quad (7)$$

The next value that we need to determine is $\partial A1 / \partial Z1$. Have a look at the equation of $A1$ as obtained in Equation 8.

$$A1 = \text{sigmoid}(Z1) \quad (8)$$

This is simply the Sigmoid function. The derivative of Sigmoid would be as mentioned in Equation 9.:

$$\partial A1 / \partial Z1 = (A1)(1-A1) \quad (9)$$

Finally, we need the value for $\partial Z1 / \partial f$. Here's the equation for $Z1$ obtained in Equation 10.

$$Z1 = X * f \quad (10)$$

Differentiating Z concerning X will simply give us X as in Equation 11:

$$\partial Z1 / \partial f = X \quad (11)$$

Now that we have all the required values, let's find the overall change in error concerning the filter as in Equation 12:

$$\partial E / \partial f = \partial E / \partial O \cdot \partial O / \partial Z2 \cdot \partial Z2 / \partial A1 \cdot \partial A1 / \partial Z1 * \partial Z1 / \partial f$$

Notice that in the equation above, the value $(\partial E / \partial O \cdot \partial O / \partial Z2 \cdot \partial Z2 / \partial A1 \cdot \partial A1 / \partial Z)$ is convolved with $\partial Z1 / \partial f$ instead of using a simple dot product. The main reason is that during forward propagation, we perform a convolution operation for the images and filters.

This is repeated in the backward propagation process. Once we have the value for $\partial E / \partial f$, we will use this value to update the original filter value as mentioned in Equation 13:

$$f = f - LR * (\partial E / \partial f) \quad (13)$$

This completes the backpropagation section for convolutional neural networks. We have implemented our project using python opencv and some other packages that are listed below: OpenCV-Python is a library of Python bindings designed to solve technical problems.

The complete setup is done by first connecting the different parts of the drone. It was then connected to windows through Wi-Fi and when the drone was switched on and made to fly in the air simultaneously videos and photos were captured and passed through the code for the recognition of known faces. By using the facial recognition network we generate the output feature which is the list of 128 real-valued numbers. These points will collectively be used to recognize and differentiate one face from the other one. Also, these 128 points will help to determine the face in the different scenes based on tolerance value. If we are getting multiple matches for the same person it might be that people in your photo look very similar and a low tolerance value is needed to make face comparisons more effective or more strict. As we already know that the default tolerance value is 0.6 and the lower you go the stricter it gets but it will also affect the performance and it will be slower as well. So here we can see two images of a known person based on posture, the face angle, the expression of the face, the encoding algorithm will generate facial points and compare them with the reference encoding values. So let's suppose this is the reference encoding value that we have so when we generate facial recognition encoded value for this type of face it will compare both of them and based on the tolerance value that we have as an input in the encoding step 1 it will compare with the reference encoding value which was provided as the input. So, as we said that we are very fortunate we are living in an age where the games we have right now with us are so close to real life now we have some idea of how these things work and export these things together so let's talk about the implementation now.

Here comes the interesting part here. What happens is using OpenCV and python we render the input video file with video capture and then we read and generate every frame until there are no frames left. So this video file that you see here will consist of several frames. so when OpenCV reads this file it converts it into multiple frames and will keep on reading until there are no frames left with OpenCV video capture we generate one frame per loop so the cycle that you will see is a presentation of a single loop just for example we have shown a bunch of frames but actually in real time what happens is it generates one frame at a time. And for each frame that we generate using OpenCV we read the encoding process using face recognition like we generated the facial points. and then we take this encoded frame and compare it with the encoded frame created in step 1 based on the desired tolerance value. So, the tolerance point is like 0.50 and if there is a match then we create a frame and name text so that we can show that as a part of the frame itself. so as we can see it found a match so what we did was we tried to portray it with a rectangle or a square or that green color line that you see and then it wrote the name. And this happens dynamically, and it runs throughout the video every character that you add will go through the same cycle and this will keep repeating until there are no frames left. So what we do is we take the video and

convert that into frames using OpenCV and then we fill each frame to the face recognition algorithm.

Then it converts into 128 real-valued numbers which is the encoding step that we have and then with the reference encoding step that we have already created before compares both the values based on the tolerance value then if there is a match it generates the frame. so that's why you see the green boxes here. Once it generates it tells us yes we have found a match.

Dataset and results

We have proposed this methodology to recognize facial characteristics on a dataset of 13233 images and videos as cited in Table 1. On the dataset this network compares to other states of the methods reaching 99.3% accuracy. Labeled faces in the wild (<http://vis-www.cs.umass.edu/lfw/>)

Table 1. Dataset statistics

Total	Images	Videos
No. of Images	13233	15680
No. of Persons	5749	5876
No. of Persons with two or more snaps.	1680	1997



Figure 3. Proposed model case study captured by the shown quadcopter drone

As a case study, we drove the drone over the crowd. So, several people were captured by the drone, and it identifies the faces very nicely as per expectation which can solve our problem expectedly which is shown in Fig.3.

Application for social impact

This project paper proposes an idea to deal with some of the real-life problems to become an asset for society and to make people's life a bit easier. If we place the drone at the main gate of a college and track the students incoming, the drone would recognize it as a known or unknown student which would be very helpful for security guards to decide whether the student belongs to the college or not. This can easily happen with a CCTV camera but the extra plus point

with the drone is that the unknown person can escape the CCTV easily, but the drone can be controlled with the remote and made to follow the person to capture him.

V. CONCLUSION

From the above synopsis and after doing a lot of research we hereby conclude that we succeeded in making and developing a wifi camera drone to fight against the security threats of society by collecting video and photos by capturing them and passing them through the code to get the desired output. Also, the drone is very helpful to mankind in many ways it can detect if a student belongs to our college or not by recognizing it as known or unknown apart from wearing identity cards.

Also, by making further improvements in our project we can make a move in sociological advancement by engaging in delivery services which will help in making delivery by knowing a person's identity also there is 1,2 limitations of our drone according to paper no 8 like it can fly up to forty meters in height but that is not a major issue in our project. So, we consider this project as successful and hope to modify it in an advanced way in future. Our face recognition work is linked through wifi camera drone can be very beneficial to tackle some real-life problems if a robber breaks into a house and then tries to run and goes into a crowd full of people then we can easily capture and detect the unknown robber's face by controlling the drone and through the captured path passed through the code instead of running behind the robber.

Secondly, we can detect if there's any accident on a busy road and capture it so that it would help people to know so they can take an alternative path that would not lead to heavy traffic jams and save time. Another fact is to use drones for security. With the appropriate license, operators can use unmanned aerial vehicles to provide security and surveillance to private companies, sporting events, public gatherings, and other venues. Drones can also gather valuable data during and after natural disasters to aid in security and recovery efforts.

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Coinstack : The Paper Trading App for Crypto

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Abstract - Crypto has launched in 2008 but still there is no any prominent solution for paper trading in crypto. Paper trading is basically a concept where people analyse the outcomes of investments on paper before actual investment. Existing solutions in the market provides a platform for paper trading in crypto but does not provide enough features. Users must refer other platforms to use the other services. So, we have developed one stop solution which provides all the necessary as well as advance features like easy buy and sell option, latest news, predefined baskets, interactive portfolio section, indexes, live charts and data, etc. Our aim is providing full-fledged crypto paper trading app where people can learn, trade and gain some experience at the same time. Somehow this will contribute in growth of crypto community and CoinStack (our app) will be our contribution to the society.

Index Terms – Crypto mobile application, Cross platform virtual crypto exchange, Paper trading for crypto, virtual exchange for crypto

I. INTRODUCTION

- With the constant ups and downs and complicated inner workings of the crypto market, it's easy for new investors to feel intimidated. But there's a free way to get some practice before you start investing for real through paper trading.
- Most of the user don't invest their money with the fear of losing their money and also don't go for paper trading as it is quiet boring.
- Most of the time people are not entirely sure that they are ready to invest don't feel like they know enough.
- So, we come up with the idea of giving user an interface which will be as similar as crypto exchange application.

So, we have built virtual currency exchange platform which will exactly simulate real world trading environment. Our project aims to educate people on their crypto journey without having a fear of losing money. They can learn, trade, and gain some experience at the same time.

II. BASIC CONCEPTS/TECHNOLOGY USED

Suppose a new investor wanted to invest 100000 rupees in the market there is high probability that user is going to lose the money. This is the same situation

currently happening in Indian markets. Lack of knowledge and expertise leads to the loss of money in investments.

But there is a way to get some practice and save loss of money before you start investing for real — through paper trading. Paper trading means analyzing investments on paper before actual investment. But this approach has 3 major flaws with it i.e.

- It requires other devices like mobile, computer, etc. for market research.
- It includes additional cost of equipment's and takes more human efforts, time.
- And last but not the least – In this digital era we need a digital solution.

Currently, in the market there are apps which provides crypto paper trading services but as a secondary service and their primary service is different. So that platform will never focus on developing lot of features for paper trading. So, we have developed a one stop solution for crypto paper trading with all the necessary as well as advanced features. 55% of US invest into the markets while India has that numbers only up to 3%. Now it's time to close the gap with Coinstack.

These are our major competitors in this field as they are from long time in the market. Some of the existing features that are similar in our app as well as above apps are they provide facility for paper trading in crypto. Competitors and we provide some of the common features like buy and sell options, portfolio building, interactive charts, and statistics. But the major drawback we observed was that our competitors provide paper trading as a secondary service so their intention would never be in adding new features to make job easier. Our focus is always on adding new features that will make trader's life lot easier.

Some of the features that our app provides different than our competitors are:

- App provides dedicated NEWS screen where user will be updated by latest news in the market. Also, user can search a news and read the article.
- Crypto fear and greed index which helps user to understand current mood of market. So according that user can plan their investments.
- Predefined baskets of crypto coins developed by high market research and expert advice.

Figure 1. shows the tools and techniques used in this work.



Figure 1. Tools and Techniques used

III. LITERATURE REVIEW

Table 1. represents the literature review done for this work.

Table 1. Literature review

Sr. No.	Literature	Publication Year	Description
1	Database Management System	2021	The book introduces database systems, their importance and working. It also introduces with different types of databases like SQL and NoSQL. It briefly describes SQL databases like MySQL and Oracle, how to query database and connectivity with different higher level languages like Java and Python, etc. It also introduces with NoSQL databases like MongoDB and Firebase, explains about their architecture, query structure, database connectivity, etc.
2	Investopedia	2022	Investopedia is a financial media website headquartered in New York City. Founded in 1999, Investopedia provides investment dictionaries, advice, reviews, ratings, and comparisons of financial products such as securities accounts.
3.	React Native	2022	React Native is an open-source UI software framework created by Meta Platforms, Inc. It is used to develop applications for Android, Android TV, iOS, macOS, Web, Windows and UWP by enabling developers to use the React framework along with native platform capabilities. It is also being used to develop virtual reality applications at Oculus.
4	Expo	2022	Expo is an open-source platform for making universal native apps for Android, iOS, and the web with JavaScript and React.

MEASURABLE INDICATORS FOR PROJECT

Table 2 shows the tangible/non-tangible indicators to access the service quality of the project developed:

Table 2. Measurable indicators

S. No.	Indicators
1	Access to cryptos 12000+ cryptos
2	Access to all NEWS in the market

3	Reduces human efforts and saves lot of time
4	Pre-Built crypto Baskets for beginners
5	Amazing user interface and experience
6	Cross platform support i.e., android and IOS
7	Makes market research incredibly easy

IV. PROPOSED MODEL

The architecture of Coinstack is shown in Figure 2.

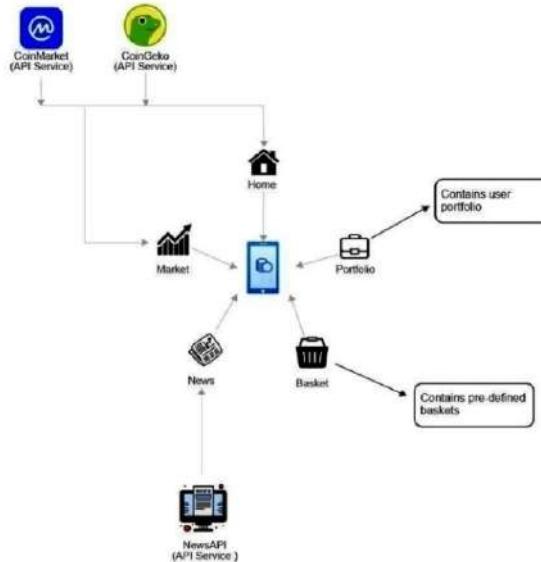


Figure 2. Architecture of CoinStack

V. IMPLEMENTATION AND RESULTS

The main problem for us was to choose a tech stack because we want our app to be accessible to both the **platforms**. So, we preferred to go with **react native** as it is cross platform technology. For this app we used tech stack as React native expo, node js and various crypto APIs. Then we identified features that are necessary in app like

- Access to all the cryptocurrencies in the market
- Easy buy and sell options
- Easy market research, access to coin's info and charts
- Access to latest news in the market
- Pre-built crypto categories to make it easier for new user
- Full functional portfolio management screen
- Crypto indexes like greed and fear index so that user can decision when to

buy and sell.

We started developing our app with considerations of all these features. **Approach** we followed while developing our app was before developing any new feature, we need to do **market research**, **authenticate** data sources, and see how existing competitors have implemented it and what we can do better. For example, greed and fear index in our app is implemented much better way because some of the existing competitors have only implemented current day's greed and fear index while we have also added historical data so that user can have better context while taking investment decisions. We have successfully implemented all these features within our app.

Our app basically contains five main screens i.e., home screen, Market Screen, News Screen, Basket Screen, Portfolio Screen. Inside these screens there is a stack of other screens like live Chart and Data Screen, Buy Screen, Sell Screen, Greed, and fear index screen, etc.

1. **Home Screen:** Whenever user opens the app it first lands on a home screen. Home screen, as shown in Figure 3., basically contains most frequently used crypto categories by traders like newly launched coins, most gained coins in last 24 hours, popular coins, etc. At the top of home screen app provides a scrollable carousel for the sake of providing important news to the users like if app is under maintenance for next 24 hours, new coins launch, airdrops, etc. It is all dynamic and can be changed through database. Each category in the home page contains coins in the form of Cards if user clicks on a card, then he/she will be redirected to coin's info screen. Here app gives a live chart as well as list all the information of the coin. Live charts and data make market research extremely easy for user.



Figure 3. Home screen

2. **Market Screen:** Market Screen is shown in Figure 4. It contains the huge list of crypto coins i.e., 12000+ coins. It is a main screen in this app. To search

in a long list there is also an option provided to search in the list. Users must click on search bar and type coin name and will list a respective coin. From here user can initiate a transaction of buy and sell a coin. If user clicks on any of the coin in the list bottom modal will appear.

It will show user current price of coin, add to the favorite list, and buy, sell option. If user click on either of the option, it will redirect user to respective screen. In buy screen user must enter amount either in decimal or floating value and click on buy button. It will initiate transaction and add that coin in portfolio. Same is the process for sell screen but here before initiating sell transaction it will validate checks, once all the conditions are met then continue with the transaction.

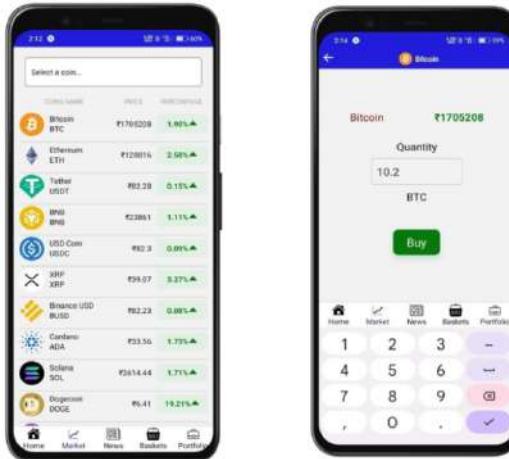


Figure 4. Market screen

3. News Screen: News Screen, as shown in Figure 5., is very important from user perspective. It will help user in market research. User will be updated with recent news, launches, airdrops, etc. in the market. News Screen list all recent news in the market in the form of cards list. If user clicks on any of the item it will redirect user to the detail news screen, here user can read whole article, news source, author, published date, etc. If user want to search about coin's news, then user can also use search option provided in news screen.



Figure 5. News screen

4. Basket Screen: Basket Screen, as shown in Figure 6., is one of the important screens for beginners in the market. There are various crypto categories in the market like most profitable coins, most lost coins, meme coins, metaverse coins, etc. Whenever beginner starts its journey, it is quite difficult to figure out all of this. So, in the app we have provided predefined set of crypto categories which are developed by high market research and expert advice. In the basket screen app list, all the categories in cards list form. If user clicks on anyone of these, he/she will be redirected to detail basket screen here user can see all the coins that belong to that category. So, it will be very easy for beginner to understand all these things.

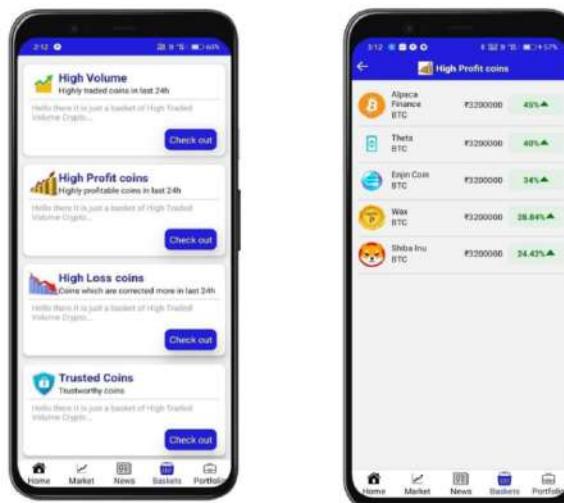


Figure 6. Basket screen

5. Portfolio Screen: Portfolio Screen contains all the coins that user has purchased. It gives total value of portfolio gained in percentage, portfolio

editing options, etc. All the transaction made with coins either buying or selling are listed in transaction history screen. With portfolio editing option's if user want to delete coin, then he/she can do that as well as can clear whole portfolio at once. Besides this app also contains other screens like greed and fear index which tells about market sentiments.

So, one can make their decisions by understanding this index.

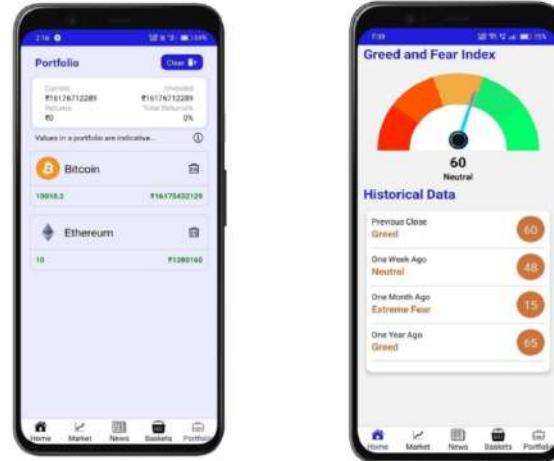


Figure 7. Potrfolio screen

ESTIMATED BENEFITS TO THE SOCIETY AND GENERATION OF INCOME

Any beginner who enters the crypto market has high chances of losing money. There could be several reasons but some of them are trying to make money quickly, sudden over exposure to market, lack of experience and expertise in this domain, etc. People can come out these situations if they do a enough practice. So, we have developed a one stop solution, which provides virtual platform where user can practice their investments. Loss of money leads to several major problems in society, providing such a platform where user can practice their investments and analyze risk. It increases higher chances of earning profits and hence there won't be a problem due to loss of money. App is designed in such a way that it makes an individual a habit of market research before actual investment so that user will be used to these habits.

App educates people on their crypto journey so it helps to build better community. And surely this will benefit to the society. People can't generate money through the app but definitely whatever that they have learnt, experience and practice in the app will be definitely useful for them to earn money in real life.

VI.CONCLUSION

- Crypto has been there from 2008 but still there is not a proper “paper trading solution” for the crypto.
- Stock market, paper trading application are available on play store, app store, web etc but same it is not case for crypto so we have built a complete solution that can meet all user requirements.
- It implements all the necessary and advance features. It make's traders life lot more easier than it was earlier. Our goal is always, to educate and help people on their crypto journey. People can learn, trade and get some experience at the same time and it will be our contribution towards a crypto community of millions and billions of people.

CoinStack is available with plenty of features, but we are trying to add more and more features to make traders life lot easier. Some of the features we are looking forward to adding in our project are:

- Adding Machine Learning Model to suggest user best portfolio possible
- Implementing reward system for users
- Adding more crypto market indicators like greed and fear index
- Adding Microsoft azure cloud services within the app so that it will be accessible all over the globe
- Adding More predefined categories in Baskets Screen
- Overall GUI improvement
- Adding expert advice support

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SERPENOBOT

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Abstract: Snake-inspired robot is a promise in potential areas of surveillance, rescue, and inspection due to the ability of snake to move through narrow spaces. This project tries to develop a modular snake with repetitive modules by using a double motor to propel one unit of four modules. This aim is achieved by developing a link mechanism to produce a snake-like motion i.e., Serpentine motion. This is the most common locomotion mode. Snakes swing body to generate a propagating wave and transform frictions from ground into push forces for moving. The modules are connected using hinged joints. Moreover, serpentine locomotion provides several advantages over traditional forms of locomotion in both animals and machines. A snake-inspired robot can lift its body up and move over obstacles than most legged or wheeled devices. The whole assembly is powered by battery. Apart from designing and developing the snake- inspired robot, its performance characteristics were determined, and the robot was successfully tested for its capability to traverse through plane surface in a snake-like fashion as well as its ability to negotiate objects.

Index Terms: Biological Snake robot, Serpentine motion, Serpenobot, Surveillance bot.

I. INTRODUCTION

Serpenobot is a snake-like robot built for various purposes like surveillance, rescue operations and inspection. These bots can be adapted and used in defense, natural disaster areas and other complex environment where there is risk for human life. The major aim of the project is to save and make human life easy. These robots can easily move through complex and undulating terrains which gives the motivation to create a bio-mimic robotic snake which can easily slither through narrow spaces and uneven surfaces and so can be used in natural disaster management and other areas. The technology used in designing this robot is 3d printing. The prototype of the project is built using any light weight and strong material like sun-board to observe the nature of it's working. Once successfully established, the outer structure can be built using 3d print to establish supremacy of the robot. Serpenobot is an innovation that has a great scope in developing countries like India which has wide range of applications and used in various fields such as firefighting, surveillance, maintenance of complex structure such as a nuclear power plant or pipeline.

These kinds of robots when adopted at the ground level can help a country to prosper by minimizing the risk on human lives.

II. BASIC CONCEPTS AND TECHNOLOGY USED

The Serpenobot is a well-equipped robot which contains major components. The outer structure of the bot is divided as head, body, and tail. It is designed using 3d printing and the motion for the bot is given through servo motors (for 3d model) or dc motors (for 2d model). Once the motion is established, the motors are programmed using embedded C language to execute delay and thus the serpentine motion is achieved. For surveillance Foxeer razer nano camera is used on the head of the bot and preferably in the tail to obtain the video of the surrounding.

It is connected to a transmitting antenna and the signal is obtained on computer using a receiving antenna. All the other components have a specific purpose such as location tracking, temperature measurement etc. The movement of the bot is controlled wirelessly using a Bluetooth module. The range of the model can be increased by increasing the size of the antennas. The whole bot is powered by batteries in our prototype model. It can also be powered by solar energy by implementing solar cells on the body of the bot. The power consumption is less as the bot is comparatively small, which is very helpful in moving to compact and risk areas. The model is used in defense for surveillance as it is smoothly travelled in rough terrains and least likely to gather attention due to its movement. It can be implemented in disaster management like earthquakes to identify the survivors before the rescue team enters. It can also be used in mining areas where we can check the temperature of the under-ground, and likelihood of the surroundings.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED

Design and Realize a Snake-Like Robot in Complex Environment: Bingqi Liu, Mingzhe Liu, Xianghe Liu, Xianguo Tuo, Xing Wang, Shibo Zhao and Tingting Xiao (Published: 3 February 2019). This paper presents design method of a snake-robot which is a pavement to research and development of future counterparts that will be applied in seismic search and rescue, pipeline inspection, space exploration, and many other fields. It also provides reference values for other bionic robots' research.

Design of a Modular Snake Robot: Cornell Wright, Aaron Johnson, Aaron Peck, Zachary McCord, Allison Naaktgeboren, Philip Gianfortoni, Manuel Gonzalez-Rivero, Ross Hatton, and Howie Choset. Proceedings of the 2007 IEEE/RSJ International Conference on Intelligent Robots and Systems San Diego, CA, USA, Oct 29 - Nov 2, 2007. The robot must satisfy various constraints when confronted with the challenges of high-level gaits. The architecture design must consider size, weight and power while producing the

necessary torque in every joint. Even while juggling these constraints, the design maintains a very high level of reliability. This has resulted in a very versatile robot that can function in a wide variety of environments. The development of the Super Servo has been an integral part of the achievements of our robot.

Snake Robot with Driving Assistant Mechanism: Junseong Bae 1, Myeongjin Kim 1, Bongsub Song 1, Maolin Jin 2 and Dongwon Yun. (Accepted: 22 October 2020; Published 24 October 2015). In this paper, the driving assistant mechanism (DAM) is attached to a snake robot, it can perform locomotion on rough terrain such as a slope or grasslands without additional driving algorithms and sensors. In the slope environment, vertical motion and side winding motion can be used in descending the slope and vertical motion can be used in ascending the slope.

Mamba - A Waterproof Snake Robot with Tactile Sensing: Pal Lilje, Oyvind Stavdahl, Kristin Y. Pettersen, and Jan Tommy Gravdahl. The Mamba, which is a modular and reconfigurable experimental platform developed to support the ongoing research on snake robot locomotion. The robot is waterproof and consists of different types of modules that can be interconnected in many different configurations. To measure environment, contact forces acting along its body, each joint module of the robot contains a custom designed sensor (based on strain gauges) that measures the interaction forces and torques between the links. The paper has described the design of the sensor and presented experimental results that illustrate its performance.

These are some of the major papers studied and we identified that the major work has to be done in creating the structural movement. Once the structural movement of the bot is established, it can be further developed in all the remaining major areas. This snake-robot research is still ongoing in a deeper manner to establish the serpentine motion and its implementation is yet to be completed in any part of the world.

IV. PROPOSED MODEL

The proposed model to overcome the challenges is the Serpenobot. The core of the project is the Arduino Uno. Arduino Uno which is based on ATMEGA328P. The ports of the Arduino uno i.e., the RX and the TX ports have been connected to the respective ports of the Bluetooth module HC05 (not shown in block diagram). The ports of the motor driver 9,10,11 and 12 have been connected to the respective ports of the Arduino Uno for the control of the DC motors. The ports of the motor driver have been connected to the motors ports which ensures the proper running of the DC motors.

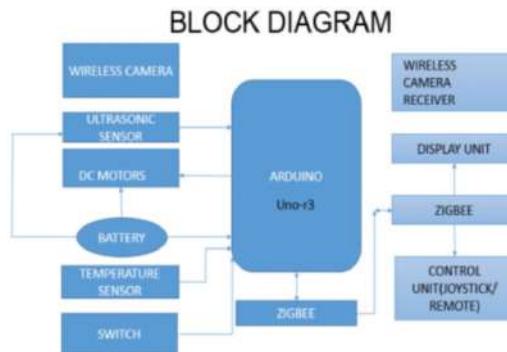


Figure1. Block diagram of Serprnobot

The Arduino has been programmed using the Arduino IDE software after its successful testing. The source code mainly contains the information to control the direction of the motors with the help of motor driver. After successfully connecting the Bluetooth module HC05 to the user's mobile, the direction and the movement of the bot can be controlled as per the user requirement. All the modules we're using have been connected and given power supply via breadboard connection with the help of Step-down buck converter. The motor driver has been given 12V and 5V supply. The Arduino Uno has been given a 5V supply and the Bluetooth has been given a 5V supply. The power is supplied here with the help of the Batteries or solar cells. The block diagram, as depicted in Figure 1, shows the bot is controlled by Joystick/Remote and we've tried working on it. The result was better when controlled using a smartphone. The smartphone can be used to control the direction of the bot as required by the user. By considering these changes, the flow chart, as shown in Figure 2, of the bot can be deduced as follows.

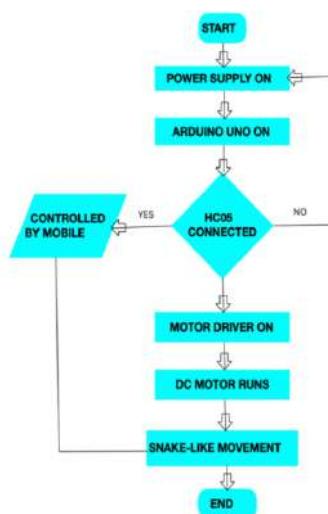


Figure 2. Flow chart of Serpenobot

The steps as to be given for flow chart of “SERPENOBOT”, it shows operating procedure and how to use the proposed module. The module can be used for many purposes such as surveillance, rescue operation, disaster management etc. The proposed module is most useful than the already existing module because of its shape and the serpentine motion which can be useful while operating under unsafe and unstable environmental conditions.

V. IMPLEMENTATION AND RESULTS

1. Give the power supply to the bot by pressing the switch to the ON condition. Ensure that the power supply reaches the Bluetooth module.
2. Select the HC-05 Bluetooth module and the device gets paired with the Bluetooth module.
3. To check for the successful connection, see the blinking light on your application. If it is Green, then the pairing has been done successfully.
4. After successfully connecting the Bluetooth module, check for the working of DC motors which ensures the proper working of the code uploaded.
5. The four control arrows are: Forward, Backward, Right direction and Left direction. Please click the arrows and check for DC motors working.
6. Both the DC motors are coded using embedded C and has been connected to the head of the bot. So when the head of the body moves in any direction, the rest of the body and the tail follows, moving in a serpentine motion.
7. After successfully completing the above process, the bot is now ready for the movement, and it can be used for various purposes like defense, surveillance, disaster management etc.

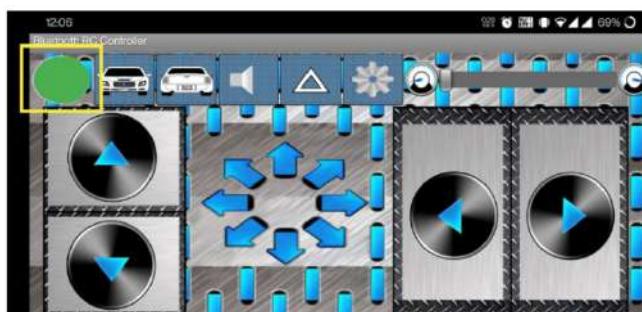


Figure 3. Bluetooth RC Controller

RESULT

The model has been successfully implemented and the serpentine motion has been obtained. The bot movement is successfully controlled via mobile with

the help of a Bluetooth module and the video of surveillance is successfully observed on the computer.

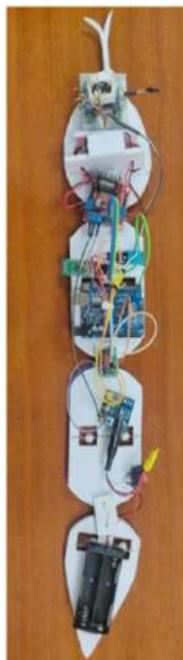


Figure 4. Serpenobot

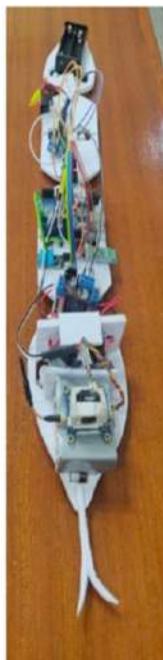


Figure 5. Serponobot successful implementation

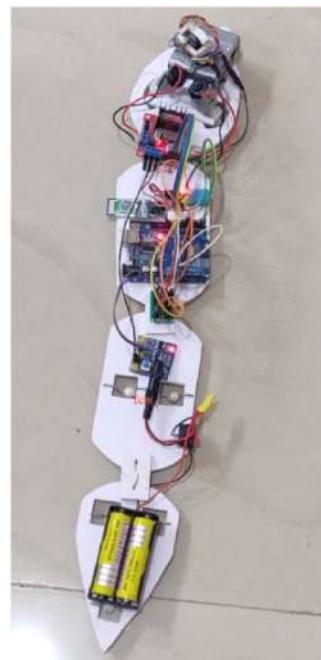


Figure 6. Video output

The “SERPENOBOT” is not an input-output type of machine but an action kind which shows movement and the controlling method. So, a drive link has been included has been included below to get a better idea of what is a “SERPENOBOT” and how exactly it works and how it is controlled by the user.

VI. CONCLUSION:

Snake robot is an innovation that has a great scope in India and we should look forward to use snake robots in a wide range of applications in various fields

like Firefighting, Surveillance and Maintenance of complex and possibly dangerous structures or systems such as nuclear plants or pipelines, Intelligent services, Media, Exploration, Research, Education, Military, Disaster management and Rescue & Search operations. These unique features and degrees of freedom of snake robots make them fascinating topic for research and is worth investment & applicability.

FUTURE SCOPE

- Hyper redundant robot-This gives them superior ability to flex, reach, and approach a huge volume in its workspace with infinite number of configurations.
- The future snake design will consist of three degree-of-freedom stages - roll, pitch, and extension.
- Outer structure to be made of fire-proof ABS plastic to withstand extensive climate, temperature and surrounding.
- Haptics to be added in the robot for sensation and control to interaction with computer applications and the robot would be able to touch and identify survivors.

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Crack Detection for Canal Inspection by using Autonomous Underwater Vehicle (AUV)

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Abstract- The cracks in the canals or dams which are caused by waterborne particles or some external disturbances is one of the major surface damages leading to canal deterioration. For determining the repair of such cracks, periodic inspections of the erosion conditions of canals are required. The practical problem is how to get the underwater image without unwatering and how to analyse the cracks through the images. This paper aims at developing a novel and cost-effective technology for reliable crack detection consisting of an underwater robot and a quantitative analysis method. The system would detect cracks in the canal up to a depth of 3-5 meters. Firstly, the integrated system will obtain the image of the concrete surface of canals in the desired position from the camera mounted on the vehicle. Secondly, through image processing technology an image algorithm will be used for quantitative crack analysis. The proposed AUV is equipped with 2 thrusters in order to achieve easy manoeuvrability.

Index Terms- AUV, Cracks, Dams, Inspection, Image capturing, Underwater Image

I. INTRODUCTION

An Autonomous Underwater Vehicle (AUV) is a robot that travels underwater without requiring input from an operator. They are considered autonomous because they have no physical connection to their operator, who may be onshore or aboard a ship. They are self-guiding and self-powered vehicles.

The oil and gas industry uses AUVs to make detailed maps of the seafloor before they start building subsea infrastructure; pipelines and subsea completions can be installed cost-effectively with minimum environmental disruption. The AUV allows survey companies to conduct precise surveys of areas where traditional bathymetric surveys would be less effective or too costly. Also, post-lay pipe surveys are now possible, which include pipeline inspection. The use of AUVs for pipeline inspection and inspection of underwater man-made structures is becoming more common. Civil infrastructure systems represent a significant fraction of global assets, and due

to many factors, cracks will appear on the surface of these structures. These cracks not only affect the visual appearance of the structures but also lead to steel corrosion, which accelerates concrete aging affecting the normal use of these structures and leading to underuse of the infrastructure and a shorter life span.

Canals are an integral part of the dam water distribution system. Canals are built for a variety of uses including irrigation, urban water supply, hydroelectric power generation, etc. Waterproof linings keep a canal's water from seeping into the ground. The Canals are built using a mixture of sand, clay, and water that dried to a waterproof state and Modern materials and additives that are more durable include concrete, fly ash. Since the flow of water through this open channel is huge, the pressure of water on the walls is high. Also, the canal walls are subjected to erosion. Due to these cracks, there is water seepage, and thus the canal walls get deteriorated. Underwater environments are complex, cracks are quite random and diverse in nature. Marine life in the water bodies, atmospheric temperature, heavy rainfall, and local bodies can contribute to canal strength deterioration. Over the period, the developed crack widens.

Cracks are always used to indicate the degree of risk in the field of canal damage. These cracks if not monitored regularly can cause accidents. In the year 2018, Pune witnessed unexpected flooding when a wall of the Mula-Mutha canal saw a breach. Several vehicles were damaged in the sudden floods, causing panic in several areas.

The proposed system aims at early detection of such cracks in the canal walls to avoid such instances in the future. The system aims at developing a crack detection system that is cost-effective using the latest technology for reliable crack detection.

II. STATEMENT OF THE PROBLEM AND OBJECTIVES

Problem Statement:

Crack detection for Canal Inspection by using Autonomous Underwater Vehicle (AUV).

Objectives:

- A. To propose an AUV to detect the cracks in canals up to a depth of 3-5 meters.
- B. To develop a system which is a cost effective using the latest technology for reliable crack detection.

By keeping the objectives in mind, an Autonomous Underwater Vehicle was developed. This AUV of ours was fabricated by using lightweight PVC pipes. The electronics is considered as the heart of our AUV as it powers up the system and forms the communication with the offboard controller. Electronics

was placed at the central part of the AUV by keeping Neutral Stability in the mind.

An underwater camera was installed at the front position of the AUV with a flashlight. This camera mainly focuses on the canal cracks and either captures the images or videos. Real time images were used for the further Digital Image Processing. The code was written in such a way that result shows whether the crack is harmful enough or not.

AUV was radio controlled and receiver was installed in the electronics module. Two thrusters were used which could perform forward and backward motion of the AUV along with the left and right turns. Collectively, crack detection was achieved.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED

This paper [1] discusses the operating scope for the Autonomous Vehicle Research Platform (AVRP). It mainly focuses on types of sensors for understanding the surrounding environment, and their optimal mounting locations, and hardware for positioning and navigating within that environment. It also covers the power estimation for the hardware and systems, computing benchmarks from other autonomous research platforms, and a communication structure for the AVRP. The author of the [2] has employed a prototype of the Autonomous vehicle system (car) using the Internet of Things. They have used a Raspberry Pi, a Picamera, a Web interface and Internet modem. It is based on Computer vision algorithm. Using this module we can transfer the digital parameters to cloud storage through the internet. The saved data so obtain find a use for monitoring purpose and analysing the information. This paper [3] aims to design and develop an AUV as a test bed platform for a variety of research in underwater technologies especially involving small-scale and low-cost underwater robots. It also can be used for testing and learning conventional and advanced control algorithms and techniques to other underwater systems. With a limited budget a small autonomous underwater vehicle has been developed.

The stated paper [4] introduces Maribot LoLo and presents the underlying design philosophy which focuses on versatility and endurance. The vehicle is designed to be operated at moderate water depths and on long-range missions. This leads to challenges in the design of the variable buoyancy system (VBS) which also is presented. The achievable range of the AUV is evaluated with a simple hydrodynamics model based on frictional drag. The concerned research [5] describes the electromechanical design of a compact, light-weight Autonomous Underwater Vehicle (AUV) for archaeological applications; the vehicle is named Zeno (Zeno Environment Nautical Operator), protector of freshwater and flood victims, and was developed in the framework of the European project ARCHEOSUB; the AUV specifications, its navigation devices and payload are given. The main characteristics of the vehicle are described

with particular attention to its system architecture, propulsion system and structural design.

Author of [6] had introduced a model-driven control realization, which was based on the systems engineering concepts of the model-driven architecture (MDA) or model-based systems engineering (MBSE) approach combined with the real-time UML or SysML, extended/ unscented Kalman filter algorithms, and hybrid automata, in order to conveniently deploy controllers of autonomous underwater vehicles. The model also created a real-time communication pattern, which could permit the designed components to be customizable and reusable in new application developments of different AUV types. It had stepwise adapted the AUV dynamics for the control that are then combined with the specialization of MDA or MBSE features. Mentioned research in [7] had a new, low cost and modular AUV design and was built to replace Odyssey IV, the primary research vehicle. The new AUV was a shallow cruising vehicle with a depth rating of 100 meters. With a weight of less than 50 kg, the AUV could easily be launched and recovered by hand from Sea Grant's 25 ft vessel. Although specifically designed to support Didemnum research, the AUV incorporated a flexible and modular design that allowed the vehicle to be reconfigured for existing Didemnum missions or upgraded with additional sensors and payload. Incorporating a separate, interchangeable Li-Polymer Battery pack allowed the vehicle to achieve both a high mission duty cycle and extended bottom time.

IV. PROPOSED MODEL/TOOL

Our AUV system is combination of the Electronics and the Mechanical assembly. Along with the vehicle architecture we have also discussed the crack detection methodology below.

A. MECHANICAL SYSTEM:

The primary goal of ours was to design our AUV in 2D model before directly hopping onto the manufacturing. We modelled it in *AutoCAD* as shown in the Figure 1.

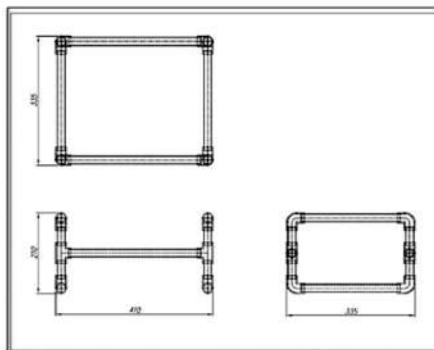


Figure 1. 2D CAD design

Later, we proceeded with the 3D model of the vehicle according to our specifications in the *TinkerCAD* as shown in the Figure 2 and 3. 3D modelling made us go with further fabrication of the vehicle.

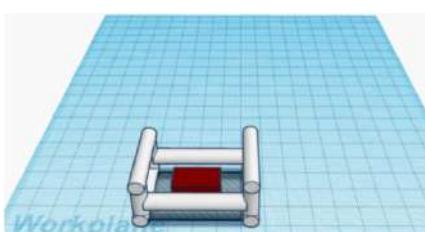


Figure 2. Front view of 3D CAD model

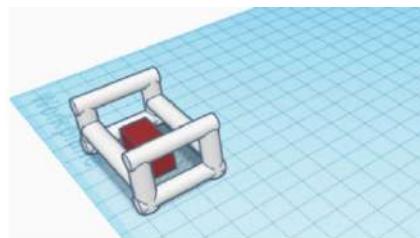


Figure 3. Side view of 3D CAD model

AUV was manufactured with the PVC pipes for cost effective solution and weight reduction. The detailed specifications are listed below:

Materials Required:

- PVC pipe
- 2 Pool Noodles
- Tie Wraps - Motor Mount
- 2 Film Canister
- 2 Propellers
- Electronics (refer to section III.A.)
- Underwater Camera
- Underwater Flashlight

PVC Pipes:

- Two Pipes - 16.5" long
- Four Pipes - 13.5" long
- Four T Connectors
- Eight Round Connectors



Figure 4. Vehicle Architecture

Before locking this configuration of vehicle structure, we had tested various PVC frames but the CG was not balancing and we were not getting desired results so we decided to go for a symmetrical structure. The results were desirable for the above vehicle frame. This Vehicle consists of PVC structure as

shown in the Figure 4. We are using pool noodles for the ease of floating. This vehicle assembly has been tested and found stable in the water. Its CG is balanced along with the BLDC motors, propellers, underwater camera, and underwater flashlights onboard.

B. ELECTRONICS SYSTEM:

For powering up the AUV, we had designed the electronics module which consists of BLDC Motors, propellers, ESC, ESC Calibration throttle hub, radio transmitter, receiver, battery, power distribution module as shown in the Figure 5 and 6.

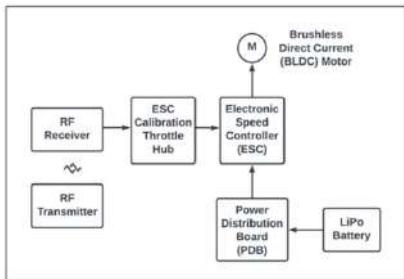


Figure 5. Block diagram of Electronics System **Figure 6.** Circuit diagram of Electronics System
The complete electronics architecture overview has described below:

BLDC Motor:

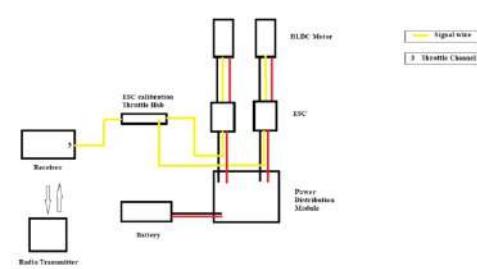
As the BLDC motor has high power density, high efficiency, and lower rotor inertia, it could give better torque characteristics than other motor types. We compared BLDC motors of different makes. Considering our thrust requirements, we decided to go with the BLDC motor of 935 kV which provides us with the required thrust and weight constraints. In our AUV design, we have used 2 BLDC motors for the forward and backward motion.

ESC:

Ampere rating of ESC should be 20-30 % more than the maximum current requirement of the motor. This will allow the motor to work at a lower temperature. The 935kV BLDC motor draws a current of 18 Amp. So, for safety purposes, we are using ESC of 40 Amp, which is also recommended by the manufacturer.

Propeller:

We had selected three bladed propellers of 6x4.2, where 6 signifies six inches of diameter and 4.2 signifies 4.2 inches. of propeller pitch. Both the propellers are of clockwise rotation.



Battery:

LiPo battery was chosen because of its convenience, reliability, affordability, and its renewability. The maximum draw from the 935kV BLDC motor is 18A. The battery should be able to deliver more current than this. We had chosen a 2200 mAh 30 C 3S LiPo battery for our mission.

The effective battery capacity = Battery Capacity x Battery Efficiency =
2.2Ah x 80% = 1.76Ah

Maximum Current delivered by battery = Effective Battery Capacity x C Rating = 1.76Ah x 30C = 52.8A

Radio:

The AUV control was done by a transmitter and receiver pair with 2.4GHz of range.

Underwater Camera:

We are using a waterproof action camera with 4k resolution for best capture of the underwater environment. It comes with Wi-Fi connectivity which is capable up to 50-60 meters range. This camera is perfect for our application.

Underwater Flashlight:

To explore the underwater scenario in the dark, underwater flashlight was chosen with the specification of 12V and 12 W power.

Power Distribution Board:

As we were using two BLDC motors with two ESCs, there was a requirement of handling two motors with the single throttle of the radio transmitter. Power distribution board of 6 ESC tabs was selected for this purpose with regulated 5V and 12V outputs.

ESC Calibration Throttle Hub:

8 in 1 throttle calibration hub distributes throttle signal up to 8 ESCs where we used only 2 hubs out of 8.

C. IMAGE PROCESSING:

Images of interest are captured at a particular distance from an underwater concrete structure as set time intervals using a webcam. This system is mounted on an Autonomous Underwater Vehicle. After capturing an image, the work station (PC) runs an image processing algorithm to detect whether the image has a crack or not. If a crack is found, the algorithm determines the dimensions of the crack (coordinates in the image) and relates it to the actual size of the crack in engineering units as explained in Figure 7.

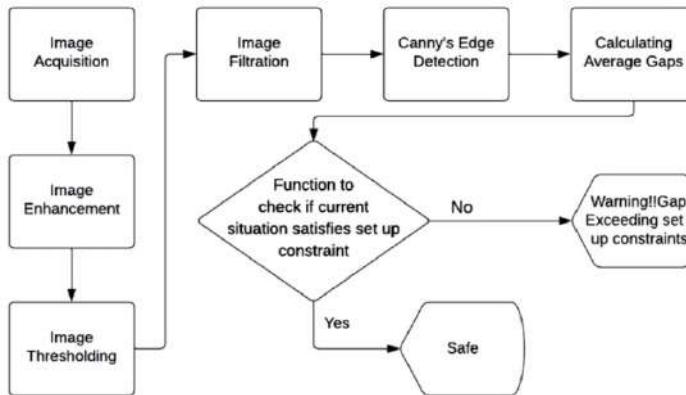


Figure 7. Image Processing Block Diagram

Step Involved in Image Processing:

Image Acquisition: Acquisition of an image can be as simple as being given an image that is already in digital form. Image is captured with the Wi-Fi module and preprocessing is done.

Image Enhancement: It is the process of manipulating an image so that the result is more suitable than the original image for the specific application. Gray Scale operation is performed to binarized the image.

$$R = G = B = (R + G + B)/3$$

Image Thresholding: It is the simplest method for segmentation of image. It is carried out to get binary image.

Image Filtration: This step is essential for greater image enhancement. Here, median filters applied to deblur image.

Canny's Edge Detection: It is technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed.

Calculating Average gaps: This involves conversion of image into an array, detection, and calculation of crack length by calculating median of pixel distances.

Condition check: Function is used to check the conditions if the current situation satisfy the given constraints. If the calculated gap of crack is within the set-up constraints, then it is a 'Safe' crack but if its not within the set-up boundaries then the 'Warning' is displayed.

D. Camera assembly:

This assembly consist of a pulley system, constructed using a DC motor and a dial cord. This system can move camera and flashlight assembly as per the required depths (up and down). DC motor is connected to the camera and

flashlight assembly by using a dial cord in the pulley formation as shown in the Figure 8.

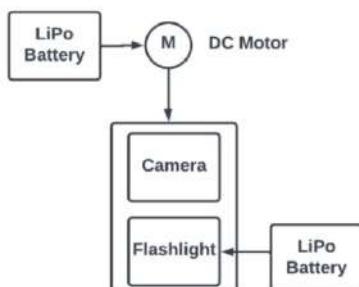


Figure 8. Pully Assembly

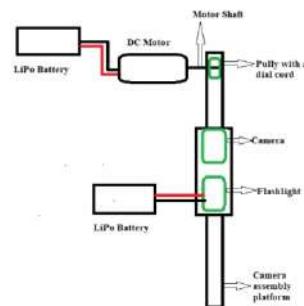


Figure 9. Circuit diagram of Camera assembly



Figure 10. Camera and Flashlight Assembly



Figure 11. Dial Cord wound on the motor



Figure 12. Testing of the Assembly

V. IMPLEMENTATION AND RESULTS

In this section, discussion is done on the various tests performed for the evaluation to meet the desired outcomes. Following tests were conducted-

- A. Mechanical Assembly Test
- B. Electronics Setup Test
- C. Complete Vehicle Test
- D. Image processing Test

A. Mechanical Assembly Test

In this test, we checked the stability of our vehicle. At first it seemed that the PVC structure was tilting a little on one side. To see what was going wrong, we removed the 16.5" PVC pipe from the structure and it was still tilting on the same side. We figured out that it was because of the uncentered heave control motor mount PVC pipe. To make the structure more stable underwater, we decided to mount more structure on the opposite side edge of the 16.5" PVC pipe. Refer to Figure 13.



Figure 13. First Iteration

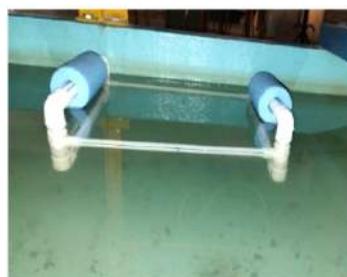


Figure 14. Second Iteration

After our third iteration we decided to go for a symmetric PVC structure for achieving the best stability. It was observed that the vehicle frame was stable. Refer to Figure 14.

B. Electronics Setup Test

We tested our sealed electronics in a bucket full of water. In this test we sealed one BLDC motor with the silicon sealant and tested it in a bucket full of water to check whether the sealing was properly made or not.

C. Complete Vehicle Test

After the conclusion of the above tests, we assembled the vehicle frame with the electronics shown in Figure 15. Then this assembled vehicle was tested in the tank with a depth of 5-6 feet.

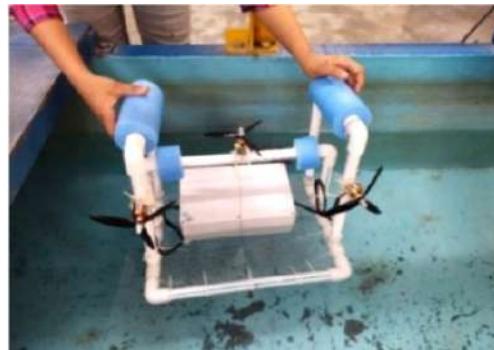


Figure 15. Vehicle Test

D. Image Processing Test

After the development of required algorithm we had tested the camera and images with the cracks present. Figure 16. shows the results for above test.

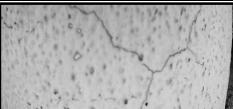
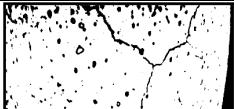
Captured Image	Thresholding	Canny Edge Detection	Result
			1.9 mm: Safe
			4.0 mm: Unsafe

Figure 16. Image Processing Results

Based on various experiments done, we have summed up the results as shown in the Table I and enhancement was carried out later.

Table 1. RESULTS OF VARIOUS TESTS CONDUCTED

	Execution	Results	Enhancement
Test 1. Stability Test	<ul style="list-style-type: none"> Vehicle Stability Check: <ol style="list-style-type: none"> First iteration included the unstable AUV structure Second iteration was concluded with the stable structure 	<ul style="list-style-type: none"> Vehicle was unstable Structure was tilting at one side due to assymetry 	<ul style="list-style-type: none"> Make the vehicle architecture more like a symmetrical to get the stable model
Test 2. Electronics Test	<ul style="list-style-type: none"> Electronics check : <ol style="list-style-type: none"> All the electronics were sealed inside the ABS container BLDC motors were sealed with the silicon Sealant 	<ul style="list-style-type: none"> ESC had lesser amperage BLDC motors stopped working after a while due to sealant blocking 	<ul style="list-style-type: none"> Increase the ESC amperage Remove the sealant in the BLDC motors and instead keep them inside the canister
Test 3. Vehicle Test	<ul style="list-style-type: none"> AUV maneuvering and communication check: <ol style="list-style-type: none"> AUV structure was asembled with the electronics It was then controlled by setting the communication by radio 	<ul style="list-style-type: none"> Vehicle structure was floating on its own In the first iteration, due to absence of power distribution board and ESC calibration hub, only single thruster could run 	<ul style="list-style-type: none"> Remove the pool noodle as we want our vehicle to partially submerge Connect 2 BLDC motors with ESCs and then futher with the power distribution board to which battery will be connected
Test 4. Image Processing Test	<ul style="list-style-type: none"> Algorithm Check: <ol style="list-style-type: none"> Image was captured underwater via camera by connecting it 	<ul style="list-style-type: none"> Underwater Cracks were detected Based on the 	<ul style="list-style-type: none"> Camera with high resolution must be used for neat image processing

	<p>with WiFi</p> <ul style="list-style-type: none"> • Further, Image processing was carried out 	analysis, severity of the cracks was found	<ul style="list-style-type: none"> • More sensors must get installed for enhanced data acquisition and image processing.
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After the proposed enhancement, amperage of ESC was increased to 40A, power distribution module was included and vehicle was further made stable.

VI. CONCLUSION

The AUV has an easy construction. The model constructed uses a transmitter - receiver pair which has reduced complexity caused due to the use of cables. It has wireless communication. In addition, it does not require a bulky and complex component for support. Using AUV to conduct Underwater Canal Inspection is far safer than using a human diver. Thus, the proposed system design will significantly contribute to efficient canal inspection and reduction in the water seepage through the crack detection analysis by using Digital Image Processing. This design is advantageous for cost effective solution and weight reduction of the vehicle. Furthermore, for future scope, we are aiming for installment of sensors for reliable and required data for data acquisition. This will enhance the crack detection system.

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Linking Low Earth Orbit Satellites and High-Altitude Platforms for more efficient usage of Direct-to-Satellite IoT

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Abstract- Space-air-ground networks play important parts in both fifth generation (5G) and sixth generation (6G) methods. Low earth orbit (LEO) satellites and high-altitude platforms (HAPs) are crucial factors in space-air-ground networks to give access services for the massive mobile and Internet of Things (IoT) end-users, especially in remote areas short of ground base station scope. LEO satellite networks give global scope, while HAPs give terrestrial end-users nearer, stable massive access service. In this project, we consider the cooperation of LEO satellites and HAPs for the massive access and data backhaul of remote area end-users.

Index Terms- Direct-to-Satellite IoT (DtS-IoT), High Altitude Platform Stations (HAPS), Low Earth Orbit Satellites (LEO), Space-air-ground networks

I. INTRODUCTION

By implanting enumerative capabilities into every- day objects, it's possible to fluently interact with the terrain and draw out complex monitoring and actuation operations in several grueling and critical operation areas, similar as disaster recovery, smart husbandry, and artificial processes, among others. The consequent tidal increase of dispatches among humans and objects has made factual the conception of pervasive computing through its natural accomplishment, the Internet of effects(IoT). touched off by such a revolutionary networking paradigm, a huge number of concurrent technological results have been proposed. Although in numerous ways it's like satellite broadband — the satellite- grounded IoT network, itself a last resort for people who have no other connectivity options — IoT networks and satellites are, in some ways, a great fit for each other. The Fraunhofer Institute for Integrated Circuits, for illustration, lately blazoned that its terrestrial IoT technology, mioty (massive IoT), could be fluently used by satellites.

Detector-acquainted technologies and protocols (e.g., ZigBee, 6TiSCH, and ZWave) have been designed to be used in small bias with low power consumption and with data rates in the order of hundreds of kbps. These protocols are only suitable for low business operations at both short range in

Wireless Personal Area Networks (WPANs), and long range in multihop WPANs (40).

In discrepancy, Cellular Networks (e.g., UMTS and LTE) offer a rich variety of long- range, high- data rate, from knockouts of kbps up to several Mbps. Indeed, though they can be used for IoT dispatches, traditional cellular networks weren't designed for the transmission of small dispatches nor for low- consumption outstations. In this environment, a new type of network is presently arising Low- Power Wide- Area (LPWA) Networks. Some representative LPWA technologies as LoRa (34) and SigFox (50) are specifically designed to partake the parcels of both WPANs and cellular networks low- power and long- range (further than 10 km).

Space- air- ground networks play important places in both fifth generation (5G) and sixth generation (6G) ways. Comparing with the traditional geostationary earth route (GEO) systems, low earth route (LEO) satellite constellation has the advantages of low propagation detention, small propagation loss and global content. likewise, modifications of being IoT protocol are necessary to enhance the comity of the LEO satellite constellation- grounded IoT with terrestrial IoT systems. Along with LEO satellite constellations, high- altitude platform station (HAPS) systems- or high- altitude pseudo-satellites operating in the stratosphere, have the eventuality to address the challenge of furnishing ubiquitous connectivity.

Although there has been great progress in rolling out high speed mobile networks to serve major centers of population, terrestrial connections will never realistically cover every part of earth's surface. To deliver the full promise of 5G and address the 'digital divide,' it is essential to provide coverage to low population areas where terrestrial mobile networks are not viable. This will be particularly important not only for improving personal communications, but also because many Internets of Things (IoT) sensors will need to be in these regions. The proposed model gives an overview of the role of HAPS and satellites in forming "networks in the sky".

Low earth orbit (LEO) satellites along with high altitude platforms (HAPs) are the vital components of space-air-ground networks to give access services for the massive mobile and Internet of Things (IoT) users, especially in remote areas short of ground base station coverage. LEO satellite networks provide global coverage, while HAPs provide terrestrial users with closer, stable massive access service. In this work, we consider the cooperation of LEO satellites and HAPs for the massive access and data backhaul of remote area users and as an alternative for wireless transmission.

II. STATEMENT OF THE PROBLEM AND OBJECTIVES

To support the emerging applications such as Internet of Things (IoT), cloud computing, and big data, new standards, and technologies for next generation mobile systems (5G), are being proposed and implemented. However, limited

by the network capacity and coverage, only depending on the ground communication systems cannot provide wireless access services with high data rate and reliability at any place on the earth, especially in the environmentally harsh areas like ocean and mountains. It is imperative to exploit new network architectures to accommodate diverse services and applications with different quality of service (QoS) requirements in various scenarios.

Utilizing modern information network technologies and interconnecting space, air, and ground network segments, the space-air-ground integrated network (SAGIN) has attracted many attentions from academia to industry. In recent years, more and more organizations have been starting their projects on SAGIN such as the Global Information Grid (GIG), OneWeb, SpaceX, etc. Thanks to the inherent advantages in terms of large coverage, high throughput, and strong resilience, SAGIN can be used in lots of practical fields, including earth observation and mapping, intelligent transportation system (ITS), military mission, disaster rescue, and so on. Satellites can provide seamless connectivity to rural, ocean and mountain areas, air segment networks can enhance the capacity for covered areas with high service demands, while densely deployed ground segment systems can support high data rate access. The integration of these network segments would bring lots of benefits for the future 5G wireless communications.

As a multidimensional network, SAGIN adopts different communication protocols in each segment or the integration of different segments to achieve high throughput and high reliability data delivery. Unlike traditional ground or satellite networks, SAGIN is affected by limitation simultaneously from all three segments, from the aspects of traffic distribution, spectrum allocation, load balancing, mobility management, power control, route scheduling, end-to-end (E2E) QoS requirement, etc. Thus, it is critically necessary for network designers to achieve optimal performances in E2E data transmission, given various practical network resource constraints from each segment. However, in SAGIN, a specific heterogeneous network (HetNet) consisting various kinds of communication systems, it is difficult to use the limited network resources to obtain the best performances for information exchanging, especially for the inter-operating among different network segments. Therefore, the network design and system integration in SAGIN are of great significance. Toward this end, we provide in this paper a detailed survey for the latest research progress in SAGIN, with the emphasis on protocol optimization, resource allocation, performance analysis, mobility management, and inter-segment operation.

In the future, advances in personal communications will promote the evolution of smart verticals in the fifth-generation networks (5g) to a higher level, including health care, remote education/training, industry internet, fully autonomous driving, and super smart homes/cities. During this paradigm shift, the internet of things (IoT) plays a vital role in enabling these emerging applications by connecting the physical environment to the cyberspace of

communication systems. Although these IoT-enabled applications will bring convenience to human life, it is an extremely daunting task for 5g to support these applications. First, these IoT-enabled applications require superior performances in terms of data rate, latency, coverage, localization, and so on. Second, they are more data-intensive and computation-intensive, which far exceeds the range of ultra-reliable low latency communications and massive machine-type communication of 5g. Third, it is hard to efficiently manage massive IoT devices in this case. Fourth, with massive data generated, serious security issues are accompanying. With IoT evolving, 5g will gradually reach its limitations and be unable to provide support to most of these advanced applications, which can be predicted from the history of previous generations. So there is a strong motivation for the sixth generation networks (6g), to extend 5g capabilities to a higher level to enable massive IoT.

III. BACKGROUND STUDY

We first note that, depending on the network configuration, data can be directly transmitted from LEO satellites to internet via ground stations in range, or go to another satellite via inter-satellite links, or stored and carried until a suitable ground station is in sight.

Indeed, end-users from the ground see a LEO satellite crossing the sky with a veritably high speed (several km/s), and within a time interval of no further than around 10 minutes on average. Further than the inferred Doppler goods on dispatches, such a particular configuration impacts the overall network topology dynamics, that must seamlessly permit handover from one satellite to another. Nonetheless, satellite dispatches give a further cost effective result with respect to other terrestrial technologies and have the eventuality to play an important part for different reasons as listed in (i) smart objects are frequently remote or they're dispersed over a wide geographical area or they're inapproachable; (ii) satellites can naturally support broadcast transmissions (i.e., towards all bumps of the whole network), multicast transmissions (i.e., towards a portion of bumps of the whole network) or Geocast transmissions (i.e., towards a portion of bumps placed in a given area of the network); (iii) satellites can give an indispensable spare path for critical operations taking high vacuity at reasonable cost; and (iv) being LPWA operations generally target low data rate transmission indicating that current low bandwidth satellite architectures can be effectively reused. That being said, the most applicable scientific interest is concentrated on the network link between satellites and IoT bias on ground. There are two modes of inter operability envisaged, a link Direct access and circular access. The direct access mode allows bias to directly communicate with the satellite, while in the circular access mode, each detector and selector in a network may communicate with the satellite through an intermediate Gomorrah knot i.e., the LPWA gateway in our script of study. Such a gateway is equipped with a traditional satellite terminal and a traditional LPWA radio interface to communicate with the detector or selector

bumps in the area. On the one hand, the being protocols can be abused in circular mode, with the limitation that the area of a deployment is confined to the content of the gateway knot on ground. On the other hand, a direct access from the detector and selector outstations to the satellite is a more charming result in grueling scripts, for illustration (i) in disaster areas where rapid-fire and infrastructure-less deployments are needed, (ii) in areas with veritably low device viscosity where a gateway result isn't profitable, and (iii) in areas where bias will be present for a limited period of time and therefore a gateway placement is discouraged.

Existing Systems:

In the past decades, several space-air-ground, especially space-ground integrated systems were proposed and applied into wireless communications. A well-known space-air-ground integrated network is the GIG. Among the space-ground integrated systems, there are mainly two kinds of network architectures, one is geostationary orbit (GEO) satellite system such as the transformational satellite (TSAT) system, and the other is non-GEO (NGEO) system such as O3b, Iridium, Globalstar, etc.

1) GIG:

GIG mainly consists of four layers containing the communication devices and nodes required to support seamless global communications: ground layer, aerospace layer, near-space layer and satellite layer.

2) TSAT:

The TSAT system is a future generation GEO satellite system which is designed for military applications by National Aeronautics and Space Administration (NASA), the U.S. DoD, and the Intelligence Community. The TSAT system is made up of 5 GEO satellites, and these satellites communicate with one another using laser links, forming a 10 Gbps backbone network, which allows ground terminals to access optical and radar imagery from UAVs and satellites in real-time.

3) O3b:

O3b satellite system is a medium earth orbit (MEO) constellation which has been developed by O3b Networks and is current being deployed. O3b means “the other 3 billion”, that is, the main objective of O3b is to help 3 billion people in Africa, Asia and South America access the Internet through satellite network. The O3b network has proposed the O3b constellation of 12 to 20 MEO satellites at an altitude of about 8000 km and four satellites have been already launched in the operational orbits.

4) Iridium:

The Iridium system is a satellite-based, wireless personal communications network which is designed to provide full earth coverage for date and voice

services. The constellation consists of 66 LEO satellites at a height of approximately 780 km. Every satellite of the Iridium system has the same capacities of on-board processing, routing, and delivering. Each satellite has four inter-satellite links (ISLs) through which the satellites can connect to their neighbouring satellites.

5) Globalstar:

Globalstar cellular telephone system uses 48 LEO satellites to provide users with seamless connectivity, low cost, and full coverage satellite mobile communication services. These 48 satellites are distributed in 8 circular orbital planes (1400 km altitude), inclined 52 degrees with respect to the equator with six satellites in each orbital plane.

IV. TECHNOLOGICAL GAPS IDENTIFIED

In this section, from aspects of network design, protocol optimization, and performance enhancement, we identify several technical challenges and future directions in SAGIN.

A. High latency in satellite network

In general, latency, which can be defined as the time it takes data packet to be transferred from source to destination, mainly consists of four parts: Transmission delay, propagation delay, processing delay and queuing delay. Different from terrestrial systems, the high latency plays a key role in satellite networks for QOS purposes, especially when considering the usage of satellites as back hauling network. According to, the latency in satellite systems can be divided into two parts: Fixed one and dynamic one. The former refers to propagation delay and the latter includes transmission delay, processing delay and queuing delay.

In satellite systems, it is expected that the fixed propagation delay is dominated. Geo satellites are at fixed positions of 35,786km altitude in the sky, even if all other signaling delays could be eliminated, it still takes radio signals about 125ms to travel from the satellite to the earth's surface. In the case of MEO/LEO satellites, the propagation delay is determined by the satellite altitude above the earth, for example, increasing the satellite height of 1000 km will add roughly 20 ms to the one-way delay for a single hop, and additional satellite hops will add to the latency. Due to the high mobility, the propagation delay in an LEO satellite system varies with the changing of satellite's positions.

Every network device on the E2E communication path may process information and slow the transmission, thus contributing some visible amount to the overall processing delay. To reduce the processing delay, a direct solution is to improve the computing and storage capacities of devices, which results in the cost increasing as well. It is also noted that many devices can be highly

configured to serve a wide range of applications, and different configuration may lead to lower latency.

B. Traffic offloading in integrated network

There have been many studies works focusing on traffic offloading in terrestrial, satellite, space-ground, and air-ground networks, and several efficient architectures and approaches have been already proposed to address such an issue. Besides, a proof-of-concept prototype has been introduced in to show how data offloading can be carried out in satellite-terrestrial integrated networks. However, unlike terrestrial network, in which the traffic offloading methods are significantly mature, moving traffic from terrestrial cellular system to satellite and/or air-based networks still faces following changes.

Long propagation latency: When satellite links are used to offload traffic from terrestrial networks, the long latency introduced by the long propagation distance from the earth surface to satellite should not be neglected. Therefore, deciding which kind of traffic may be offloaded via satellite links is necessary. For instance, it is not suitable for traffic flow of delay-sensitive services to be transmitted through satellite networks. Fortunately, as described in section vii-a, the long latency can be reduced with the aid of intelligent caching.

Link selection: In SAGIN, there usually exist multiple links including terrestrial links, satellite links, and air-ground links, which have different link cost. Thus, selecting different kind of links will lead to different usage cost. When the traffic offloading decision is made, it should consider the comprehensive factors such as network capacity, performance degradation caused by congestion, queuing delay, and link cost. To address such a problem, competition and cooperation mechanisms between resource providing and utilizing are required, and game theory [186] and auction theory [187] should be introduced.

Channel allocation: When using UAV to offload traffic from terrestrial network, due to the limited number of channels, one UAV cannot provide wireless access services for all users in its covered area simultaneously, especially when there are many users. Thus, an efficient channel allocation scheme is necessary.

C. Multi-Layered Networks

Consisting of multiple satellites constellations moving different orbitals, MLNs have many special merits compared to single-layered satellite networks, such as high space spectrum utilization, low link congestion and high robustness. However, due to the rapidly changed topology and complex structure in MLNs, there are also some challenging issues to be addressed, including Quality of Service guaranteeing, handover management, and load balancing among the different satellite layers.

D. Disadvantages of using HAPS

Stratospheric winds pose a critical challenge to this model. In between 65000 and 75000 ft based on latitude, the average minimum wind velocity is 30 to 40 m/s at this layer. HAPS are designed to resist such winds, but it is difficult to resist sudden wind gusts which results into temporary or total loss of communication.

V. PROPOSED MODEL

The combined model of LEO and HAPS have the potential to be the future of universal connectivity. Covering every part of the earth with terrestrial connections is impossible even though a great effort has been made in providing high speed mobile networks. To deliver the full promise of 5G and address the ‘digital divide,’ it is essential to provide coverage to low population areas where terrestrial mobile networks are not viable. Being a terrestrially challenging area, it will need a lot of IoT sensors and thus this model will play a vital role for the same. This article gives an overview of the role of HAPS and LEOs in forming “networks in the sky” and describes some of the RF challenges in designing the high data rate (10 Gbps-plus) communication links needed to back haul data between the satellite or HAPS and earth as well as between the platforms themselves. Modern life has come to depend on this ubiquitous connectivity as successive generations of mobile communications technologies have been effective in covering the most highly populated areas of the world. Mobile network operators in most developed countries have worked hard to meet their targets of connecting typically around 98 percent of the population in terms of where they live. Terrestrial mobile networks solely can’t fulfil the modern dream of total global connectivity in the 5G era. A ‘digital divide’ has been created between populations who do have a broadband connection (whether fixed or mobile) at an acceptable speed and those who do not. The FCC currently defines this benchmark as 25 Mbps, which indicates that some rural parts of the U.S. are on the wrong side of the divide. Another drawback of terrestrial 5G telecommunication network is that mobile platforms like aircraft and ships along with other IoT sensitive devices located in remote locations will fall out of the range of these networks. This ambition to connect everyone and everything, wherever they are located, therefore cannot be fulfilled by ground-based communication networks alone. Therefore HAPS, operating in the stratosphere at an altitude of around 20 km, along with constellations of LEO satellites at an altitude of between 350 and 1,100 km, are beginning to be deployed to help address the challenge of providing universal connectivity. A HAPS (high altitude platform station) station comprises an unmanned aerial vehicle - which may be either a gas-filled balloon, an airship structure, or a fixed wing aircraft—and a payload that is essentially a moving 5G base station with onboard solar panels or fuel cells to provide power. As the technology evolves, we can expect to see terrestrial networks being converged

with non-terrestrial infrastructure. The proposed link has been shown in Figure 1.

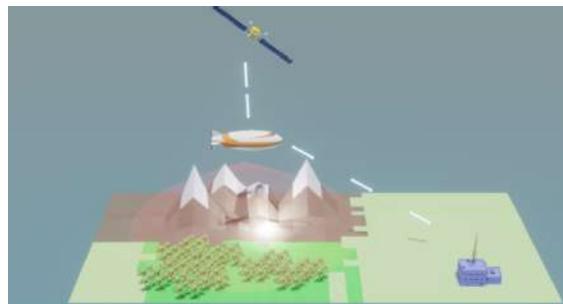


Figure 1. Proposed linkage of HAPs to LEO satellites
(Credits: Saurav Kumar)

VI. IMPLEMENTATION AND RESULTS

The critical range, bandwidth, and quality of service requirements for environmental monitoring applications are met accordingly by satellite communication platforms. However, the presence of satellites demands a relatively high-cost and high-power solution for this area. Even so, the energy self-sufficiency of many environmental monitoring applications (e.g., those utilizing solar panels), and the absence of competitor networks operating in remote locations means that satellite communications remain the most viable solution for environmental monitoring in a short and medium run. In contrast, a lower-cost, lower power satellite solution would offer significant value for users in this area.

Overview of a System Design:

1. This research aims to design and to implement a working tested model of a temperature forest monitoring system based on IOT using narrow-band low earth orbit satellite. These are steps to do:
2. Gather all relevant data and information regarding the Forest Fire Map, and pair them with the GPS location.
3. Prepare and set up the IoT Box equipment. This shall include the sensor, modem, battery, solar panel, and antenna. Make sure the monitoring device can work properly.
4. Pre-install the installers at locations where forest fires occurred previously
5. Install the sensor and the IoT box at the location correctly. Make sure the position is locked, the solar panel heads towards the sun directly, cover it with box, so it will not move if an animal hits it. Make sure everything runs properly before leaving out the sensor.
6. Perform connection testing. Make sure the sensor can receive data to the station without any packet loss.
7. Data receiving testing. Make sure the data received as it is sent.

8. To make the implementation handy, the computer that receives the data from the sensor can use the Global Downlink from the satellite operator. It means, the satellite operator already has a downlink, and pass through the data to the Cloud that is connected to the internet. The receiving side needs only a computer that has an internet connection to receive it. The downside of this option is that only the internet from the receiving side will go off, then the data will not be received until the internet gets recovered.
9. Creating a downlink at the receiving facility is a better option because it does not depend on the internet connection, but it has a significant impact on the pricing part. Since the local government and the palm Oil Operator are the main participants of this project, this type of infrastructure must be the option to implement.
10. Data and Information monitoring server must store all data packet downlink from the satellite
11. Data connection to all related stakeholders is to be distributed. Stored data will be published to the Government, people in the area, Media (Radio, Television, and Newspaper), and to the city hall. The data usage needs to be streamlined since steady internet connection will be a challenge in that area (Slow internet connection)

Preliminary Project Requirements

1. The operator that runs the IoT narrowband using a low earth orbit satellite needs to be trained both in theory and practice. Therefore, the following requirements shall be met:
2. Maps Mapping Division: personnel who will be tagging the location and decide where to put the sensor across the forest by comparing across all data when the forest fire happened, this also includes the location accessibility to install the sensor.
3. Installer: the personnel who installs the sensor equipment in the forest.
4. Transportation: this person will be responsible to bring the Sensor Installer to the marked location in the forest. This includes transporters on land, sea, and air. Besides, we also need a person who will handle all-terrain, whether they need vehicles such as helicopter, car, boat, motorcycle, or even horse ride and sprinter. They must be familiar with the forest, they need to be able to predict the time, when to go to the forest and how to handle the safety of the Installer's sensor from the wild or poisonous animal.
5. IT and Network: This personnel is responsible for the connection, and the connectivity between the sensor to the head Office. This includes all the software required for the operation.
6. Equipment: this person is responsible for the sensor and the IoT box. All equipment must be checked and tested correctly before the Installer takes it and install it in the forest.

7. Quality Control: this person is responsible to check the whole system now and then, from the sensor, IOT Box, transmission, satellite transmission, downlink, and data received at the client-side.

VII. CONCLUSION

As we move towards an all-connected era, IoT networking technologies will need to embrace satellite to connect remote devices over long-range, low-power, and low data-rate. While indirect approaches can leverage existing satellite and LPWA protocols, a direct connection to devices on ground offers a real remote IoT experience. We have presented a comprehensive survey of recent studies related to SAGIN, which has attracted intensive attentions from both academia and industry. We first provided an extensive overview of the available research works on the three segments of the integrated network according to the major research topics, ranging from cross-layer design, resource management and allocation to system integration, network performance analysis and optimization. We have dealt with the cooperation of HAP-based massive access and satellite-based back haul in the space-air-ground networks since compared with LEO satellites, HAPs are more realistic for the massive terrestrial users in remote areas to access with stability and lower transmitting energy cost, since the direct connections between terrestrial users and satellites are intermittent and not stable due to the high-speed movement of satellites, and it also require the terrestrial users equipped with strong transmission power due to the long distance to satellites.

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Computation of surface area of a symmetric/ ax symmetric objects using OpenCV

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Abstract- The objective of current work is to bring about accurate measurement of surface area of axi-symmetric and asymmetric shapes from images of those objects. Surface area calculation is done in a quadrilateral manner because surface area calculation of irregular objects is more difficult as compared to symmetrical shapes. The quadrilateral method helps in achieving consistency over various shapes. To find a solution for such situations in today's automated environment, the proposed work describes a method that uses simple camera configuring model estimating intrinsic parameters (optical/image centre, focal length) and extrinsic parameter (orientation and location) of camera. The focal length and optical center are primarily measured in pixels and scale with image resolution. The pixels can be converted into mm using conversion ratio to find the dimension of different objects in the image.

Key Terms - Surface area, Computation, Axi-symmetric, OpenCV

I. INTRODUCTION

The surface area of various items/jobs has long been manually calculated in the metal coating industry in order to metal coat them with different metals like nickel, aluminum, and so forth. Therefore, putting in place a system that automates the computation of surface area would not only assist save manpower but also save the time needed for the completion of the process.

Knowledge of surface area of the object is important for billing process of chemical to be plated on it. Also, the wastage of chemical can be prevented that may occur due to fault in manual calculations of surface area. The manual calculation of surface area of asymmetric objects becomes laborious. To simplify this work, a system computing the dimensions and surface area of 3d objects using image processing on 2d images would be useful.

II. BASIC CONCEPTS / TECHNOLOGY USED

Grayscale: The process of grayscaling involves transforming an image from other color spaces, such as RGB, CMYK, HSV, etc., to various shades of gray.

Complete black and white are both possible.

Importance of grayscaling

Dimension reduction: For instance, while grayscale images are one-dimensional, RGB images have three color channels and three dimensions.

Reduces model complexity: Think about developing neural networks with RGB pictures 10x10x3 pixels in size. 300 input nodes will be present in the input layer. The same neural network, however, will only require 100 input nodes for grayscale photos.

For other algorithms to work: Many algorithms are modified to only operate on grayscale images, such as the Canny edge detection function built into the OpenCV library, which only operates on grayscale images.

Thresholding: The assignment of pixel values in relation to the specified threshold value is known as the Thresholding technique in OpenCV. Each pixel value in the thresholding process is contrasted with the threshold value. It is set to 0 if the pixel value is less than the threshold; otherwise, it is set to the maximum value (generally 255). A common segmentation method for differentiating an object that is deemed to be in the front from its background is thresholding. A threshold is a value that can be divided into two regions: below the threshold and above the threshold. This thresholding method is used for grayscale images in computer vision. Therefore, the image must first be transformed to a grayscale color space.

Image Blurring: Blurring an image means reducing its clarity or clarity of detail. Different low pass filter kernels are used to accomplish this.

Advantages of blurring:

- It aids in reducing noise. Since noise is regarded as a high pass signal, we limit noise by using a low pass filter kernel.
- It aids in image smoothing.
- edges of low intensity are eliminated.
- When necessary, it aids in concealing the specifics. For instance, it is often necessary to blur images where the police have chosen to purposefully conceal the victim's face.

The outcome of applying a Gaussian function to blur an image is known as gaussian blur. It is a common effect in graphics software that is often used to shave off some of the detail and noise in images. Additionally, it serves as a preprocessing step before applying our deep learning or machine learning models.

III. STUDY OF SIMILAR PROJECTS OR TECHNOLOGY / LITERATURE SURVEY

1. Real-time Measurement Method for Fish Surface Area and Volume Based on Stereo Vision. Jotje Rantung, Frans Palobo Sappu, Yan Tondok.
2. Application of machine vision technology in geometric dimension measurement of small parts. Bin li.
3. Digital Image Processing based Surface Area Calculation. R. A. Joshi, S. N. Helambe, R.R. Deshmukh

Paper 1 and 2: taught us that a real time image segmentation technique can be implemented using Open-source computer vision libraries to simplify the representation of image and make it easier to analyze. Along with this the use of contour detection is helpful in finding the objects boundaries for further analysis of the image. Different mathematical and morphological transformations can be employed for thresholding purposes

In paper 3 the use of a reference object was done to estimate the dimensions of the object and calculate the surface area corresponding to the type of object. Operations such as gray-thresholding was done to separate foreground and background followed by border clearing, filtering was performed for image enhancement.

IV. PROPOSED MODEL/TOOL

- For calculating surface area of 3d objects we setup the camera at a fixed position so as to maintain measurement accuracy.
- Along with the position the lighting is also to be taken care of as it can cause image flickering that can introduce some measurement errors.[3]
- Calculation of the surface area with a distorted image will affect our results directly. To eliminate this, we can use 4-point OpenCV get Perspective transform.
- After capturing image, the next steps are:
 - Bring up the image, make it grayscale, and then use a Gaussian filter to smooth it out.
 - Use edge detection and contour extraction to identify the object's borders.
 - Object gets enclosed in a quadrilateral frame (this will give us the parameter).
- The following steps are done for 2-dimensional image in one plane (e.g.: XY-axis).
- The same steps can be repeated for obtaining other parameters of object's

surface from multiple angles and estimate the area using appropriate formulae depending on the type of object.

V. IMPLEMENTATION AND RESULTS

Many studies from the past have focused on the concept of object detection and size estimation/ computation. A real time hardware along with software-based solution can be suggested for implementation of detection of objects and estimation of object parameters. For real time surface area calculation of objects, a webcam is mounted on a stand erected on a table. Lights are setup to eliminate the shadow of objects on white paper. The model provides both manual as well as automatic boundary creation so as to fix the object inside a quadrilateral. For manual method, configuration of the camera is done using a measuring scale. By this, the optical i.e., image center is obtained.

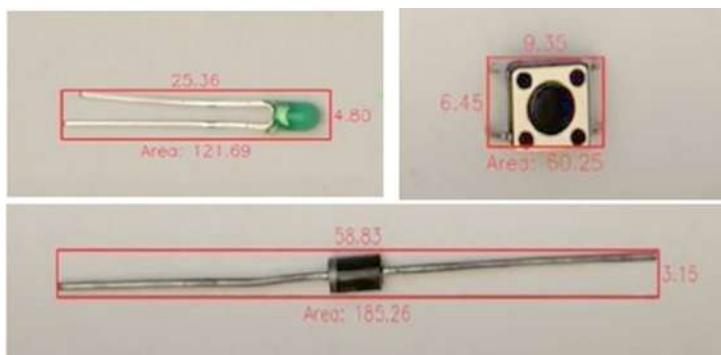


Figure 1. Testing on different objects

Results (All the measurements are in mm)

Dimensions estimated displayed (red) in the frame in mm, Area calculated based on the dimensions and average of area displayed (green).



Figure 2. Both intended objects in focus

Threshold adjustment and gaussian blur required here as the match box dimensions are not captured properly because of high threshold.

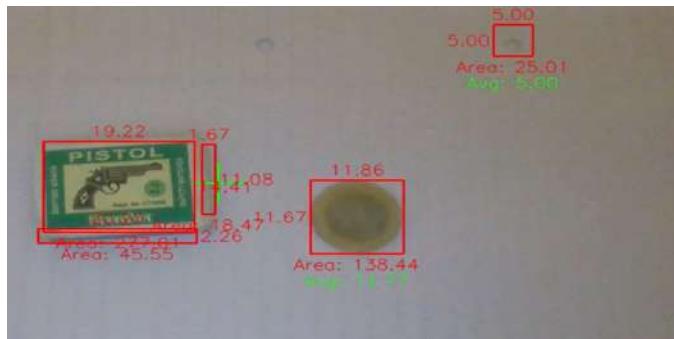


Figure 3. Unintended object in focus

Light adjustment also required as the shadows of object interfere with actual dimensions of the object.

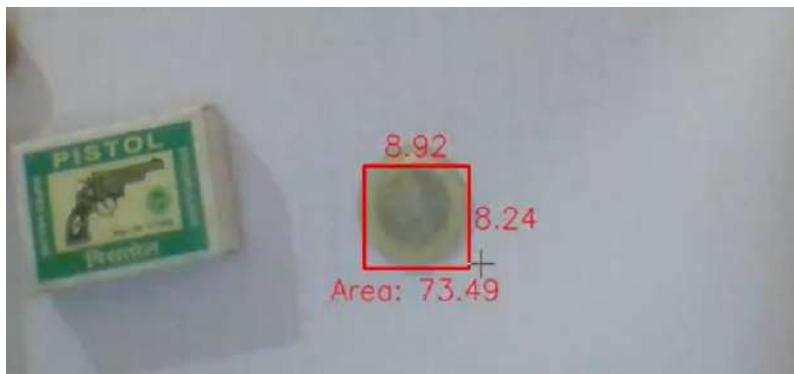


Figure 4. Intended object out of focus

Low accuracy in measurement and other object not being detected because of low resolution and the other object being out of focus. Table 1. Shows the results obtained in the experiment.

Table 1. Testing results for various objects

Objects	Calculated surface area (In cm^2)	Measured surface area (In cm^2)	Accuracy (In %)
Wallet	78.5	90.8	87.22
Pill	2.23	2.92	75.86
Coin	6.15	7.85	78.34
Menthol Rub	13.85	18.49	74.90
Matchbox	17.5	21.11	82.93
Mobile phone	108.5	129.4	83.84
Notebook	74.16	95.34	77.78
Adapter	28.98	38.25	75.41

VI. CONCLUSION

This method adds automation to a process in the metal painting business where billing demands expert labor and a lot of time. The user is able to manipulate the values of threshold and gaussian blur to their own will which helps in object detection and more accurate parameters are obtained. The dimensions of the object are obtained in real-time. This will also make it easier for us to determine the surface area the object which is also calculated in real-time. By adding the surface areas of each side of the object taken at various angles or by rotating the object, the total surface area is ultimately determined.

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IoT Based Smart Street Lighting System

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Abstract: The aim of IoT Based Smart Street Light System is the conservation of energy by reducing electricity wastage as well as reducing the workforce. The Saved energy can be utilized for various purposes like residential, commercial etc. This is done by using the LDR sensor. Here the LDR sensor is used ON-OFF the streetlight based on the ambient intensity level, and IR sensors are used to control the streetlights according to the detection of obstacles on the street. This switching can be done by a low-cost wifi module ESP8266 after reading the LDR value. The real-time information of the streetlight (ON/OFF Status) can be accessed anytime, anywhere, through the Internet. It ensures high reliability and excellent long-term stability. This work is implemented using a programmed NodeMcu board to provide the required light intensity at various times. The proposed work has achieved better performance compared to the existing system.

Index Terms: IoT, LDR, IR Sensor, wifi module ESP8266, NodeMcu

I. INTRODUCTION

Streetlights are integral to any developing locality, present on all major roadways and in the suburbs. On a global scale, millions of dollars are spent each day on these streetlights to provide the required electrical energy. The main aim of work is to design and execute the advancement in embedded systems for energy saving of streetlights which is a solution for electrical power wastage and eliminates manual operation of the lighting system. The proposed design can be implemented by sensing and approaching a vehicle using an IR transmitter and receiver along with the intelligent embedded system, which controls the streetlights based on detecting vehicles or any other obstacles on the street. Whenever the block is seen on the road within the specified time, the light will get automatically ON/OFF. The proposed system consists of intelligent streetlights with LDR to sense external lighting conditions, which helps to Switch the lighting system accordingly. This information can be accessed from anywhere using the wifi module's IP address to display the street's status.

II. BASIC CONCEPTS AND TECHNOLOGY USED

As shown in Figure 1, IoT is an interconnection of physical things with a virtual environment through internet protocol (IP) connectivity. In IoT, the material things are embedded with sensors and actuators for sensing and controlling.

A communication protocol integrates with the sensors and actuators for updating and transmitting the sensory data to the server. Integrating sensors/actuators, connectivity, data processing, and user interface (UI) forms an IoT network. IoT comprises the four components that define functionality, and a sensor is a device that senses and responds to input from the physical environment. The output signal of the sensor is converted into a digital signal. Connectivity is necessary for transmitting sensory data, and there are different wireless protocols for establishing connectivity. The Arduino integrated development environment (IDE) is a cross-platform application (for Microsoft Windows, mac OS, and Linux) written in the Java programming language. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting. It also provides simple click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for standard functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports C and C++ using special rules of code structuring. In addition, the Arduino IDE supplies a software library from the Wiring project, which provides many standard input and output procedures.

An Internet Protocol address (IP address), as shown in Figure 2., is a numerical label such as 192.0.2.1 connected to a computer network that uses the Internet Protocol for communication. An IP address serves two principal functions: network interface identification and location addressing. Internet Protocol version 4 (IPv4) defines an IP address as a 32-bit number. However, because of the growth of the Internet and the depletion of available IPv4 addresses, a new version of IP (IPv6), using 128 bits for the IP address, was standardized in 1998. IPv6 deployment has been ongoing since the mid-2000s. IP addresses are written and displayed in human-readable notations, such as 192.0.2.1 in IPv4 and 2001:db8:0:1234:0:567:8:1 in IPv6. The address's routing prefix size is designated in CIDR notation by suffixing the address with the number of significant bits, e.g., 192.0.2.1/24, which is equivalent to the historically used subnet mask 255.255.255.0.

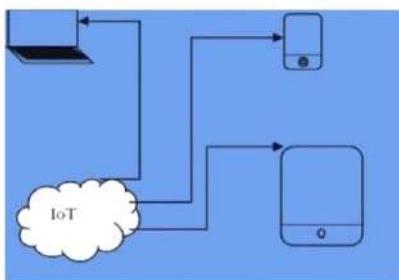


Figure 1. Internet of Things



Figures 2. Internet Protocol

III. STUDY OF SIMILAR PROJECTS OR TECHNOLOGY / LITERATURE REVIEW

[1] S.Suganya have proposed Street Light Glow detecting vehicle movement using a sensor that utilizes the latest technology for light sources such as LED lamps. It is also used to automatically switch streetlights according to the light intensity to develop flow-based dynamic control statistics using infrared detection technology and maintain wireless communication among lamppost and control terminals using ZigBee Wireless protocol. It also combines various technologies: a timer, statistics of traffic flow magnitude, photodiodes, LED, and power transistors.

[2] K.Santha have surveyed Street Lighting System Based on Vehicle Movements. The system operates in the automatic mode, which regulates the streetlight according to brightness and dimness algorithm and light intensity. The control can be made according to the seasonal variation. It includes a time cut-out function and an automatic control pattern for conserving more electricity. The whole project was implemented using a PIC microcontroller.

[3] Piyush Jain proposed a ZigBee-based Remote Control Automatic Street Light System. The system is designed with the help of ZigBee modules that help detect faulty lights and control the light. It also discusses an intelligent system that automatically decides ON/OFF/DIMMING considering vehicle movement, pedestrians, and the surrounding environment. Moreover, PIR motion sensors detect the direction of both living and non-living things.

[4] M. Abhishek implemented the design of a traffic flow-based street light control system with the effective utilization of solar energy in 2015. They used renewable energy sources, i.e., solar power, for street lighting. They have also used an 8052 series microcontroller developed by replacing the standard bulbs with LEDs, reducing power consumption by three times. Sensors are placed on either side of the road, which sense the vehicle movement and send commands to the microcontroller to switch ON and OFF the lights. Here all the streetlights remain switched off and it glows only when it senses the vehicle movement. Hence, because of the microcontroller, the lights are switched off even when it's night.

[5] C.Bhuvaneshwari have analyzed the streetlight with an auto-tracking system by which one can increase the conversion efficiency of solar power generation. Here, the sun tracking sensor is the sensing device that senses the sun's position from time to time and gives the output to the amplifier based on the light density of the sun. The Sun tracking sensor is LDR, and the amplifier unit is used to amplify the LDR signals, which converts low-level signals to high-level signals, and the output is given to the comparator. The LM324 IC is used as an amplifier. The comparator compares the calls and gives the command to AT89C51 Microcontroller.

IV. PROPOSED MODEL / TOOL

The proposed work, as shown in Figure 3., is implemented for three light street poles and requires 3LED (streetlight) controlled by 3 IR sensors connected to the digital pins of the Node-Mcu controller. IR sensors receive the input when they sense a vehicle or human; its output goes LOW (0). Then the controller reads the Low output value from the sensor it turns on the LEDs. When the IR sensors do not detect any vehicle or human position, its output goes HIGH (1). Then the controller reads the High output value from the sensors it turns off the LEDs. LDR is connected to the analogue pin of the controller. It controls the LEDs by detecting the presence or absence of sunlight. The LDR offers low resistance when sufficient daylight is present in the surroundings. In this case, the controller reads high analogue output values from the LDR and automatically turns off all LEDs (streetlights). During the absence of sunlight, the LDR detects dark and offers high resistance. In this case, the controller reads Low analogue input values from the LDR and automatically turns on the LEDs (streetlights). Finally, the Smart Street lighting system can be controlled by using LDR based on the presence of sunlight. The components, along with their description, are shown in Table 1.

Table 1. Components used in the proposed model

Components	Features	Image
NodeMCU : ESP32S microcontroller	<ul style="list-style-type: none"> A feature-rich MCU with integrated wifi connectivity. The max i/voltage is 3.6volts It is a 2.4Ghz wifi module It has 512kb SRAM, and it has 32bit 10silica extensive processor clocked at 160 or 240Mhz 	
LDR	<ul style="list-style-type: none"> Light-dependent resistors The dark resistance is high 1012ohm 	
LEDs	<ul style="list-style-type: none"> Light-emitting Diode emits visible light when the electric current passes through it. 	

Resistors	<ul style="list-style-type: none"> 220 ohm helps in saving led from high voltage battery 	
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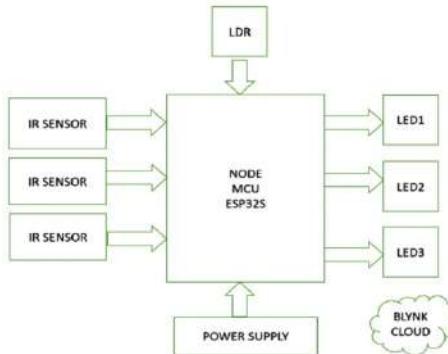


Figure 3. The IoT-based street lighting system

V. IMPLEMENTATION AND RESULTS

The Implementation of the proposed work is located out by using a wifi module, node mcu esp8266 and, IR sensors, LDR sensor and has been used according to required and. Figure 4. shows the interconnection of components used for Implementation. The work has been implemented for three light street poles, which is working per the design's expectations. The prototype can turn on the light during the night with obstacle detection. This is shown in Figure 5. Simultaneously system is turned off during the day.

The same data can be accessed in Google using the IP address of the wifi module. The module must be extended for a complete street or for a specified area to check for pros and cons related to the wifi module, data storage requirement and power consumption. Further enhancements can be discussed based on these results. The above work can be implemented for women's safety and crime detection in remote areas, irrespective of the cost.



Figure 4. Proposed model implementation

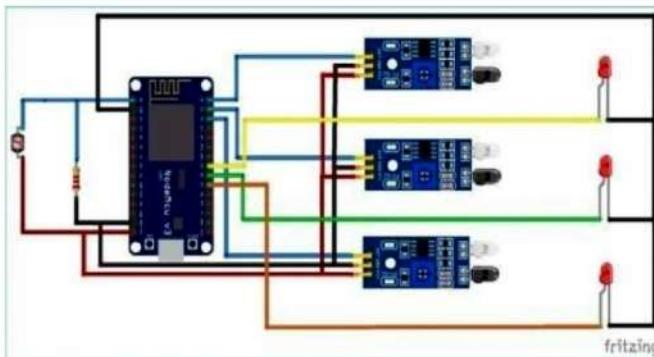


Figure 5. The schematic diagram for intelligent lighting

VI. CONCLUSION

IoT has groomed rapidly with our day-to-day life. Innovative Street light System is one of the significant parts which use IoT concepts. Smart Street Lighting System tackles major problems like Energy wastage, Crime detection, disposal of incandescent lamps, maintenance cost, etc. This system ensures traffic safety and security for the people, which can stop women's annoyance, burglaries, and further intimations. The Energy crises that occur in the cities may be reduced because 50 to 60 per cent of electricity is saved, and this energy is used for other essential purposes. This system adapts to users' requirements and creates a safe environment. This approach requires minimum hardware with simple software. Since the system controls streetlights, it is possible to avoid negligence factors caused by humans.

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Sentiment Analysis of Twitter Data

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Abstract - Twitter is a melting pot of opinions and trends with billions of users. Tweets have the power to influence content and change business strategies. So, it becomes essential to identify the sentiment of the users. Sentiment analysis is a prevalent NLP task that performs well for general English texts with no character limitations. On the other hand, Twitter has limited characters per tweet, forcing users to express themselves using acronyms and emojis. This makes it difficult for traditional NLP modules to perform well on tweets, pushing the need to propose new models that work with such datasets. Through this work, we offer to use sequence encoders like LSTM/GRU to perform sentiment analysis.

Index Terms – Twitter, Natural language processing, LSTM

I. INTRODUCTION

After Twitter got acquired by Elon Musk, we can understand the importance of Twitter in the 21st century. In the past many years, the internet has been multiplying, and the social media platforms like Instagram, Meta, Twitter, WhatsApp, and Reddit have been on the boom. Twitter is a micro-blogging platform where people share their views, ideas, insights, and feelings on a particular situation or product. Now a company needs to know the feelings of their user after a new product launch for govt about their schemes.

We aim to analyze the sentiment of the tweets from the Sentiment140 dataset by developing a machine-learning pipeline using three classifiers (Logistic Regression, Bernoulli Naive Bayes, and SVM) along with using Term Frequency- Inverse Document Frequency (TF-IDF), LSTM. The performance of these classifiers is then evaluated using accuracy and F1 Scores and compared for best.

II. PROBLEM STATEMENT/ OBJECTIVES

We want to identify the tweet's sentiment as either positive, negative, or neutral.

The dataset provided is the Sentiment140 Dataset which consists of 1,600,000 tweets extracted using the Twitter API.

The various columns present in the dataset are:

- **Target:** the polarity of the tweet (positive or negative, or neutral)
 - **Ids:** Unique id of the tweet
 - **Date:** the date of the tweet
 - **Flag:** It refers to the query. If no such question exists, then it is NO QUERY.
- **User:** It refers to the name of the user that tweeted
- **Text:** It refers to the text of the tweet

III. BASIC CONCEPTS/TECHNOLOGY USED

Twitter Sentiment Analysis: A Review:

The basic knowledge required to analyze Twitter sentiment is discussed in this review paper. Sentiment Analysis can be viewed as a field of text mining and natural language processing. Thus, we can study sentiment analysis in various aspects. This paper presents levels of sentiment analysis, approaches to do sentiment analysis, methodologies for doing it, and features to be extracted from the text and the applications. Twitter is a microblogging service to which one has to follow the explicit path if sentiment analysis is done. Thus, this paper gives an overview of tweets extraction, preprocessing, and sentiment analysis.

A Study on Sentiment Analysis Techniques of Twitter Data

Gathering and analyzing peoples' reactions toward buying a product, public services, and so on are vital. Sentiment analysis (or opinion mining) is a typical dialogue preparation task that aims to discover the sentiments behind opinions in texts on varying subjects. In recent years, researchers in the field of sentiment analysis have been concerned with analyzing views on different topics such as movies, commercial products, and daily societal issues. Twitter is an enormously popular microblog on which clients may voice their opinions. Opinion investigation of Twitter data is a field that has been given much attention over the last decade and involves dissecting "tweets" (comments) and the content of these expressions. Sentiment analysis is also known as "opinion mining" or "emotion Artificial Intelligence". It utilizes natural language processing (NLP), text mining, computational linguistics, and bio measurements to methodically recognize, extricate, evaluate, and examine emotional states and personal information. Sentiment analysis is generally concerned with the voice in client materials; for example, surveys and reviews on the Web and web-based social networks.

Stemming/Lemmatization

For grammatical reasons, documents will use different word forms, such as writing, writing and writing. Additionally, there are families of derivationally related words with similar meanings. The goal of both stemming and lemmatization, as shown in Figure 1. is to reduce inflectional forms and sometimes derivationally related forms of a word to a common base form.

Stemming usually refers to a process that chops off the ends of words in the hope of achieving the goal correctly most of the time and often includes the removal of derivational affixes. Lemmatization usually refers to doing things properly using a vocabulary and morphological analysis of words, generally aiming to remove inflectional endings only and to return a word's base and dictionary form. This is shown below in Figure 1.

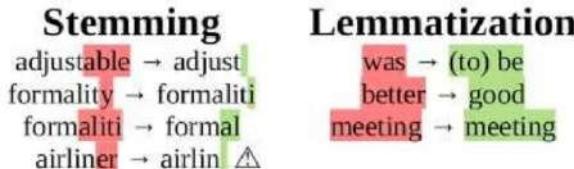


Figure 1. Text preprocessing

Hyperlinks and Mentions

Twitter is a social media platform where people can tag and mentions other people's ID and share videos and blogs from the internet. So, the tweets often contain lots of Hyperlinks and Twitter mentions.

- Twitter User Mentions - Eg. @arunrk7, @andrewng Hyperlinks - Eg. <https://keras.io>, <https://tensorflow.org>

Stop words

Stop words are commonly used in English with no contextual meaning in a sentence. So, therefore, we remove them before classification. A sample of stop words is shown in Figure 2.

```
> stopwords("english")
[1] "i"          "me"         "my"         "myself"     "we"
[6] "our"        "ours"       "ourselves"  "you"        "your"
[11] "yours"      "yourself"   "yourselves" "he"         "him"
[16] "his"        "himself"   "herself"    "she"        "her"
[21] "herself"    "it"         "its"        "itself"    "they"
[26] "them"       "their"     "theirs"     "themselves" "what"
[31] "which"      "who"        "whom"       "this"       "that"
[36] "these"      "those"     "one"        "is"         "one"
[41] "was"        "were"      "be"         "been"       "being"
[46] "have"       "has"        "had"        "having"    "do"
[51] "does"       "did"        "doing"     "would"     "should"
[56] "could"      "ought"     "i"          "you're"    "he's"
[61] "she's"       "it's"       "we're"      "they're"   "i've"
[66] "you've"     "we've"     "they've"    "i'd"        "you'd"
[71] "he'd"        "she'd"     "we'd"       "they'd"    "i'll"
[76] "you'll"     "he'll"     "she'll"    "we'll"     "they'll"
[81] "isn't"       "aren't"    "wasn't"    "weren't"   "hasn't"
[86] "haven't"    "hadn't"   "doesn't"   "don't"     "didn't"
[91] "won't"       "wouldn't" "shan't"    "shouldn't" "can't"
[96] "cannot"     "couldn't" "mustn't"   "let's"      "that's"
[101] "who's"       "what's"    "here's"    "there's"   "when's"
[106] "where's"     "why's"    "how's"     "a"         "on"
```

Figure 2. Stop words

Some stopwords (see Figure 2) are that it looks like a tedious process. Don't worry. There is always some library in Python to do almost any work. The world is excellent!!!

NLTK is a python library with functions to perform text-processing tasks for NLP.

Word Embedding

In Language Model, words are represented in a way to intend more meaning and to learn the patterns and contextual meaning behind them. Word Embedding is one of the popular representations of document vocabulary. It can capture the context of a word in a document, semantic and syntactic similarity, relation with other terms, etc. It's a feature vector representation of words used for other natural language processing applications. We could train the embedding ourselves, but that would take a while to prepare, and it would need to be more effective. So going in the path of Computer Vision, here we use Transfer Learning. We download the pre-trained embedding and use it in our model. The pre-trained Word Embedding like GloVe & Word2Vec gives more insights for a word which can be used for classification if you want to learn more about Word Embedding.

Model Training - LSTM

IV. LITERATURE REVIEW

- A Study on Sentiment Analysis Techniques of Twitter Data by Abdullah Alsaeedi, Mohammad Zubair Khan
- Role of Text Preprocessing in Twitter Sentiment Analysis by Tajinder Singh and Madhu Kumari

In article 1, diverse techniques for Twitter sentiment analysis methods were discussed, including machine learning, ensemble approaches and dictionary (lexicon) based approaches. In addition, hybrid and ensemble Twitter sentiment analysis techniques were explored. Research outcomes demonstrated that machine learning techniques; for example, the SVM and MNB produced the most incredible precision, especially when multiple features were included. SVM classifiers may be viewed as standard learning strategies, while dictionary (lexicon) based techniques are incredibly viable at times, requiring little effort in the human-marked archive. Machine learning algorithms, such as The Naive Bayes, Maximum Entropy, and SVM, achieved an accuracy of approximately 80% when n-gram and bigram models were utilized. Ensemble and hybrid-based Twitter sentiment analysis algorithms performed better than supervised machine learning techniques, achieving a classification accuracy of approximately 85%.

From article 2, we can observe they have used a Support Vector Machine (SVM) based classifier for preprocessing results of experiments, clearly suggesting that the proposed scheme is not only robust to the size of data but also perform better in terms of accuracy of sentiment classification.

V. PROPOSED MODEL

The architecture of the proposed model is shown in Figure 3.

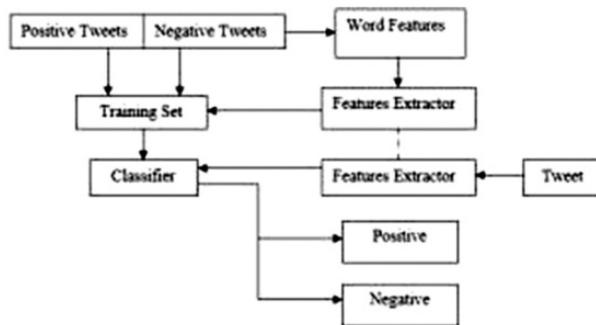


Figure 3. The architecture of the proposed model

Sentiment Analysis- This is analyzing people's opinions in textual data (e.g., product reviews, movie reviews, or tweets) and extracting their polarity and viewpoint. The task can be cast as either a binary or a multi-class problem. Binary sentiment analysis classifies texts into positive and negative classes, while multi-class sentiment analysis classifies texts into fine-grained labels or multi-level intensities.

VI. IMPLEMENTATION AND RESULTS

Gathering of data:

Download (85 MB)

About Dataset Context This is the sentiment140 dataset. It contains 1,600,000 tweets extracted using the Twitter API. The tweets have been annotated (0 = negative, 4 = positive) and can be used to detect sentiment.

Content It contains the following six fields: target: the polarity of the tweet (0 = negative, 2 = neutral, 4 = positive) ids: The id of the tweet (2087) date: the date of the tweet (Sat May 16 23:58:44 UTC 2009)

flag: The query (lyx). If there is no query, this value is 'NO- QUERY'.

User: the user that tweeted (robotickilldozr) text: the text of the tweet (Lyx is cool)

Preprocessing: Text Preprocessing

Tweet texts often contain other user mentions, hyperlink texts, emoticons, and punctuations. To use them for learning using a Language Model. But, we cannot permit those texts for training a model. So, we have to clean the text data using various preprocessing and cleansing methods.

The flow chart of the proposed model is shown in Figure 4.

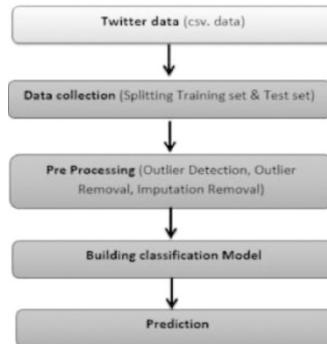


Figure 4. Flow chart of the proposed model

1. **Data Analysis and Visualization:** This is the sentiment140 dataset. It contains 1,600,000 tweets extracted using the Twitter API.
- Model Development: Sequence Model (as shown in Figure 5)

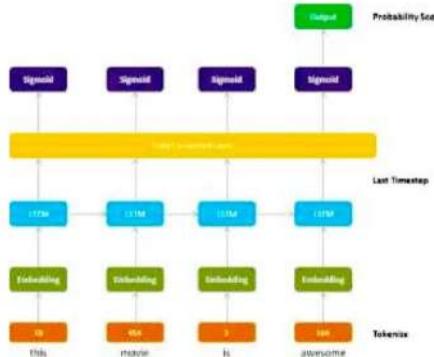


Figure 5. Sequence model

Recurrent Neural Networks can handle a data sequence and learn a pattern of the input sequence to give either series or scalar value as output. In our case, the Neural Network outputs a scalar value prediction.

For model architecture, we use

- 1) **Embedding Layer** - Generates Embedding Vector for each input sequence.
- 2) **Conv1D Layer** - It is used to convolve data into smaller feature vectors.
- 3) **LSTM** - Long Short-Term Memory, a variant of RNN with a memory state cell to learn the context of words that are further along the text to carry contextual meaning rather than just neighbouring words, as in the case of RNN.
- 4) Dense - Fully Connected Layers for classification

Result:

While the model's accuracy is depicted in Figure 6., other performance

measures like precision, recall, and f1-score have been shown in Figure 7.

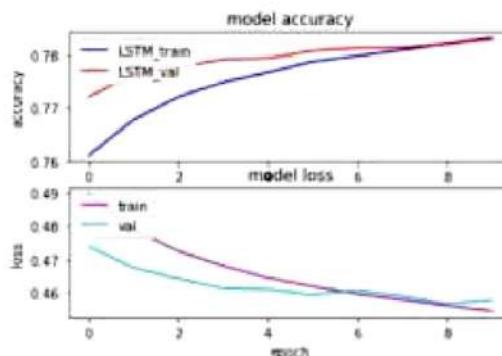


Figure 6. Accuracy graph of the LSTM model

	precision	recall	f1-score	support
0	0.82	0.81	0.82	263321
4	0.81	0.83	0.82	264679
accuracy			0.82	528000
macro avg	0.82	0.82	0.82	528000
weighted avg	0.82	0.82	0.82	528000

Figure 7. Other performance measures

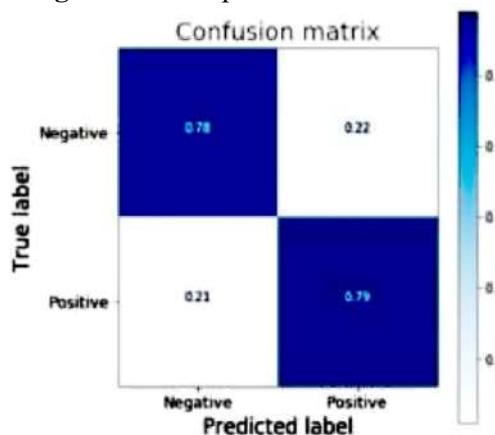


Figure 8. Confusion matrix

The confusion matrix of the LSTM model is shown in Figure 8.

VII. CONCLUSION

Upon evaluating all the models, we can conclude the following details, i.e. **Accuracy:** As far as the model's accuracy is concerned Logistic Regression

performs better than SVM, which in turn serves better than Bernoulli Naive Bayes.

F1-score: The F1 Scores for class 0 and class 1 are:

- (a) **For class 0:** Bernoulli Naive Bayes (accuracy = 0.90) < SVM (accuracy = 0.91) < Logistic Regression (accuracy = 0.92)
- (b) **For class 1:** Bernoulli Naive Bayes (accuracy = 0.66) < SVM (accuracy = 0.68) < Logistic Regression (accuracy = 0.69)

AUC Score: All three models have the same ROC-AUC score.

We conclude that the Logistic Regression is the best model for the above-given dataset. In our problem statement, Logistic Regression follows the principle of Occam's Razor, which defines that for a particular problem statement, if the data has no assumption, then the simplest model works the best. Since our dataset does not have any beliefs, Logistic Regression is a simple model. Therefore the concept holds for the dataset mentioned above.

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Deep Learning Based Emotional Music Player

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Abstract- Music plays a very important role in our lives. It works as a stress relief for many people by uplifting their mood. The mood of a person can easily be predicted by facial expressions. So, this project aims at capturing expressions based on convolutional neural networks (CNN) by developing an algorithm for real-time emotion recognition using virtual markers that works effectively during subject head rotation, asymmetric subject orientation, different backgrounds, and various skin tones. Seven facial emotions (happiness, sadness, anger, fear, disgust, neutral, and surprise) are collected using virtual markers. Virtual markers are placed on defined locations, one subject's face based on a facial action coding system using the mathematical model approach. The distance between the center of the subject's face and each marker position is used as a feature for facial expression classification. Finally, the features are cross-validated using fivefold cross-validation and given to the CNN classifiers.

Index Terms- DCNN, Haar Cascade, Emotion detection, Deepface, Kivy, OpenCV

I. INTRODUCTION

“The man that hath no music in himself,
Nor is not moved with concord of sweet sounds Is fit for treasons, stratagems,
and spoils.”

-Shakespeare *The Merchant of Venice* 1596

Emotional responses in humans frequently occur due to visual stimuli. Like, a photograph of a happy family gives rise to a ‘happy’ emotion, and a picture from a crime scene gives rise to a ‘fear’ emotion. Real-time emotion recognition has been an active field of research over the past several decades. Here, we are exploring emotion detection through this application which will enhance the user’s real-time emotions with the appropriate music.

Music is essential to life and a person’s real-time emotions are what trigger the kind of music he/she will listen to. The facial expressions of a person are one of the most important ways to express their emotions. And this is rightly so as in this project paper, we are proposing an emotion-detecting application that will read the user’s face and play the appropriate music depending on the user’s

mood. Automatic expression detection is one of the most important topics in research. Apart from the entertainment industry, this project has the feasibility to help in a greater cause like the integration of emotions with the IPAs will increase the level of effective communication. With this application, we aim to help especially abled people interact better with each other and the world. It aims to understand their taste in music and implement it on a larger music platform with a broader audience.

II. BASIC CONCEPTS AND TECHNOLOGY USED

This GUI-based model was created with the help of Kivy. Moreover, its facial recognition feature works by integrating the Haar Cascade machine learning model and a CNN-like Classifier through OpenCV which provides virtual interfaces and connects the dots between the input and output. The proposed model primarily uses Deepface [7] for its implementation. Finally, the features are cross-validated using fivefold cross-validation and given to the CNN classifiers.

We use the Deepface facial recognition system which includes four steps: detect, align, represent and classify. This method focuses mainly on the alignment and representation of the detected images.

Facial Feature Extraction

In this study, a camera was used to capture the subjects' faces and create a grayscale image. This simplified the facial image process in facial expression recognition. Then, by using a grayscale image, the subject's eyes are detected, and ten virtual markers (action units) are placed on the subject's face at defined locations using a mathematical model.

III. BACKGROUND STUDY AND TECHNOLOGY GAPS IDENTIFIED

A person's mood is mainly affected by the surrounding atmosphere and the type of company they keep around them. Its repercussions are seen in the person's day-to-day life, socially and career-wise, leading to a positive or negative mindset [5]. Music is an essential component of our daily life. We listen to songs as per our mood. Music is one of the media of entertainment and even imparts a therapeutic approach. It is important to play an appropriate song depending on the emotional state [4].

Facial emotion detection from photos and real-time video images is a popular part of modern biometric research. One of the main components used for this is the OpenCV library of Python. This machine-learning algorithm is widely applied in various research areas today such as diagnosis of mental illness and general human social/psychological interaction. Previously, there have been projects where in-depth reading technology has been used to create models with facial expressions based on perceived emotions that use six or seven of the emotions we detect in our application. In this application, we use Deep Convolutional Neural Network (DCNN) for marking out patterns on faces in

real-time videos or photographs as and when required. DCNN has achieved significant success in a wide range of machine-learning applications, such as image classification, natural language processing, speech recognition, and video classification [8]. Deep Convolutional Neural Networks mostly focus on fields of object detection, and image classification and it is also sometimes used in natural language processing.

Here, in our model, we take emotion detection one step further by adding the aspect of music to it according to the real-time emotions. Every person has unique facial features, and every face has its own unusual and straightforward characteristics, so it is very difficult to understand and map out the facial features of every person accurately. Currently, our project is based on facial expressions that are characterized by only seven emotions namely, happiness, sadness, fear, surprise, disgust, and neutrality [6]. Here, we take a raw attempt to detect all the crucial facial features (like eyes and lips) and then classify them under the above-stated seven different emotions [5]. Finally, with the help of the OpenCV libraries and the music linked to the application, it recognizes the emotional state, and the device plays music according to the user's mood.

IV. PROPOSED MODEL / TOOL

The proposed model works in the following manner: First, the application starts by initializing the program, which automatically initializes the linked camera. After the face is detected using the Haar cascade code, the program automatically sets the marker placement. The application then saves the initial coordinates. Finally, the final coordinates are then saved to calculate the distance between the initial and final coordinates. This is needed to identify the emotion. The recorded emotion is then classified into one of the following 7 emotions: happy, sad, angry, surprised, fearful, disgusted, and neutral. As the output, average results are used to detect the person's emotions. The process ends with this.

Alignment generates the frontal face from the image detected by the camera from the given pose or angle using the '3D frontalization' based on fiducial which finally gives us a 2D model to extract the frontal face and for representation, the Deepface is trained to recognize images of multiple people based on their identities. Finally, to establish the relationship between the 2D and 3D models, we use the following relation:

$$x_{2d} = X_{3d} P$$

To improve this transformation, we need to minimize the loss on P which can be calculated by the following relation:

$$loss(\overline{P}) = r \sum r^T$$

Where r can be defined as,

$$r = (x_{2d} - X_{3d} P)$$

For example, in the right mouth column of the given Figure 1, line m1 is the hypotenuse of a right-angled triangle that is mapped out on the face. Here, the line mapped parallel to the x-axis is dx [the difference between coordinates of p_m1 (xp_m1) and the point (Xc)], and the other line parallel to the axis is dy [the difference between y-coordinates of p_m1 (yp_m1) and the point (Yc)]. Thus, the final formula for the calculation of the distance while mapping on the face detected is given in the above equation [1].

After facial recognition through Deepface, the application detects the various emotions by calculating the distance of different components of the captured face using the Pythagorean Theorem (say, *Distance (m1)*).

$$\text{Distance (m1)} = \sqrt{(Xc - Xp)^2 + (Yc - Yp)^2} \quad (1)$$

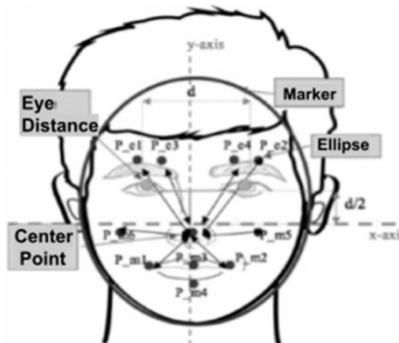


Figure 1. Marker position

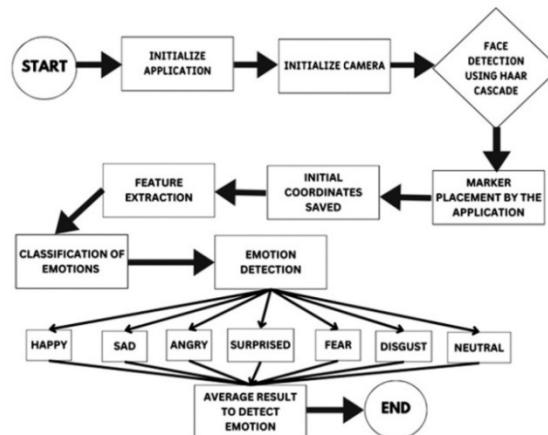


Figure 2. High level block diagram

V. IMPLEMENTATION AND RESULTS

This is a complete GUI-based application essentially created using Python, DeepFace, Kivy, and OpenCV libraries. The webcam required by this application is accessed by OpenCV and the face is captured through the Haar Cascade Classifier. Then, the recorded facial expressions are compared with predefined models to get the emotion. Here, the lightweight library Deepface is used. After getting the appropriate emotion, the correct music is played by Kivy.

In this project paper, we are preparing an emotion-detecting application using visual and speech input devices, which will provide a new dimension to these current smart-era applications by making them more user-friendly. The basic model works on detecting the emotion from the facial expression that is captured by the phone camera, webcam interlinked with the application, or any other tool that provides an input of a face. The camera (of any sort) would scan for a face if available and would take a photo of it. Then it would crop the photo for emotions and using the post-image processing software it would classify the emotion of the face to be one of the following emotions: Happy, Sad, Angry, Surprised, Fear, Disgust, and Neutral.

The model was trained from the dataset from Kaggle, in which 7164 happy emotion images were trained out of which 1825 were validated. Similarly, 4938 sad emotions images were trained and 1139 were validated. 3993 images of angry emotion were trained and 960 were validated. 436 disgust emotion images were trained and 111 were validated. A total of 4982 neutral emotions were trained and 1216 were validated. Lastly, a total of 4103 and 3205 fear and surprise emotion images were taken respectively and 1018 and 797 of them were validated. The dataset [Table 1] is given below.

Table 1. Dataset Statistics

Emotion Image	Training Images Count	Validated Image Count
Happy	7164	1825
Sad	4938	1139
Angry	3993	960
Disgust	436	111
Neutral	4982	1216
Fear	4103	1018
surprise	3205	797

After detection of the face, the application then displays the emotion that is detected on the face. Based on the model's detection, the application then plays appropriate music in the background accordingly.

A case study was conducted through a live demo test of the program in which the subject was recognized to be happy. The application detected a happy emotion on the face of the subject and played a song that is related to happiness. The screenshot of the live demo is attached below [Figure 3].



Figure 3. Case study with Live Demo of the Proposed Model

IMPACT ON SOCIETY

- Entertainment purpose - In this smart era where appliances in the house are being controlled with various advanced devices, with the help of this emotion detector, we can detect the emotion of a particular person and after reading the visual of the face, the application will play the music as per the mood. This gives the user a better experience of music without having to search for the desired songs.
- Security purpose - With the help of the visual input, one can set up an alert mechanism. Suppose we consider a hypothetical case where when an aviator enters the cockpit, he/she will have to pass a display scanner that will detect the emotion and might as well trigger a warning according to the emotion detected.
- Medical cause - With the help of emotion detection, this application model aims to help us understand especially abled people better and make communication easier for them. An emotion detection device will make it easier for doctors to treat patients who might be suffering from paralysis or autism.

LIMITATIONS

One of the drawbacks of this application is that it cannot be a judge of the user's actual expressions; a bluff in user emotions can very well result in misguided results by the application. Aside from that, multiple faces and/or filtered images in front of the camera may prevent accurate face detection. Hence, the model won't give the desired result or could lead to wrong or default results. The application needs a complete front view of the face for emotion detection. It will generate errors if the user is sideways or if the user's entire face is not visible to the camera. Moreover, inappropriate background light play might lead to fallacious results.

VI. CONCLUSION

An algorithm for real-time emotion recognition using virtual markers has been developed to create a real-time emotion recognition system with less

computational complexity (execution time, memory) using facial expressions. This algorithm works effectively with uneven lighting, subject head rotation, asymmetric subject orientation, different backgrounds, and various skin tones. The system aims to assist people with special needs in recognizing and communicating with others. Moreover, it can drive business outcomes, judge the emotional responses of the audience, and help in design thinking. It has a benefit in personalized e-learning aside from helping to maximize learning. The system can recognize seven emotions, namely, happiness, sadness, anger, fear, disgust, neutrality, and surprise, in real-time for facial landmarks. Users of the system need to face the camera connected to the application to record the raw data wirelessly and collect the virtual marks placed on the subject's face. Finally, a versatile output spanning over seven emotions is displayed in front of the user by processing the input data.

In the near future, we are trying to implement a speech recognition model in this application, which will help us make the data more accurate. Through this technology, we can improve the preexisting visual recognition of emotions and make it better, which can be used in various fields in the current smart era. The addition of speech recognition to IPAs will result in a better understanding of emotions and more effective assistance. For future work, the system's precision and accuracy can be improved by collecting more data from more subjects. Additionally, techniques can be used to extract more features. In addition to improving the system's techniques, putting the subjects in real-life situations to express their exact feelings can help improve the system's accuracy.

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Measuring Water Quality using Arduino and Turbidity Sensor

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Abstract: In the context of liquids, turbidity is a crucial concept since it plays a crucial role in the dynamic. Turbidity is the measure of a liquid's degree of opacity or cloudiness. Because of the numerous tiny invisible airs during compression, this occurs. As the quantity of loose suspended particles increases, so does the turbi inversely connected. These small particles cause light waves to scatter when they pass through liquids. So, let's use Arduino to test a liquid's turbidity. To further assess the purity of the water, it is feasible to link an Arduino to a sensor that measures the transparency loss caused by suspended particles in water. A measurement of turbidity could be used to determine the water's quality. The concentric transmission, which is used to determine whether there are suspended particles in water.

Index terms: Arduino, Turbidity module, LCD

I. INTRODUCTION

Water is a fundamental need for human living that cannot be substituted. It is used for a variety of purposes, including drinking. Water can either be a source of life and wellness for humans or a source of diseases and fatalities, depending on this. Protecting water supplies from pollution, whether deliberate or inadvertent, is a serious problem for drinking water services in urban areas and water distribution to consumer taps. In addition, the World Health Organization estimates that 3.4 million people worldwide pass away each year from water-related diseases, the majority of whom are children (WHO). As a result, the distribution system needs a mechanism to check the quality of the water. Turbidity is a measure of how murky the water is. High turbidity typically results in poor clarity, while low turbidity typically results in excellent clarity. Since silt, sludge, and organic matter, which are small particles, can reduce water clarity, the Arduino's turbidity sensor measures the amount of turbidity to assess the water's quality. Particles suspended in the water can be observed by observing the changes in light transmittance and scattering rate brought on by the concentration of TSS in the water. The turbidity sensor measures the water as a result, and the LCD panel displays the measurement's findings, including the water's clarity, cloudiness, and dirtiness.

II. TECHNOLOGY USED

i. **Arduino UNO**: The open-source, affordable, and user-friendly microcontroller board known as Arduino UNO was developed by Arduino.cc and can be used in a variety of electronic applications. Its core element is a microcontroller made by Microchip called the ATmega328P. The board's sets of digital and analogue input/output pins are compatible with a wide range of expansion boards and other gadgets. Relays, LED's, servos, motors, and other output devices can all be controlled by this board via connections to other Arduino boards, Arduino shields, and Raspberry Pi boards. This is shown in Figure 1.



Figure 1. Arduino Uno

ii. **Turbidity Sensor**: Turbidity sensors, as shown in Figure 2., are used to measure the amount of light that is scattered by suspended particles in water. The amount of total suspended solids (TSS) in water increases together with the turbidity level (and cloudiness or haziness).



Figure 2. Turbidity sensor

iii. **16x2 I2C LCD**: It has a 16x2 LCD and an I2C interface. It can display 16x2 characters on 2 lines with white text on a blue background. The cost-effectiveness of this LCD is tested using projects that require the display of text, data, or any type of ASCII character. Connect to the GND, Vcc, SCL, and serial data line (SDL) (serial clock line). Especially with Arduino Uno, projects for LCD screens commonly run out of pin resources quickly. A 16x2C LCD is shown in Figure 3.

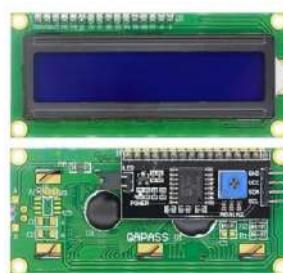


Figure 3. 16x2 LCD

iv. **Common cathode RGB-LED:** The three LEDs' common RGB-LED cathode, which they all have, is negatively linked (cathode). A common anode RGB LED has positive connections between its three LEDs (anode). The result is that the LED has a total of four pins: one for each LED and one common cathode or anode. It is shown in Figure 4.



Figure 4. Common cathode RGB LED

v. **Breadboard:** Utilizing a breadboard, sometimes referred to as a plugblock, is necessary when creating temporary circuits. It is advantageous to designers since components can be removed and replaced with ease. It is advantageous to be able to construct a circuit, show how it operates, and then use the same parts in another circuit. A breadboard is shown in Figure 5.

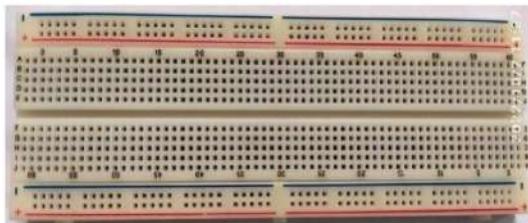


Figure 5. Breadboard

vi. **Jumper wires:** Jumper wires are cables composed of many electrical wires with connections or pins on either end. Without soldering a breadboard or other prototype or test circuit, it is often used to join elements of a prototype or test circuit inside or to other machinery or components. Jumper wire is shown in Figure 6.



Figure 6. Jumper wire

III. PROPOSED METHODOLOGY

To ensure that the sensor in the system is measuring accurately, calibration is done. The output is given based on the values entered into the application. Below is a list of the steps taken to test the sensor.

Procedure:

- 1) Gather some samples of clean, hazy, and dirty water.
- 2) Properly insert the sensor into the water samples.
- 3) Run the Arduino Software application in parallel.
- 4) Write down the value that the sensor read.
- 5) Compare the recorded value to the values listed in the programme.
- 6) If the turbidity of the water is ($\text{turbidity} < 15$), show it as clear water.
- 7) Display water as cloudy if the turbidity is ($(\text{turbidity} > 15) \ \&\& (\text{turbidity} < 50)$).
- 8) Display water as unclean if the turbidity is ($\text{turbidity} > 50$).
- 9) The turbidity of the water is tested when samples are delivered, and the results are shown on an LCD.

Figure 7. shows the flowchart that depicts the working of hardware.

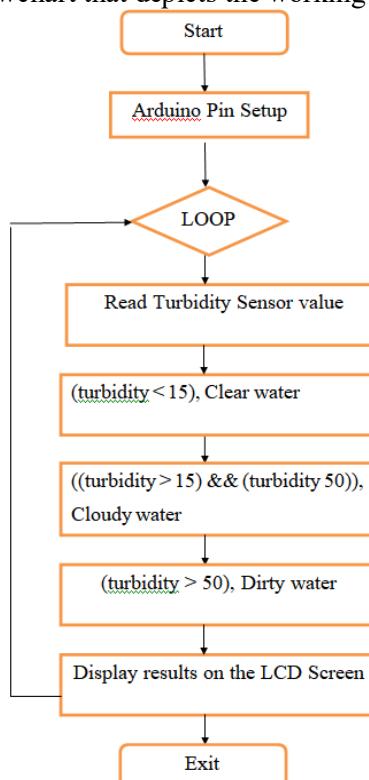


Figure 7. Flowchart demonstrating about working of hardware

The system architecture of the proposed model has been shown in Figure 8. And Figure 9.

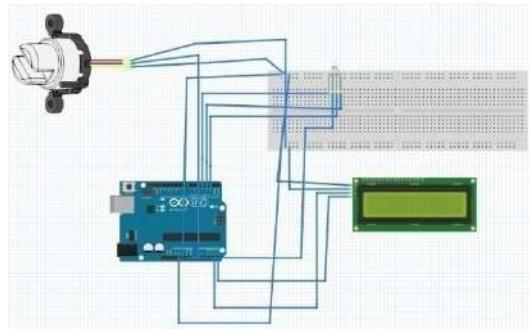


Figure 8. Connection diagram

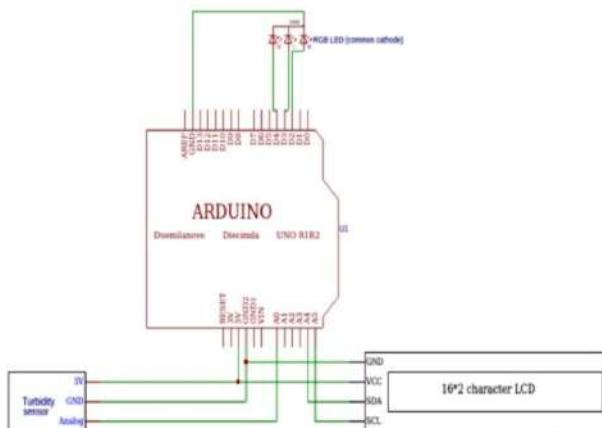


Figure 9. Schematic diagram

The SCL to A5 and SDA to A4 I2C pins of the Arduino are used to connect the I2C LCD to the Arduino. The turbidity sensor output is analogue; thus, it is tied to the Arduino's A0 pin. Digital pins D2, D3, and D4 were next used to connect the RGB LED. After connecting ground to ground, connect the sensor's VCC to the Arduino's 5volt supply. the sensor's output pin to Arduino's analog 0 pin. Connect the LCD module's VCC and ground to the Arduino's 5v and ground next. Pins A4 and A5 on the Arduino I2C pins are used for SDA and SCL, respectively. Green, blue, and red are connected to D2, D3, and D4, respectively, with the ground of the RGB LED eventually being connected to the Arduino's ground.

IV. IMPLEMENTATION & RESULTS

After taking a water sample, as shown in Figure 10, the turbidity sensor is utilized to assess the water's quality. The Arduino board was used to process the sensor readings. The water's suitability for human consumption was determined using these numbers. Regular checks are made to the water's quality to

determine if there have been any changes; even a small adjustment will have an impact on the outcomes. The outcomes are then shown on the LCD. The results of the proposed model implementation is shown in Figure 11, Figure 12, and Figure 13.



Figure 10: Water Samples with different mixtures

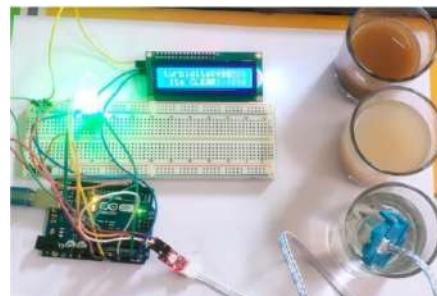


Figure 11. Result of clear water

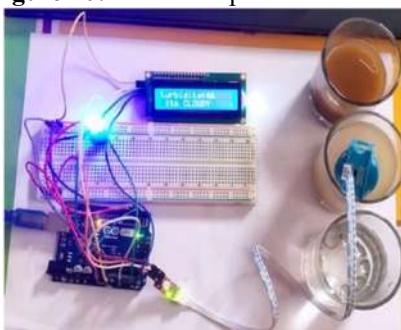


Figure 12. Result of cloudy water

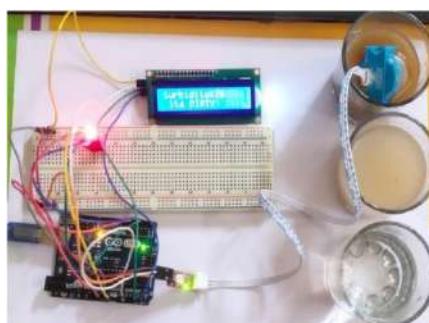


Figure 13. Result of dirty water

V. CONCLUSION

The project "Measuring Water Quality Using Arduino and Turbidity Sensor" has been successfully constructed and tested. system that monitors the water sources' water quality in real time. Using the Water Quality Monitoring, researchers may anticipate environmental natural processes, learn from them, and determine how humans affect an ecosystem (WQM). These measurement attempts can guarantee that environmental requirements are being met in addition to aiding with restoration work. The WQM, which utilises IoT technology, needs to be a useful and efficient system for monitoring drinking water quality.

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Crime Rate Prediction Using Web Scraping

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Abstract: Crimes result in devastating ramifications in a society. It affects the quality of life, economic growth, and reputation of a nation. It hinders development. Unfortunately, the annual crime rate is increasing year by year at an alarming rate. Therefore, it is necessary to take any and every measure possible to keep the crime rate low. There exists a vast amount of data pertaining to crime and it is not being used to its full potential. Processing and analysing this data will provide valuable insights. These insights can be used by law enforcement agencies to effectively reduce the crime rate. Therefore, we want to scrap the web for any data related to crime and do real time data collection using our developed portal which will be used by police stations to fill up the details. After which we will clean and process the obtained data using Natural Language Processing techniques. With this refined data, we will use Machine Learning algorithms to make crime rate predictions for the future. We use PowerBI to visualize the data to draw meaningful conclusions and identify trends, there is a need for advanced systems and new approaches for improving crime analytics. This will help law enforcement agencies like the Government to effectively reduce crime rate.

Index terms: Natural language processing, Web scraping, Machine learning

I. INTRODUCTION

In any society, crimes bring down the morale, happiness, and safety of the people. It ignites fear in people and hampers their general well-being. Having a high crime rate can also affect the reputation of a place. People who can afford to migrate will do so leaving only people with lesser means in that place. A lot of fear will be instilled in people and therefore they will have an aversion to that place. Therefore, it can take a significant toll on its tourism. This can lead to loss of revenue. Inevitably, a high crime rate can set the society as a whole back and hinder development.

A lot of data has been collected and stored, especially now in this age of the internet. However, this data is not being used to its full potential. It is like a gold mine that is left unexplored. It is unfortunate that we have the means and the method to be able to reduce crime rate but it has not been put to use effectively. Crime rate prediction is a scientific and methodical approach that allows one to predict the rate of occurrences of crimes in the future using existing data pertaining to crimes that have already occurred. We obtain the

data related to crimes that have taken place through web scraping, predefined dataset provided by the government of India and real time data collection then clean and process it. This makes it significantly easier to analyze the data and identify patterns and trends. We make predictions for the future using Machine Learning (ML) algorithms.

All this will help in initiating corrective measures that will significantly bring down the crime rate. It will aid law enforcement agencies to a large extent as crime reduction is becoming one of the most important social issues in enormous metropolitan areas as it affects people's security issues, youngster growth and personal socio-economic status. The prediction and analysis we will do using our developed system can help Government bodies to identify several trends and pay more attention to the areas which are more prone to crimes and take appropriate actions within time.

Technology Used:

1.1 Programming Language: For our project, we used python which is a high-level object-oriented programming language popularly used for rapid application development. It has built-in data structures and dynamic binding. We used python library beautifulSoup in our project for web scraping, Google Translate for multilingualism, geopy.geocoders for identifying location of the crime.

1.2 NLP techniques: We have used Natural Language Processing techniques namely, POS Tagging for categorization and cosine similarity for removing repetitive news,

1.3 PowerBi (Dashboard): We have Visualized data on the dashboard of Power BI with dynamic map charts and different dynamic charts like Pie charts, Bar charts and dynamic lists.

1.4 Python Flask: Flask is a web framework that provides libraries to build lightweight web applications in python.

1.5 Machine Learning: We have used several machine learning algorithms like Non-Linear Regression, Logistic regression, K-Nearest Neighbor for prediction and classification.

Section I is the introduction that provides context to the project. Section II contains the problem statement which is a crisp paragraph on the rationale and objective of the project. Section III is the literature review which gives a broad overview about existing research work that is similar to our own, done by others and their shortcomings. Further, section IV is the Methodology that describes in detail our workflow and process. It also contains a description of all the tools and technologies employed. Section V encompasses the result of our work. Finally, section VI contains the references used throughout this project.

II. LITERATURE REVIEW

Analysis and prediction of crime is an important activity that can be optimized

using various techniques and processes. Lot of research work is done by various researchers in this domain. In one of the papers, the author developed the tool which provides a framework for visualizing the crime networks and analysing them by various machine learning algorithms using Google Maps and various R packages. The project analyses these crime networks by means of various interactive visualizations. The interactive and visual feature applications report and discovers the crime patterns. The work started with Data Collection, then Data Pre-processing and followed by data Visualization and finally Crime Prediction using Machine Learning Techniques. For the Crime Classification, authors have used the K- Nearest Neighbour (KNN) method. In K-NN classification, the output is a class membership. An object is classified by a majority vote of its neighbour, with the object being assumed to be the class most common among its k nearest neighbours. This algorithm can be applied to the crime dataset. Suppose a theft has happened in a house, then the house next to it is also vulnerable for the theft as the criminal estimates the security is less and can try for the theft at the same locations again. Hence, the areas nearby the previous crime location are more probable for crime occurrence. For the crime prediction, Naïve Bayes algorithm is used which is based on Bayes theorem which describes the probability of an event based on the prior knowledge of conditions that might be related to the event. And finally for the visualization the various modules of the tool are developed in R by using various R libraries mainly RgoogleMaps, googleVis, ggplot2 and ggmap [1].

Another paper uses different clustering approaches of data mining to analyse the crime rate of Bangladesh and K-nearest neighbour (KNN) algorithm is used to train the dataset. Prediction rate of different crimes at different places is calculated by analysing the data and different algorithms are used to determine the prediction rate of the path. Finally, for the safe route, forecast rate is used. Multi-linear regression is used to find a relation between the dependent variables (Victim age) and a set of independent variables whose input values gathered from the crime spot. This methodology predicts the Era of the victims age values based on the input characteristics indicated in the metadata column. For predicting criminal activity, Z-Crime Tools and Advanced ID3 algorithm with data mining technology is used. And finally, Forensic Toolkit 4.0 is used to remove research and visualization of data. This uses the K-Means Clustering algorithm for unsupervised learning to determine the crime rate [2].

Apriori algorithms are used on the datasets to find spatial and temporal criminal hotspots. Apriori is one of the basic algorithms for mining frequent patterns. It scans the dataset to collect all item sets that satisfy a predefined minimum support. The goal of using this model is to find all possible crime frequent patterns regardless of the committed crime type. Hence, the algorithm is implemented on location and time features and excludes the crime type feature. Additionally, to obtain more frequent patterns were applied constraint-based mining by restricting the extraction process on the frequent patterns

having this formula of three specific item sets (Location, Day, Time).

Using predefined thresholds all the interesting patterns are extracted. By the analysis of the dataset, conclusions are made about the most likely crime locations along with their frequent occurrence day and time. Using Bayesian classifiers, prediction on the type of crime that might occur in a specific location within a particular time is done. Finally, some demographics analysis is done using the Denver neighbourhood demographics dataset. Decision Tree Classifier Decision is also used as a supervised learning algorithm. It creates a model to predict the class label values by learning simple decision rules implied from the data features [3].

Different techniques for Crime rate prediction are discussed which as well includes data mining techniques that consists of Association Rule Mining, Classification Rule and Clustering. The next is Crime cast which can done by Multivariate Time Series Clustering, Support Vector Machine, Bayesian Network, Fuzzy Time Series and Artificial Neural Network and finally deep learning technique [4]

Lastly, research was conducted to prevent and respond to crimes by predicting crimes based on artificial intelligence. To predict the occurrence of crime in advance and prepare countermeasures, crime records are analysed that occurred in the past and predictions are done about types of crime and tools used in crime using Multiclass Logic Regulation algorithm which can increase model stability through fast learning time and unnecessary variable selection, and the Multiclass Neural Network, which can create accurate and highly complex models. Through further research, this researcher plans to create a model that predicts the probability of a criminal again committing a crime according to the type of crime and deploy it to web services [5]

One of the major gaps that we came across in the research papers is that most of the papers have used pre-defined datasets and hence are not doing real-time analysis and prediction, and to solve this gap, we are scraping news from the web and collecting data in real-time. Another issue that is seen is language, since we have to collect and process as many news websites as we can, ranging from local to national news, language is one of the major challenges as local newspapers are in their native language and this can be solved using a language-independent approach.

We would also like to use several resources to extract crime-related news to create an accurate and comprehensive dataset. While doing so, there is a chance that we will encounter the same news from different sources and hence this repetition should be filtered out from the dataset to get better accuracy. Also, oftentimes we see cases that go on for a long period of time. News websites write follow-up articles on these from time to time. We have to club all of them together otherwise the model will count them as separate crimes and our inferences and predictions will be faulty. To get more relevant information

about the particular crime, we would require a description. Unfortunately, the predefined data sets which are used in other works do not provide any. Moreover, some of the news headlines can be a little ambiguous. It could fall into more than one category of crime. Apart from that, it could also be that the headline is figurative and not quite literal. In this case, sentiment analysis will help us get a clearer idea of what the news article is about. This way we can classify it more accurately. We have used several ML techniques for crime prediction to figure out the best model. In most of the research papers, crime areas are classified in three main regions depending on the number of crimes happening, but we used K-Means algorithm to classify the area into 5 major categories, namely: Very Low, Low, Medium, High, and Very High.

III. PROPOSED METHODOLOGY

In this section we will discuss the workflow and techniques adopted in our project. We started off with data collection. Then we processed the collected data using various NLP techniques. Then we proceeded to analyse and interpret the data. For easier interpretation, we have also visualized the data. Finally, we've made predictions for the future using Machine Learning Algorithms. To make our project real time, we also made a website which will require the time, date, state, district, type of crime and then using that data we will be showing different visualization through pie chart and bar chart so that it helps police and local people to know about how many crimes had happened and all which time is more prone to crime that is day time or night time. Figure 1 shows the workflow of the model and the detailed explanation of each step is given below.

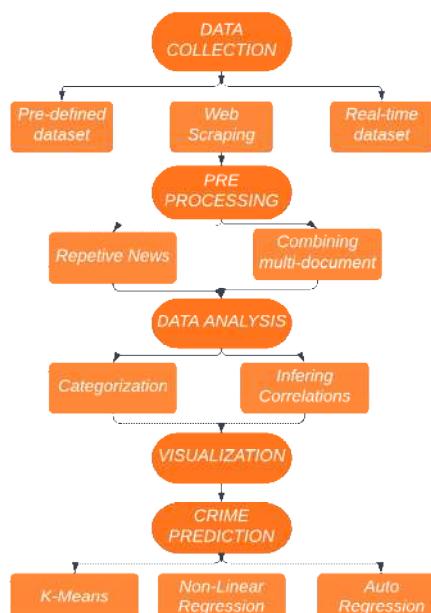


Figure 1. workflow of the model

3.1 Data Collection: First step has to make a dataset for our research work. We have made the dataset using following two strategies:

3.1.1 Predefined dataset: We have taken a predefined dataset for the year of 2013, 2014, 2015, 2016, 2017, 2018, 2019 and 2020 from the Indian website of the national crime record bureau i.e., (<https://ncrb.gov.in/en>) and extracted 7 major crimes that we have considered namely Murder, Robbery, Rape, Accident, Kidnapping and Suicide from it. Figure 2 shows the dataset we took from the government website. Figures 2 shows the predefined dataset from government website.

Districtwise IPC Crimes - 2020																				
S. No	State/UT/District	Culpable Homicide		MURDER		Causing Death by Negligence							Dowry Deaths (Sec.304-B IPC)	Abetment of Suicide (Sec.305/306 IPC)						
		Murder (Sec.302 IPC)	Murder (Sec.304 IPC)	Causing Death by Negligence relating to Road Accidents		Deaths due to Negligence relating to Road Accidents		Hit and Run	Other Accidents (other than Hit and Run)	Deaths due to Negligence relating to Rail Accidents	Deaths due to Medical Negligence	Deaths due to Negligence of Civic Bodies	Deaths due to other Negligence							
				Deaths due to Negligence relating to Road Accidents		(Sec.304-A IPC) (Col.6+Col.7)	(Total)													
				5	6															
1	State: Andhra Pradesh	2	3	4	5	6	7	8	9	10	11	12	13	14						
1	1 Anantapur	104	5	109	553	541	sn	508	0	0	0	12	17	66						
2	2 Chittoor	41	15	56	461	459	38	421	0	0	0	2	14	39						
4	4 Iduki	28	1	29	58	51	13	38	0	1	0	6	1	3						
5	5 Kannur	18	2	20	156	152	1	151	0	1	0	3	0	2						
6	6 Kasargod	16	0	16	65	64	0	64	0	0	0	1	0	3						
7	7 Kollam Commr.	23	2	25	136	136	0	136	0	0	0	0	0	1						
8	8 Kollam Rural	18	6	24	67	65	3	62	0	0	0	2	0	0						
9	9 Kottayam	22	2	24	149	142	12	130	0	0	0	7	0	1						
10	10 Kozhikode Commr.	5	4	9	76	75	1	74	0	0	0	1	0	0						
11	11 Kozhikode Rural	7	4	11	122	120	2	118	0	0	0	2	0	2						
12	12 Malappuram	18	4	22	224	217	2	215	0	1	0	6	0	4						
13	13 Palakkad	29	8	37	211	210	1	209	0	0	0	1	2	4						
14	14 Pathanamthitta	14	4	18	77	74	1	73	0	0	0	3	0	3						
15	15 Railways	1	0	1	0	0	0	0	0	0	0	0	0	0						
16	16 Thrissur Commr.	18	3	21	124	118	0	118	0	0	0	6	0	3						

Figure 2. Predefined Dataset

3.1.2 Web scraping: We have extracted crime news from several news websites using web scraping. We have scraped the following information about a particular crime from the news article given in the website and stored in the csv file and Figures 3 shows the dataset we have extracted from news website using web scraping:

- Headline of the crime
- Date of the crime
- District and State where the crime happened
- Description of the crime

1	Headline	2	date	3	district	4	description
2	Incident of taking away ATM in Kurukshetra busted, three murdered	27-Apr-22	Kurukshetra	Kurukshetra, Jagran Correspondent.	The police has solved the incident of theft of the		
3	Union Bank robbery case to Hisar, 6th accused arrested for getting a car on rent from Zirakpur	26-Apr-22	Hisar	Jagran Correspondent.	The STF has arrested the sixth accused in connection w		
4	Two sisters burnt alive in fire, helpless mother searching for daughters in ashes	26-Apr-22	Karnal	Shahabad (Karnal), (Jatindra Singh Chugh), If two flower-like daughters are burnt alive			
6	Ground dispute became the reason for indiscriminate firing, elder brother died, four including	26-Apr-22	Jhajjar	Bahadurgarh, Jagran Correspondent.	The elder brother lost his life at the hands of th		
7	Married woman went missing, relatives searched and dead body found hanging in closed chaj	26-Apr-22	Karnal	Gharaunda (Karnal), Dialogue Associate.	A married woman hanged herself under sus		
8	The girl was given the pretext of getting a job, raped by giving intoxicants	26-Apr-22	Yamunanagar	Jagran Correspondent.	A 15-year-old girl resident of the colony of Gar		
9	Preparations were being made to celebrate birthday at home, Home Guard jawan died in a	26-Apr-22	Karnal	Indri (Karnal), Dialogue Associate.	A Home Guard jawan returning from duty died in		
10	What kind of son is this, after the death of the father, the mother is torturing, beating, biting	26-Apr-22	Karnal	Karnal, Jagran Correspondent.	Sir I am in danger of my son's life. If he is injured by b		
11	Property dealer abducted in Jind, third degree torture hung upside down from tree	26-Apr-22	Jind	Jind, Jagran Correspondent.	In the case of kidnapping property dealer Kapil, resident		
13	Bahadurgarh Manish murder case solved, tenant's minor son turns out to be the killer	26-Apr-22	Jhajjar	Bahadurgarh, Jagran Correspondent.	In the Lineup area of Bahadurgarh, a case of m		
15	Kala Rana along with Goldie Brar solved the double murder maze, this is how it was revealed	26-Apr-22	Ambala	Ambala, Jagran Correspondent.	Virendra Pratap alias Kala Rana along with Goldie Br		
17	Youth dies after falling from third floor in Panipat, allegation- wife pushed	26-Apr-22	Panipat	Panipat, Jagran Correspondent.	A young man died after falling from the third floor o		
18	Robbery in the historic camp of Haryana, 4 miscreants took Mahant hostage and searched the	26-Apr-22	Kaithal	Kaithal, Jagran Correspondent.	In the historic Dera Baba Rajput located in Kaithal v		
20	Fear of miscreants, crime graph rising in Yamunanagar, murder and robbery untrace	26-Apr-22	Yamunanagar	Jagran Correspondent.	Crime graph has increased in Yamunanagar sin		
21	A mistake was made, the police reached the accused who robbed the Union Bank of Hisar	25-Apr-22	Hisar	Hisar, Jagran Correspondent.	In the case of dacoity of 16.19 lakh from Union Bank b		
22	America's flight was full to fulfill dreams, life was hanged in Tanzania	25-Apr-22	Kurukshetra (Pehowa)	Kurukshetra (Pehowa) (Kurukshetra), Dialogue thread.	Sanjot had lost his mother in his childhood		
23	Finance company's recovery agent was shot by members of Thurana gang in Bahadurgarh, on 25-Apr-22	25-Apr-22	Bahadurgarh	Bahadurgarh, Jagran Correspondent.	A week ago, the police has revealed the case of		
25	The dead body of the driver of the Agriculture Board was lying in the car, was stationed	25-Apr-22	Karnal	Karnal, Jagran Correspondent.	The dead body of a person was found late on Sunday		

Figure 3. Dataset from web scraping

3.2 Data Pre-Processing:

We are doing pre-processing on the data we have scraped using web scraping. Since we have to collect and process as many news articles as we can, ranging from local to national news, language is one of the major challenges as local newspapers are in their native language, so we build a language independent approach where we converted news in local languages like Hindi, Tamil, Malayalam etc. to English. We had taken local newspapers which were in the native language of a place, translating it to English and then processing that data as well. After this step we have a language independent dataset with all types of crime news. Figures 4 shows the modified dataset we get after pre-processing.

SR. NO.	ODISHA	MURDER (2013)	MURDER (2014)	MURDER (2015)	MURDER (2016)	MURDER (2017)	MURDER (2018)	MURDER (2019)	MURDER (2020)	MURDER
1	Angul	201	147	100	220	201	216	341	100	1526
2	Balasore	166	197	187	189	166	234	265	187	1591
3	Baragarh	111	147	214	148	111	144	132	214	1221
4	Berhampur	106	107	91	120	106	108	122	91	851
5	Bhadrak	177	125	144	181	177	171	129	144	1248
6	Bolangir	135	96	132	129	135	175	160	132	1094
7	Boudi	71	59	49	64	71	64	38	49	465
8	Cuttack	101	95	96	133	101	117	128	96	867
9	DCP BBSR	157	144	95	174	157	126	156	95	1104
10	DCP CTC	64	75	60	103	64	98	100	60	624
11	Deogarh	44	48	55	38	44	72	41	55	397
12	Dhenkanal	155	226	172	169	155	220	104	172	1373
13	Gajapati	38	39	35	32	38	29	38	35	284
14	Ganjam	476	338	359	351	476	414	395	359	3168
15	Jagatsinghpur	122	105	109	122	115	135	144	109	961
16	Jajpur	78	95	80	78	84	135	199	84	833
17	Jharsuguda	56	53	67	56	60	54	84	60	490
18	Kalahandi	112	93	107	112	119	109	123	119	894
19	Kandhamal	88	43	79	88	94	74	42	94	602
20	Kendrapara	118	74	103	118	285	124	239	285	1346
21	Keonjhar	194	178	200	194	187	221	244	187	1605

Figure 4. Dataset after pre-processing

Since we've taken data from various sources, there is a high chance that the same news will be repeated multiple times. If we don't remove this repetition, our analysis and prediction will be affected. We have used cosine similarity to identify similar news and remove them from the data set. However, from different sources the information can still be slightly different. In order to not lose this additional information, we have also created a multi document for each of the repetitive news where all the similar sentences are removed and unique information is retained.

3.3 Data analysis:

In the step, we are classifying all the crime news that we have extracted into 7 main categories i.e., murder, rape, suicide, robbery, dowry, accident and kidnapping with the help pf headlines and detailed paragraph. Anything that does not fall under any of these will be classified under others. To do this, we made smaller datasets that we manually classified. Each of these datasets have crimes falling under one category. Then, we extracted the keywords from each of these datasets using NLP techniques like POS Tagger and Porter Stemmer. Using the keywords extracted, we ran it on a much larger dataset to classify it on the basis of those keywords. After this step, our dataset is improved and ready for visualization and prediction. Figure 5 shows the category of crimes we decided to go with in this project.

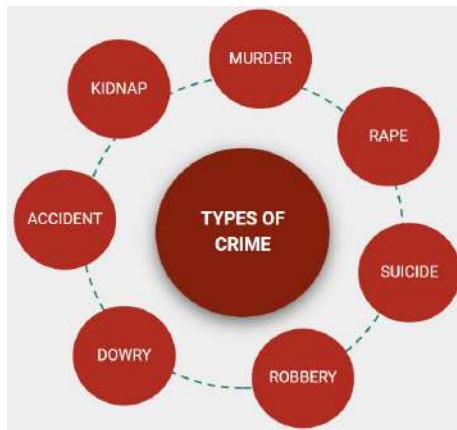


Figure 5. Categorization of crimes

3.4 Visualization:

In this step, we are going to visually represent our inferences using various data visualization techniques. We are going to show pie charts and bar charts with the help of a dataset and try to show underlying trends or patterns of different crimes.

3.5 Crime Prediction:

For crime prediction we are using several machine learning algorithms. Firstly, we will be predicting the crimes for 2020 with the help of 2019, 2018, 2017, 2016, 2015, 2014, and 2013 dataset and compare it with the pre-defined dataset and this will help us to calculate our accuracy and later we will predict the crime rate of 2021 and will compare it with the news we have scraped from different news websites.

We are using three different algorithms namely K-Means clustering, Linear Regression and auto-regression time series forecasting. These algorithms are discussed in detail in the section of the report. We are drawing meaningful inferences like which is the most and least crime-prone area and what types of crime is leading in which all places and predicting the number of crimes of 2021 and 2022 using these algorithms.

IV. BASIC CONCEPTS/ TECHNOLOGY USED

4.1 Web Scraping:

We have extracted data from different news websites using web scraping. There are many web scraping tools to choose from like BeautifulSoup, selenium, octoparse, and scrapy. We've used an inbuilt library of python called **beautifulSoup**. It extracts information from HTML and XML files. It then generates a parse tree from the page source code, which may be used to extract data in a more legible and hierarchical manner. Also, it was giving results faster than the other tools.

4.2 Multilingualism and location:

For the multilingual part, which is to convert any local language to English, we are using an inbuilt library of python called Google Translate. To use this library all we have to know is the codes of different languages defined in this library like for English the code is 'en' and for Hindi it is 'hi'. Now we just had to write this code in the program.

Example:

```
translated = GoogleTranslator(source='hi', target='en').translate(text)
```

Here source means the language you want to convert and target means the language in which you want to convert the source language.

While scraping the data instead of getting directly districts, we are getting cities as output but we are preparing a dataset for only districts so to find the district of that particular city we are again using an inbuilt library of python named geopy.geocoders:

```
location = geolocator.geocode(city)
```

Here we just have to replace city with city name and it will give all information about it.

Example: Jagadhri is a city in Yamunanagar.

```
location = geolocator.geocode("Jagadhri")
```

Output:

“Jagadhri, Yamunanagar, Haryana, India”.

From this, we can easily extract Yamunanagar and add it to the dataset.

4.3 Categorization:

For the categorization part, we are using NLP technology called POS tagger that is Parts Of Speech tagger to identify keywords from news headlines and then classifying the crime into various categories .POS tagger is basically a tool that assigns the part of speech for each word in a sentence.

Example: Let's take the example of the sentence, 'I enjoy reading on Saturday.' POS tagger will return

('I', 'PRP')----> Personal pronoun

('enjoy', 'VBP')----> Non 3rd person, singular verb

('reading', 'VBG')----> Gerund or present participle

('on', 'IN')----> Preposition

('saturday', 'NNS')----> Noun, plural

In order to reduce the number of comparisons and keywords, we've used porter stemmer. Porter stemmer converts a word to its stem word. For example, words like murders, murdering, murdered, murderous, etc, all have the stem word murder. So the keyword murder can effectively classify sentences that has any of these variations of the word murder.

4.4 Removing Repetition:

In order to get accurate interpretations and predictions we have to remove the same news cases that we've obtained from different sources. Otherwise, the model will count it as different cases and our data will be factually incorrect. To filter out repeated news we've used cosine similarity-based document similarity method. Cosine similarity computes the degree of similarity between two documents. In more mathematical terms it is the cosine of the angle between two vectors (in this case two documents).

However, simply omitting repeated data will lead to loss of valuable information. For example, an article in The Hindustan Times about a particular incident can have all the generic information and a similar article on The Times of India can have more information regarding the victim/offender. For this reason, we will use multi document summarization. All the information pertaining to an incident will be taken together and all the repeated information will be removed. For this process also we use cosine similarity.

4.5 Data Visualization:

There are many visualization tools available like PowerBI, Tableau, Google Charts, Visual.ly, etc. We are choosing to work with Power BI because as it is a Microsoft tool, it is compatible with Microsoft products and there are no speed and memory constraints. We started with cleaning the data and arranging it in a way that can be visualized on the dashboard of Power BI with dynamic map charts and different dynamic charts like Pie charts, Bar charts and dynamic lists.

4.6 Machine learning Algorithms:

We have used following Machine Learning algorithms to classify the crimes in different areas and predict crime for future

4.6.1 K-Means: We have used K-mean clustering algorithm to divide districts according to the number of crimes into different crime rate area. We have categorized the crime rate area into 4 types namely, very high, high, medium, and Low

K-Means Clustering is a popular unsupervised learning algorithm that divides the unlabelled dataset into various clusters. K is the number of predetermined clusters that must be produced during the procedure; for example, if K=2, there will be two clusters, K = 3, three clusters, and so on. In our project. We have put the value of K = 4 as we have defined the rate of crime type in 4 categories discussed above. We have made a program such that one has to type the district and the corresponding year of which he wants to see the crime rate. Then our program will show the output as low, medium, high or very high.

4.6.2 Non-linear regression: Nonlinear regression is a type of regression analysis that involves fitting data to a model and then expressing the result as a

mathematical function. In our model we are using a logarithmic function to draw the most fitted line. Nonlinear regression is much more flexible in the shapes of the curves that it can fit. We have used the equation $y = A2\ln(x) - A1$ on the dataset of 2013 to 2020 and later predicted all the 7 crimes in 2021 and 2022. We have used Microsoft Excel tool for implementing Non-linear regression. Figure 6 shows prediction of Rape using Non Linear Regression.

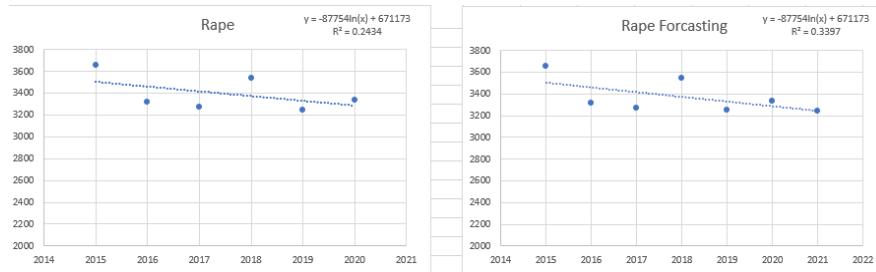


Figure 6. Non-Linear Regression

4.6.3 Auto-regression: In an autoregression model, we forecasted the crime using a linear combination of past values of the variable. Autoregression is a time series model that uses observations from previous time steps as input to a regression equation to predict the value at the next time step. Autoregressive models are remarkably flexible at handling a wide range of different time series patterns. We have made a program in which the user has to select the state, district, year and type of crime and using Auto-regression technique we will predict the crime of 2021 and 2022. For the training and testing of the dataset we have used our own well-defined dataset of crimes from 2013 to 2020.

V. IMPLEMENTATION & RESULTS

5.1 We have created a comprehensive dataset for the year 2021 by scraping the web for crime related news. After web scraping the dataset contained the headline, date, place and description of the crime. Using this information, we programmed a classifier that classifies the crime into murder, accident, rape, robbery, dowry, kidnapping, and suicide. We've scrapped the details of 1457 crimes. This gave us insights on how many crimes under the various crime types took place.

5.2 From the pre-defined crime rate dataset of years 2013, 2014, 2015, 2016, 2017, 2018, 2019, and 2020 we've successfully made predictions for the year 2021 and 2022. We've done this using Auto-Regression and we've calculated the accuracy.

5.3 Portal for Real time data collection: We have built a portal that will be used by several police stations to record real time news that will be used as database to predict crime and do analysis which is shown below in Figure 7.

CRIME RECORD FORM

Crime Title *

Crime Description

Date

Time

State

District

Crime Type

Murder Robbery Rape Dowry Suicide Accident Kidnap

Send

Figure 7. Portal for real-time data collection

5.4 Website to show future prediction and clustering: We have made the website using flask and python and apply autoregression to show the future prediction. Also, we have used the k-means clustering algorithm to cluster the district into 4 clusters as discussed. We have made a program such that one has to give input of the district and the corresponding year of which he wants to see the crime rate. Then our program will show the output as low, medium, high or very high. Figure 8 shows the screenshot of the website where we are using k-means clustering algorithm to classify districts into different crime rate area.

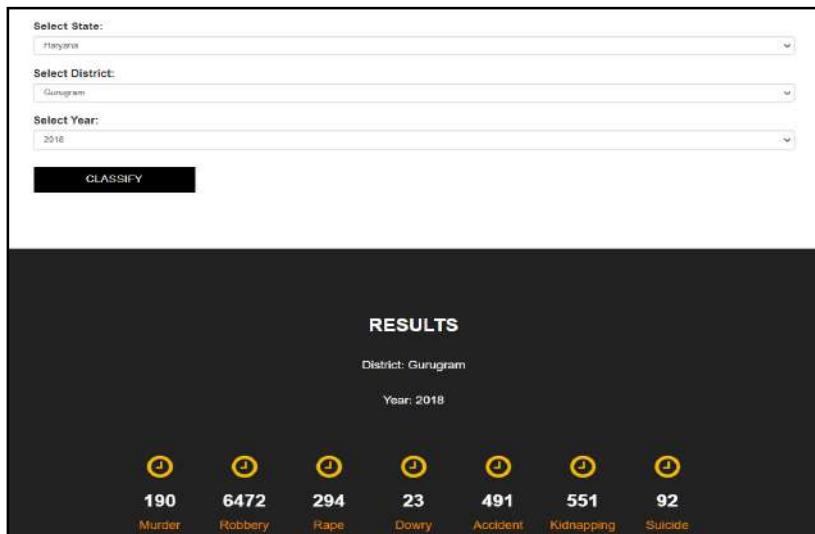


Figure 8. K-means Classification

Also, we have made the code where a user has to enter the state and the number of crimes in each crime type and then click on the submit button to see under which type of crime area it will fall under. Figure 9 shows the screenshot of the website where we are using k-means clustering algorithm to predict, where particular districts will fall in which crime rate area, given different crime numbers.

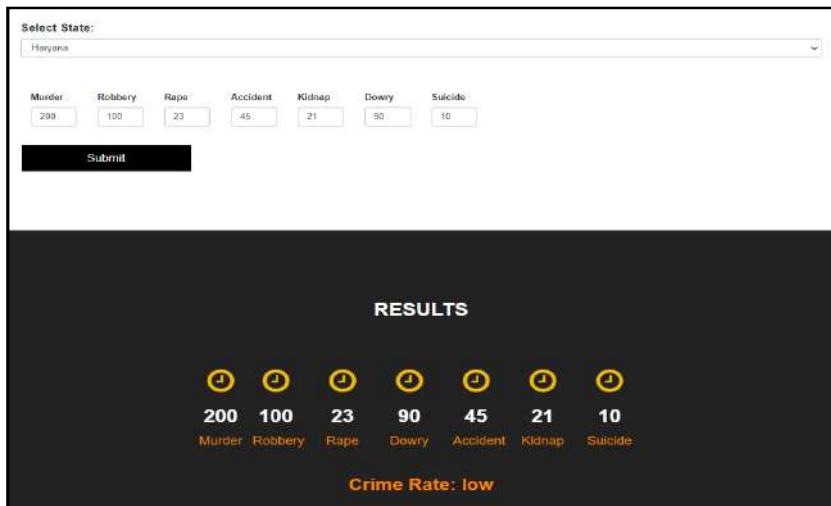


Figure 9. K-means Prediction

Now for predictions, the user must enter the state, district, year, and crime type then click on the predict button then it will show the predicted number of crimes that will happen. Figure 10 shows the screenshot of the website where we are using autoregression for predictions.



Figure 10. Prediction Using Autoregression

5.5 We have compared our prediction that we obtained from non-linear regression and auto-regression and found that mean square error is 138 which means that range of error in the predictions is approximately 138. Also, we've compared the predictions obtained from auto regression and nonlinear regression with the inferences of the web scraped data. The root mean squared error from auto regression is 208 and the same for nonlinear regression is 218.

5.6 PowerBI Dashboard for Visualization: We have built dashboard on PowerBi using the predefined dataset to show underlying trends in crime over the past few years. Firstly, we have visualized overall data of 8 years from 2013 to 2020, using Bing map, bar charts, buttons and slicers. In slicer we have added years where we can click on a particular year to change all the graphs and charts dynamically and give us all the information of that year i.e., number of crimes in that year. We can click on different cities of a state to get the information of crimes of that particular city. We can see that the overall crime rate of Haryana is decreasing from the year 2016 and several similar trends. The red spot in the map indicated that the bigger the dot, the more the number of crimes in that district is. We can also compare the number of crimes happening in a district of more than 1 year by just selecting the respective years. Figure 11 show the visualization of data on PowerBi.



Figure 11. Visualization on PowerBi

VI. CONCLUSION

Since we took very broad categories of crime, we have a lot of data points that got classified as 'others' therefore other categories should further be divided into other crimes. Not all crimes have been reported by newspapers. However, they will be counted in the statistics by the National Crime Bureau as an FIR was filed. Therefore, web scraping cannot give results as accurate as the National Crime Bureau. Also, as we know the crimes which are mostly covered in newspaper are big crimes like murder therefore the ratio of murders from

web scraping to murders from web scarping is greater than any other crime. Least ratio is of robbery as only big robberies get printed in news websites. We had an observation that the number of crimes happening in 2020 is less as compared to other years as there was a lockdown due to coronavirus. Also using web scraping we have found out that chances of crime to take place is more during day time for some districts and night time for some other districts. We tried to analyse the trend in crime with respect to the population of a state. Also till now we have considered only 3 states Haryana, Odisha and Uttar Pradesh and in future try to consider as many district in our project as possible.

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IoT Based Smart Vehicle

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Abstract. Drunkenness & sleep deprivation in driving is one of the main reasons for road accidents. Studies have shown that alcohol consumption reduces cognitive function and impairs the brain's functioning, leading to poor judgment. It also leads to alterations in vision, such as blurred or double vision. It also affects a person's logical thinking skills; therefore, they take unnecessary risks while driving without giving it a second thought. Furthermore, when a person is drunk, it is tough to concentrate while driving. Therefore, people can easily refrain from driving while intoxicated. However, many choose not to, making drunken driving one of the leading causes of road accident-related deaths and sleep-deprived drivers remain responsible for about 40% of the road accident. Thus, we need an efficient, cheap and adaptable monitoring system. In our proposed project, IoT based Smart Vehicle will observe the alcohol-drunken state, sleep deprivation, firing, and overturned accidents inside & outside of the vehicle. Then all the sensors & systems will activate, and the vehicle will slowly stop and park in the nearest zone. Then, it will send a message/call to a known person from the driver's contact list and inform them about the driver's situation and displays the situation in text in the vehicle also; so the other people on the road can notice.

Index Terms: Alcohol drunken state, Sleep deprivation, Firing, IoT, Smart Vehicle

I. INTRODUCTION

The number of road fatalities due to drunken driving is quite significant in India. Many lives have been lost on the road due to the irresponsible actions of drunk drivers. As per the latest report by the Ministry of Road Transport and Highways on road accidents in India, drunken driving is the third major cause of road fatality, with the first being over speeding, followed by lane indiscipline. There have been 12,256 accidents in 2019 related to drunken driving, where 5,325 persons were killed and 10,564 were injured. People killed in drunk driving-related road accidents account for a 3.5% share of total road fatality. It showed an increase in deaths compared to the previous year. People can easily refrain from driving while drunk. However, many choose not to, making drunken driving one of the leading causes of road accident-related deaths. Sleep-deprived drivers remain responsible for about 40% of road accidents, according to enforcement officers patrolling the highways and major streets here. It is particularly applicable to fatigued drivers, who doze off at the wheels between midnight and 5 am on our highways—stated that they usually

ascertain the cause of the accident owing to sleep deprivation by analyzing the tyre markings.

There will be no signs of the driver applying the brakes near the accident spot as he would have got up only after ramming into another vehicle [1]. In our project, IOT SMART VEHICLE, I will make a system to monitor the alcohol smell, the alcohol drunken state, sleep deprivation, firing, and overturned accidents inside & outside of the vehicle, then all the sensors & system will activate. The car will slowly stop and park in the nearest zone, then send a message/call to your saved person in which situation you are and also display the situation in text in the vehicle; so the other people on the road can notice [2].

II. BASIC CONCEPTS AND TECHNOLOGY USED

The main primary purpose model is designed using an Arduino UNO, MQ3 alcohol sensor, IF light sensor, Ultrasonic sensor, LCD Display, gravity sensor, Node-MCU and GPS module. The first step was to measure and study the characteristics and features of the sensor. In the second step, it will detect any alcohol drunken states by the MQ-3 sensor, sleep deprivation by the ultrasonic sensor, and firing if the gravity sensor overturns a sensor. Finally, the activated sensor will send the signal to the microcontroller. Four things will happen, i.e., 1st vehicle will slowly stop, or the engine will lock; 2nd give an alarm in the car displaying text about which situation you are in; 3rd, the Node-MCU and GPS module will send a call/ message to your known person. If the known person responds within 15 minutes, then it will send to the nearest Police station. The secondary purpose model uses a Node- MCU, L298N motor driver, Ultrasonic sensor, spray pump, Relay, Servomotor, and tank. This model is used for creating the above accidents and situations and controlling the vehicle, 1st, I will control the vehicle wirelessly 2nd, spray alcohol or switch on fire; 3rd, overturn the vehicle; all things are held wirelessly using a Smartphone. For that purpose, I made this system to stop road accidents, and the designs are cheap and reliable. [3-4]

III. BACKGROUND WORK AND TECHNOLOGY GAP IDENTIFIED

The alcohol-drunk state, sleep deprivation, firing, overturned, Huge road network and road traffic because increasing number of road accidents. Road accidents are a subject of great personal tragedy and social and economic losses. Road accidents are increasing at an alarming rate day by day. It causes high road damage, and people lose their family members because of low awareness. If we implement the system in the vehicle, then all accidents will decrease. And it has no drawbacks and is cheap and reliable [8-9].

IV. PROPOSED MODEL

Now I proposed a sensor monitoring system which helps us to configure the accident happening things. I used several sensors to detect the accident

happening items. It will display and send messages or calls to a known person. If the known person is not responding within 15 minutes, then it will send to the nearest Police station.

WORKING: i. Primary: Sensors are calibrated to make output voltage proportional to the PPM MQ3 alcohol sensor. The voltage sensed is converted to a digital value using an in-built ADC of Arduino. The digitized value shows the situation in which you are and display on the LCD screen and then node-MCU will send signals to the L298N motor driver then the motor driver will stop sending voltage to the motors. Receiving a signal from the Arduino, the Gps module will start to send messages/calls.

ii. Secondary: Wirelessly, I will control the vehicle to the accident situation, e.g., alcohol, sleepiness, fire, detecting and overturning the vehicle with a servomotor and a pump to spray the alcohol. [4-7]. Figures 1,2,3, and 4 represent the block diagrams and circuit diagrams of the proposed model.

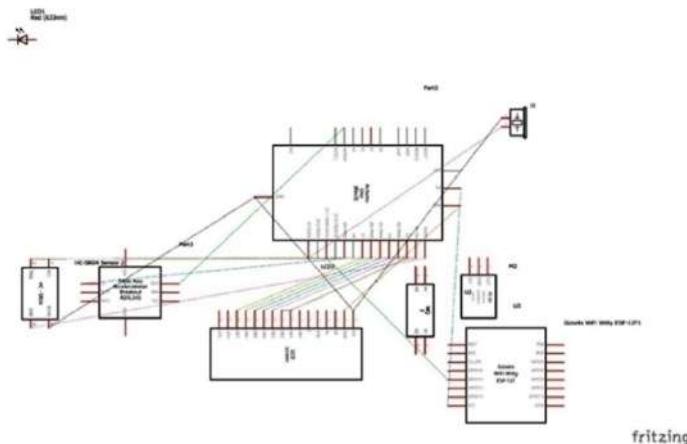


Figure 1. Block diagram

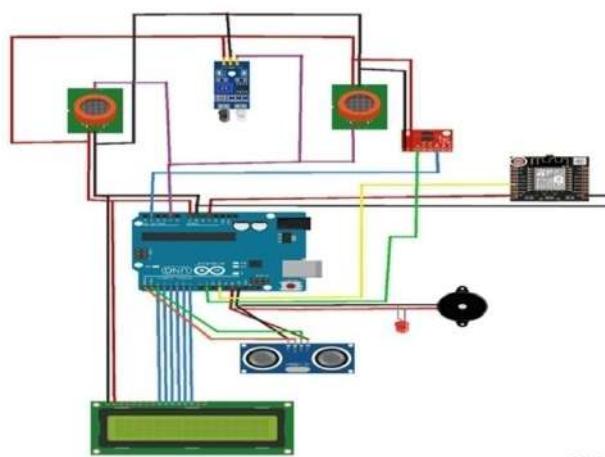


Figure 2. Circuit diagram 1

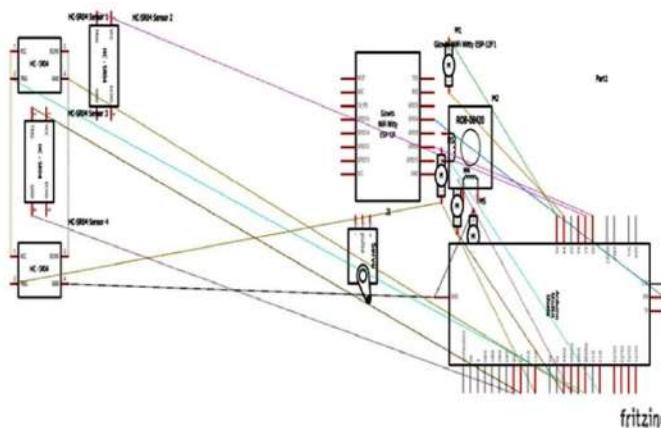


Figure 3. Block diagram 2

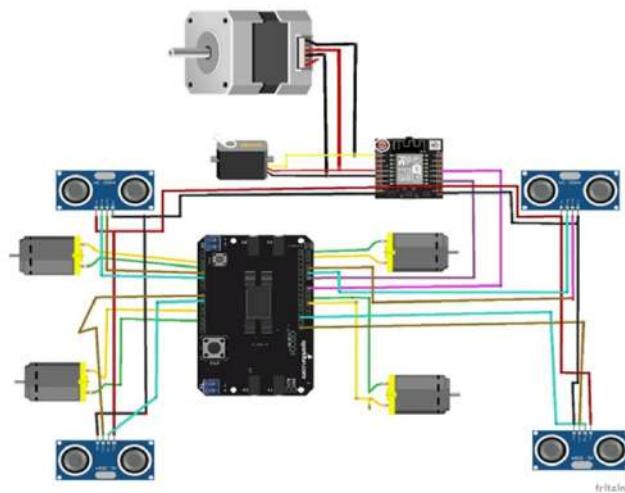


Figure 4. Circuit diagram 2

Components used- Arduino UNO, Node MCU, ultrasonic sensor, motor, L298N motor driver, MQ3 alcohol sensor, if a sensor, Gravity sensor, LCD screen, led light, speaker, servo motor, motor pump, jumper wires.

V. IMPLEMENTATION AND RESULTS

Developed an intelligent vehicle monitoring system which monitors the alcohol drunken state, sleep deprivation, firing, and overturns using an Arduino, which can be placed in any vehicle. It alerts and analyzes the result, and by using IoT, we enhance the monitoring process of accidents. So, we used many sensors which sense the situation level and use IoT to act. This is shown in Figure 5.

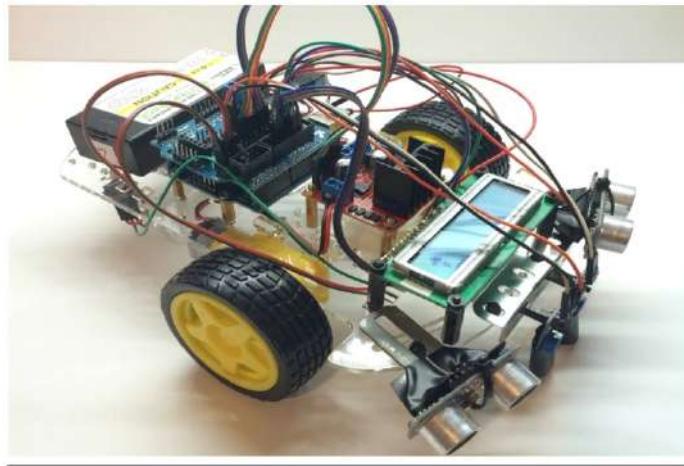


Figure 5. IoT based Smart Vehicle

VI. CONCLUSION

Our developed intelligent vehicle monitoring system will detect the alcohol drunken state, sleep deprivation, firing, overturned and any of them, e.g., alcohol drunken state by the MQ-3 sensor, sleep deprivation by the ultrasonic sensor, and firing if a sensor, is overturned by the gravity sensor. The activated sensor will send the signal to the microcontroller. Four things will happen, i.g 1st vehicle will slowly stop, or the engine will lock; 2nd, give an alarm in the car displaying text about which situation you are in, 3rd. Then, Node-MCU and GPS module will send a call/ message to your known person. If the known person is not responding within 15 minutes, then it will send to the nearest Police station. Road accidents will decrease with time if we use this technology, and this whole thing will operate through IoT.

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Designing IoT-based Smart Agriculture Devices for Monitoring Crop Parameters

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Abstract- In human life, agriculture plays a key role. Nearly 58% of India's population engages in certain agricultural activities both directly and indirectly, which is their primary livelihood source. Nowadays, however, farmers have stopped farming and migrated to other sectors because of less automation adoption and other factors such as climate change and crop diseases. The goal of the concept is to reduce human involvement and thus increase farmer procurement in the agricultural sector. Most of the time, farmers need help getting a good yield, resulting in a decrease in income. This occurs for various reasons, such as soil moisture, humidity, temperature changes, etc.

Furthermore, the high prevalence of illnesses in the crop impacts the harvest's quality and quantity. IoT sensors can provide information about agricultural areas and can be easily monitored. This article aims to create a Smart Agriculture System that utilizes cutting-edge technologies, including Node MCU, IoT, and Machine Learning. Monitoring climatic conditions and early diagnosis of plant diseases are two critical components of increasing crop output. A feature of the proposed system is a plan's ability to monitor temperature, humidity, and wetness through sensors using NodeMCU and send SMS warnings.

Index terms: Agriculture, Automation, IoT, NodeMCU

I. INTRODUCTION

From the advancement of agriculture to the improvement of yields, mechanical and compound advances have been made to recognize, examines, and data about plant infections and condition in the cultivation area. With the ascent of IoT, it is planned to make a computerized framework for agribusiness that will empower the farmer to make informed current condition information regarding his farm and to determine wrong circumstances ahead of time. Early recognition of sicknesses and condition measurement is a significant test in farming areas. Plant disease identification is essential for the normal state of a plant that interrupts or modifies its vital functions. Plant disease identification of affected plants is one of the first steps in diagnosing a plant's disease. Agriculture productivity and the economy mainly depend on identifying plant diseases. Therefore, plant disease identification roles are vital role in the agriculture field. If proper care is not taken in this plant or area, it causes severe

effects on plants and due to which respective product quality or productivity is affected. And detection of plant disease is beneficial as it reduces the extensive work of monitoring big crop farms. At a very early stage itself, it detects the symptoms of diseases.

II. STATEMENT OF THE PROBLEM AND OBJECTIVE

This project aims to create an intelligent system for monitoring agricultural land and detecting plant diseases. The following are expected outcomes to meet the objectives:

- To keep track of variables such as soil moisture, temperature, humidity, etc., using IoT based system.
- To identify the diseases that impact plants at various stages of development using machine learning.
- Provide farmers with real-time data alerts and notifications.
- To make farming easier for farmers by allowing them to manage their operations from the comfort of their homes.

Block Diagram:

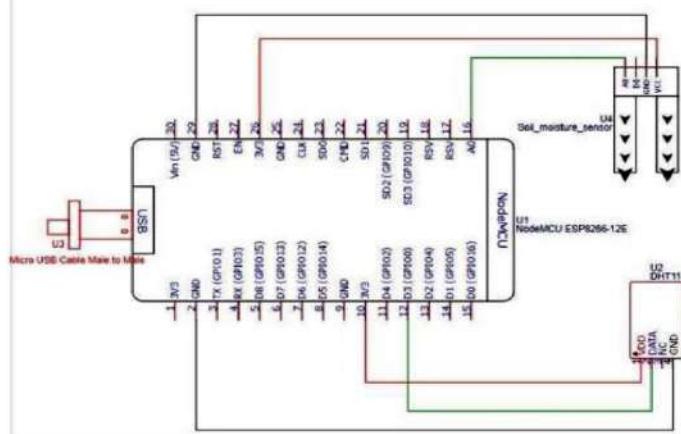


Figure 1. Block Diagram

III. BASIC CONCEPTS AND TECHNOLOGY USED

We used a NodeMCU that controls the two primary sensors that detect the soil moisture and humidity in the atmosphere around the chosen agricultural land. And for the detection of the damaged crops and we used convolution and neural network-based technology, which compares the given input image with several samples of damaged crop images, as shown in Figure 2. in the dataset, which consists of several thousands of models using CV.



Figure 2. Damaged crops

IV. IMPLEMENTATION AND RESULTS

The proposed system will try to detect conditions around the plant and in the soil. The information gathered about the ecological variables like temperature, soil moisture, and humidity will then be processed and will be stored and displayed to farmers using a cloud-based web application tool like ThingSpeak(IoT analytics tool that allows users to gather, visualize, and analyze live data streams in the cloud.).

- Temperature, Humidity values are detected by a DHT11 sensor. DHT11 is a primary, ultra-simple digital sensor. Soil Moisture will be detected using a Soil Moisture sensor.
- All sensors and Programs are installed in NodeMCU Module. It works as a Wi-Fi shield to send the information cloud stage to detect and analyze plant conditions.
- For disease detection, the project will use a pre-trained, convolutional neural network model (CNN) dataset with hundreds of sample plant leaf images.

All the above processes will produce the proposed function, i.e., to provide real-time metrics such as temperature, humidity, moisture level, etc., to farmers at their fingertips.



Figure 3. Initially detected leaf samples with diseases

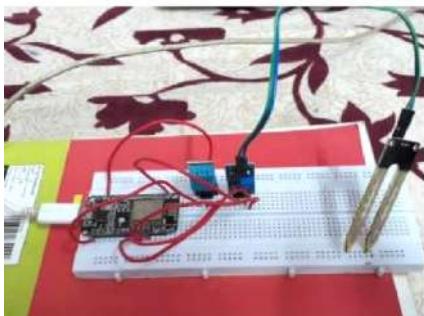


Figure 4. Implementation of the proposed model

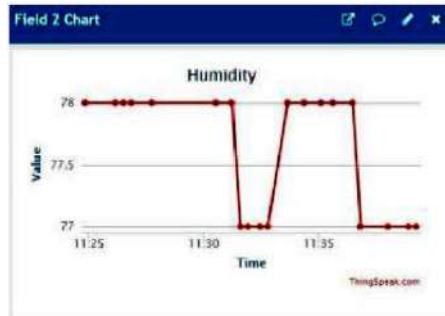


Figure 5. Field 2 chart

V. CONCLUSION

The proposed methodology uses sensor devices to detect temperature, humidity, and soil moisture parameters and detect diseases in the leaves by comparing them with other leaves in a dataset using ML. Thus, farmers may use this IoT-based Smart Farming technology, as well as Machine Learning-based plant disease detection, to increase.

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● Estimated benefits to society and generation of income

With this project's help, farmers can now monitor their crops and agricultural land remotely from any place. They can even detect the diseases occurring in their products from time to time.

This makes their work easy, and they can even do other activities previously used for crop monitoring during this time.

By this, the above project helps farmers maintain good crop production and a good income.

● Measurable indicators-

S. No.	Indicators
1	Increase in crop production
2	Increase in land productivity
3	Adoption of newly developed products indicated by the number of adopters

Readier-Reading Assistant for Visually Impaired People

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Abstract - The sense of vision plays a significant role in daily work. People with visual disabilities rely on their other senses to accomplish their tasks. In this paper, we present our project that helps visually impaired people recognize different types of texts in eBooks. With the help of the Readier app, visually impaired people can easily read the book. It will be built using the Kotlin programming language, and its UI will be built using Jetpack Composer. Optical character recognition (OCR) will be used to extract the text. To implement OCR, we will use the ML Kit and CameraX SDKs. Using the Text-to-Speech Google API, the extracted texts are converted into a voice. Through the mobile phone's speaker, this voice is delivered to visually impaired people. By using this mobile application, visually impaired people can reduce their dependence on others and read books on their own in multiple languages.

Index Terms - Android Studio, ML Kit, Jetpack Composed, OCR, Text-to-Speech Google API, CameraX, Kotlin programming language, visually impaired people

I. INTRODUCTION

A person gains knowledge of the outer world by using his visual senses. For those with vision impairments, managing their daily routine is a challenge. According to the World Health Organization, at least 2.2 billion individuals worldwide suffer from a near or distant vision impairment. Nearly half of these instances, or at least 1 billion, involved visual damage that either might have been avoided or is still unaddressed. Readier is an application for visually impaired people. It would help them to scan the entire document, be it an ebook or a text message, and convert the text into speech. Thus, reducing the dependency of visually impaired people on others and helping them with their daily needs. With the help of the Readier app, visually impaired people can easily read the book. It will be built using the Kotlin programming language, and its UI will be built using Jetpack Composer. Optical character recognition (OCR) will be used to extract the text. To implement OCR, we will use the ML Kit and CameraX SDKs. Using the Text-to-Speech Google API, the extracted texts are converted into a voice.

II. BASIC CONCEPTS/TECHNOLOGY USED

OCR: Optical character recognition (OCR) is a method of extracting text from scanned documents and images. We can extract the text using this technique.

ML Kit: It is a library for building mobile applications. With ML Kit, we can easily incorporate machine learning models into mobile apps.

CameraX SDK: CameraX is a Jetpack library, built to help make camera app development easier. Jetpack Composer: It is a modern toolkit for building native UI.

Text-to-speech: With the help of Google text-to-speech API, we can convert text into speech.

III. LITERATURE REVIEW

People who are visually challenged can read the book with the Reader app. It will be created using the Kotlin programming language, and Jetpack Composer will be used to create its user interface. To extract the text, optical character recognition (OCR) will be employed. We will make use of the ML Kit and CameraX SDKs to implement OCR. The captured sentences are transformed into voices using the Text-to-Speech Google API. Reader would be able to accurately extract text from documents and transform it to voice. The requirements of people with visual impairments can be met by processing and converting multilingual materials into speech format.

IV. PROPOSED MODEL

The first highlighted block in cyan detected the whole paragraph. The second set of highlighted blocks, in blue, detected the whole lines of text. Finally, the third set of highlighted blocks, in dark blue, extracted the words, as shown in Figure 1. For all detected blocks, lines, elements, and symbols, the API returns the boxes, corner points, and recognized languages. recognized text.

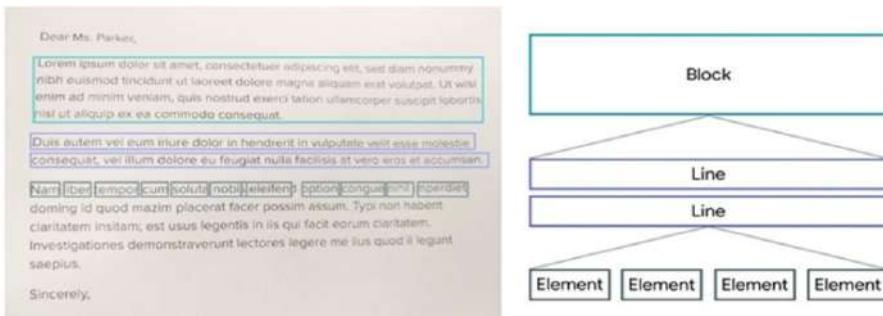


Figure 1. Text structure

With the help of OCR technology, we will extract the text from the document and send it to the API for text-to-speech conversion. Thereby, the person would be able to listen to the text written in the document as an audio.

V. IMPLEMENTATION AND RESULTS

This application can accurately convert the text present in the document to audio and provide it as a speech output to the user. This is shown in Figure 2.



Figure 2: Mobile Application

VI. CONCLUSION

In this paper, we have studied the Readier application, which is a reading aid for people with visual impairment. The benefit of this application would be to lessen the visually impaired individuals' reliance on others to meet their everyday requirements.

Readier would be further improved by incorporating facial recognition and environment-specific picture recognition techniques. Future work may involve creating tools that can recognise objects and extract language from moving pictures rather than still ones.

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Echo Text using QR Code Generator to Empower School Students

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Abstract: “Building own voice assistance using Python (Buddy)” is built using python language and using its built-in modules, packages, and API keys from internet. A voice assistant is a digital assistant that uses voice recognition, language processing algorithms, and voice synthesis to listen to specific voice commands and return relevant information or perform specific functions as requested by the user. Quick Response (QR) codes are two-dimensional (2-D) barcodes. QR code generator is software that stores data (e.g., URL link, text, Google map’s location) into a QR code. This encoded data can be decoded by scanning the QR code symbol with a mobile device that is equipped with a camera and a QR code reader software. QR codes have several purposes; they are mostly used in manufacturing, healthcare transportation, office automation, marketing and advertising and advertising. This project will describe various methods for the implementation of QR codes.

Index terms: Python, Quick Response Code, API

I. INTRODUCTION

BUDDY is Amazon’s voice based digital assistance that process an entire smart device ecosystem. BUDDY can reply to simple queries/complex queries and perform various tasks or commands that one gives. Also, it provides entertainment, information, and general assistance to its user capabilities. A quick response code (QR code) is a two-dimensional barcode, consisting of black and white squares, called modules. It encodes information such as a URL or a text message. By scanning a QR Code using a mobile phone, a user can get immediate access to its content. The QR code was developed in 1994 at DENSO Wave Incorporated and in 2000, the QR code was established as an international standard. Since 1994, QR codes have gained wide acceptance in various industries such as manufacturing (e.g., product traceability, process control, inventory and equipment management), warehousing and logistics (e.g. item tracking), retailing (e.g. sales management), healthcare (e.g. medical records management, patient identification, equipment and device tracking), transportation, marketing and advertising. With the rapid growth of smartphones and tablets, QR codes made their way into the educational process also.

This project generates the QR code and converts into TEXT TO SPEECH in all regional languages and helps in empowering the school children.

FEATURES:

- High-capacity data storage and small printout
- Dirt and damage resistant (QR codes have an error correction capability),
- Readable from any direction in 360 degrees with a structured appending feature.
- One QR code can be divided into up to 16 smaller QR symbols. Information stored in multiple QR code symbols can be reconstructed as a single data symbol.

The following are the different types of QR codes:

- Model 1 is the original QR code. The largest version of Model 1 is 14 (73 x73 modules); this version can store up to 1,167 numerals
- Model 2 is an improvement on Model 1. The largest version of Model 2 is 40 (177 x 177 modules); this version can encode up to 7,089 numerals. Due to its major feature (one position detection pattern, the regular QR code has three detection patterns located at the three corners of a symbol), the configuration of the Micro QR code allows printing in areas even smaller than the QR code. Maximum data capacity for the Micro QR version 4 code is 35 numerals.
- SQRC is a type of the QR code that has reading restriction function (e.g., can be used to store private information.), this functionality does not guarantee that the coded data is secure. It looks the same as the regular QR code.

In this project the QR code Model 2 was used.

TEXT-TO-SPEECH Improves accessibility

- Approachability is one of the major reasons why most people go for the read-aloud web option. Many people do not have the time to go through long bodies of text in the fast-paced life.
- Data shows how 21% of all readers prefer audiobooks and podcasts over traditional text. It is one of the ways people have equipped to keep up with everything in their busy schedules. Also, text to speech tech improves accessibility for children, adults, seniors, and makes content a lot more understandable and approachable.
- Our Assistance we are developing is having an additional feature of multilingual where local people can choose the language in which the voice assistance should work for them and respond to their queries, and it also has many extra features added in it which will be discussed in further sections.
- We have made sure to include some extra features that other voice assistants in the market lack like checking the internet speed, checking

RAM details of desktop we are working on, multilingual, downloading Instagram profile picture as we can't zoom on the app.

Removes language barriers

- Language barriers are one of the biggest issues online as with globalization, more and more cultural exchange can be seen across borders. People are learning new languages and reading different kinds of content. From Korean, French, German, to Spanish and English, there are all kinds of literature present online.
- Text to speech allows people to understand, learn fluency, pronunciation, and overcome the barriers of language and dialects.
- Therefore, some great text to speech tools offer detection of over 100 languages, so people from all over the world can use this technology and benefit from it.

Help reach a global audience

- In this globalized world, a business can cross borders and maximize profit, highlighting the need to cater to all kinds of people. Speech synthesis gives access to a very large audience, more than those who fluently read and write text.
- Multiple groups can benefit from the technology as text to speech online systems open ways for all to understand digital content with ease.
- There are around 244 million foreign-born people. Migrant families can benefit from read-aloud options—especially those who don't have proficiency in the language.

II. TECHNOLOGY USED

GOOGLETRANS

Googletrans is a free and unlimited python library that implemented Google Translate API. This uses

the Google Translate Ajax API to make calls to such methods as detect and translate.

Let's assume a scenario, we are traveling in Spain and we don't know how to speak Spanish or we are in any other country and we don't know their native language, then we can use this tool to overcome the problem. We can translate between all those languages which are present in google translator.

SPEECH RECOGNITION

The Speech Recognition library allows Python to access audio from your system's microphone, transcribe the audio, and save it.

Speech Recognition module using the following pip command. Type the below command in the terminal-

\$pip install Wikipedia: The above command will install the module in the system. Now, we need to import it using the following command - import speech recognition as sr.

WOLFRAM ALPHA

Wolfram Alpha is a computational knowledge engine or answer engine that can compute mathematical questions using Wolfram's knowledge base and AI technology. You need to fetch the API to use this package.

PYTTSX3

Google's text-to-speech package i.e., pyttsx3 converts your audio questions to text. The response from the look-up function that you write for fetching answer to the question is converted to an audio phrase by pyttsx3. This package interfaces with Google Translate 's API.

pyttsx3 module using the following pip command. Type the below command in the terminal-

\$pip install pyttsx3. The above command will install the module in the system. Now, we need to import it using the following command - import pyttsx3

WIKIPEDIA

Wikipedia is used to fetch a variety of information from the Wikipedia website. This module allows us to get and parse the information from Wikipedia. In simple words, we can say that it is worked as a little scrapper and can scrap only a limited amount of data.

Wikipedia module using the following pip command. Type the below command in the terminal-

\$pip install wikipedia. the above command will install the module in the system. Now, we need to import it using the following command - import Wikipedia

Features: Fetching information about a famous persons, or any instrument properties or so on.

WEBBROWSER

Web browser One of the most common commands a virtual assistant receives is opening a website like Google, YouTube, or Amazon. The Web browser module in Python takes care of that. Once called, it can open a website on your default browser.

Web browser module using the following pip command. Type the below command in the terminal- \$pip install web browser. the above command will install the module in the system. Now, we need to import it using the following command - import web browser

Features: Opening Google, opening YouTube, display location of given city .

DATE TIME MODULE

Feature: Python provides datetime module to deal with all datetime related issues in python. Using datetime we can find the number of days left for your next birthday from current year. Along with this, we need to focus on the birth month and birthday.

Wishing the user based on the current time.

DRUPAL

Drupal is a free software package written in PHP language that allows anyone to easily publish, manage and organize a wide variety of content on a website. Drupal's module system is based on the concept of "hooks". Each hook has a defined set of parameters and a specified result type. To extend Drupal, a module needs simply implement a hook. When Drupal wishes to allow intervention from modules, it determines which modules implement a hook and calls that hook in all enabled modules that implement it.

LIBQREN CODE

Libqrencode is a C library for encoding data in a QR Code symbol. The capacity of QR Code is up to 7000 digits or 4000 characters and is highly robust. This library is characterized by:

- Does not require any additional files at run time.
- Fast symbol encoding.
- Automatic optimization of input data.

Libqrencode provides command line interface as qrencode command, some commonly used options are described below:

- -o FILENAME is used to specify output filename
- -s NUMBER is used to specify the size of image.
- l {LMQH} is used to specify error collection level from L (lowest) to H (highest).
- -v NUMBER is used to specify the version of the symbol.
- -m NUMBER is used to specify the width of margin

III. IMPLEMENTATION & RESULTS

In this course of building voice-based assistant we have understood various models in python. Our project is entirely built on python. The importance of python and its built-in libraries.

- Speech Recognition Since we're building an application of voice assistant, one of the most important things in this is that your assistant recognizes your voice (means what you want to say/ ask).
- Wolframalpha: It is used to compute expert-level answers using Wolfram's algorithms, knowledgebase, and AI technology. To install this module, type the below command in the terminal.

- Pytsxs3: This module is used for the conversion of text to speech in a program it works offline.
- Wikipedia: As we all know Wikipedia is a great source of knowledge, so we have used the Wikipedia module to get information from Wikipedia or to perform a Wikipedia search.
- Date and time: Python Datetime module supplies classes to work with date and time. These classes provide several functions to deal with dates, times, and time intervals.
- Web browser module is a convenient web browser controller. It provides a high-level interface that allows displaying Web-based documents to users.
- Plyer: Plyer module is used to access the features of the hardware. This module does not come built-in with Python. We need to install it externally. To install this module type the below command in the terminal.
- Pywhatkit is a Python library for sending WhatsApp messages at a certain time, it has several other features too. Following are some features of Pywhatkit module:
 1. Send WhatsApp messages.
 2. Play a YouTube video.
 3. Perform a Google Search.
 4. Get information on a particular topic.
- Random module is an in-built module of Python which is used to generate random numbers. These are pseudo-random numbers means these are not truly random. This module can be

The code was implemented on the Ubuntu 10.04 operating system with Drupal 6.19 and qrcode3.1.1. The Drupal module extended was written in PHP. There are four parts in this module as shown below:

- Implementation of hook_menu()
- Menu callback
- Define a form
- Handle post-validation form submission

IV. CONCLUSION

In this course of building voice-based assistant we have understood various models in python. Our project is entirely built on python. The importance of python and it's built-in libraries. We have used python mainly because of its large and robust standard library it allows you to use choose from a wide range.

Voice talking gives consumers hands-free access to many functions because you only need the voice to activate them. So, it makes it easier and faster to do certain things.

QR code is now being widely used in a variety of businesses. QR code is a way of encoding more information than a traditional bar code. And most importantly, it contains information that can be easily decoded at high speed. In this paper, we show how to create the QR codes via the web browser that

facilitates users to easily create their own QR codes for websites, emails, business cards, print ads and so on. The proposed method was developed using entirely open-source software such as Libqrencode, Drupal and Ubuntu. The experimental results show that the QR codes were successfully and correctly generated. Therefore, the proposed method is considerably a QR code generator collaborative tools that is available for free use.

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Hybrid Recommender System: Enhancing Recommendation Systems using Text Analytics

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Abstract. A Recommendation System recommends products to users based on the ratings given by previous users. In basic terms, it is an algorithm that suggests relevant and personalized items to users based on their preferences. The current recommendation systems are heavily dependent on user ratings which are usually a numerical value of stars out of 5. It does not consider the written reviews which are given by users. The con of this prevailing recommendation system is that the users are prone to give wrong ratings either accidentally or due to their ambiguity regarding a product. While designing the prevailing recommendation system, one thing that is not being considered are the written feedbacks given by users for a product. We can achieve a better model for this Recommendation System by analyzing the written text reviews as well as considering ratings in the form of the no. of stars. In our proposed recommendation system based on text analysis, the new recommendation will be a combination of both the factors and enhanced recommendations will be received by users. Through this we can give a better service to the users, increase the user engagement and increase sales on e-commerce websites.

Index Terms: Consumer Habits, COVID-19, E-commerce, Recommendations

I. INTRODUCTION

The Covid-19 pandemic two years back, shook the whole world including the entire market. We were caged inside of our homes and were helpless to do any activity that required going out of our homes. The most important things that people required during that period were daily groceries, household items and medicines. Internet came in as a savior during the time and e-commerce websites acted as a boon for all of us. E-commerce websites consisted of everything we needed to have without having us to go outside of our houses. The online rating of a product played a vital role for customers as they were completely depended on the ratings and reviews given by the other users in the past.[4] The written text feedback influences a customer deeply as it provides a detailed, clearer, and unbiased review of a product. User's purchasing is highly dependent on the reviews they read on e-commerce websites. This highlights how important it is for a user to get an accurate review of a product. Here comes the role of Recommendation Systems. [1][7]

The Recommendation Systems are designed to recommend things to the user based on many different factors like their interest via previous order history or search history. These systems search the most likely product that the users may purchase or are interest of to them. The user starts to feel as if their needs and choices are being understood and they are more likely to buy related products, thereby increasing the sales of the company.[28] It is like finding a near to perfect match between item and the user by finding similarities in both for recommendation.[23] Users and services both benefit from these kinds of systems. The decision-making process and quality of recommendations has improved significantly through these kinds of systems. It is one of the most capable Machine Learning systems based on its wide usefulness specially in e-commerce settings.[9]

The prevailing Recommendation Systems are based on the ratings given by the user in the form of stars in the rating section. The products with higher number of ratings gets recommended to the user. However, this system is based solely on numerical value of stars and not on the written feedbacks that are given by the user, so the recommendations have accuracy only up to some extent. Written reviews are a great source of feedback because customers tell you exactly what's great or not great about a product in as many words as they like, hence, these reviews should also be taken into consideration while recommending a product to a user.[25]

In our proposed Recommendation System, we make use of Text Analytics based Recommendation System, which is more reliable and gives more accurate results, as we take in account both text-based feedbacks and existing numerical-based star rating system and produce a combined rating which is more accurate. Using text analytics, we will be able to analyze the reviews given by the users. Feedback analysis involves identifying the liking and disliking of customers, so that the e-commerce platforms can provide better service and eventually improve customer satisfaction and increase their revenue.[4][9] Text analytics helps in analyzing that text and thus giving us more precise recommendations. Therefore, this need for more efficient and accurate recommendation techniques within a system which will provide relevant and dependable recommendations for users, is being catered in this proposed Recommendation System.

II. BASIC CONCEPTS AND TECHNOLOGY USED

Global Internet had overloading amount of choices which makes it confusing for a user to choose between options and eventually the user gets confused.[8] During the Covid-19 pandemic, when users could not get out of their homes and had to depend completely on online purchasing for every big and small item, their purchasing was highly dependent on the reviews they read on e-commerce websites.[4] After the Covid-19 era got over, the global internet now is overloaded with humongous amount of choices with overloading amount of reviews, which makes it confusing for the users to choose between options.[29]

These existing problems can be dealt with upto a great level with an efficient model of recommender systems which is being presented in the paper.

The ratings currently available on famous e-commerce websites are solely based on the star ratings given by the user.[15] This doesn't necessarily reflect the actual product as these rating is given by user without much of a thought process and sometimes these rating is vague as well as these can be subjective, some user may give 4 stars for a good product, some may give 5 stars for the same. For a poor-quality product, some may give 2 or 1 star having no option of 0 stars.[31][26]

We have proposed an advanced and more accurate model for a recommendation system which will be based on both star ratings as well as written feedbacks provided by the user. The new 5-star rating will be a result of combination of both ratings and reviews. This will be done using the Bag of Words model which will intelligently analyze these reviews and assign them a flag based on how negative, positive, or neutral a review is. From total of 5 stars, 1 star will be decreased from the star count for negative reviews, 0 will be added for neutral reviews and 1 will be added for positive reviews. In case a product has positive reviews and already has a 5-star rating, no change will be done to its existing rating.

The data for our dataset was taken from an e-commerce website- Amazon.com.[27] We took in consideration total of 6 products from diverse categories, of which, we chose 25 most recent reviews of each product. The reviews were posted between the months of September and October 2022. The reviewers were based in India and United States of America.

We start with converting the written text reviews into a CSV file. The words from the reviews are then pre-processed i.e., they are tokenized as individual words, furthermore, they are converted into lower-case letters with the removal of punctuation and stop words along with performing word stemming on the various strings generated. The frequency of these occurring words is then found out from which a document-term sparse matrix is made. A bar graph is then plotted showcasing the frequency of the topmost used words with the previously attained matrix.

We disambiguate the words based on the probability that a word occurs with a particular tag, i.e., we need to mark up the words in text format for parts of the review based on their definition and context. We then utilize the process of chunking in making groups of noun phrases. The resulting group of words are called chunks.

The possible tags are - FW - (foreign word), JJR - (adjective, comparative), JJS - (adjective, superlative), LS - (list marker), MD - (modal), NN - (noun, singular), NNS - (noun, plural), NNP - (proper noun, singular), NNPS - (proper noun, plural), PDT - (predeterminer), POS - (possessive ending), PRP - (personal pronoun), PRP\$ - (possessive pronoun), RB - (adverb), RBS -

(adverb, superlative), RP - (particle), TO - (infinite marker), UH - (interjection), VB - (verb).

We will consider positive words to be the ones which highlight good qualities in a product. Neutral words are ones which come under the tag such as NN, NNS, NNP or NNPS, meaning they exist to give meaning to the sentence and are not targeted to portray a positive or negative image. Negative words are the ones which show the product in a bad light highlighting its drawbacks.

From the chunks formed we determine the nature of the words which have occurred most frequently in the reviews. Now, we see the nature of these words and determine whether the reviews are positive, negative, or neutral. 1 star will be decreased from the stars count for negative reviews, 0 will be added for neutral reviews and 1 will be added for positive reviews. In case a product has positive reviews and already has a 5-star rating, then no change will be done to it.

III. BACKGROUND WORK AND TECHNOLOGY GAP IDENTIFIED

Table -1: Literature Review

S. No.	Title	Proposed	Advantage	Disadvantage
1	New perspectives on gray sheep behavior in E-commerce recommendations	Gray sheep users, minimizes the efficiency of recommendation system. gray sheep users are those users whose have unique taste or those who neither agree nor disagree with majority of people. hence, it is imp to identify and remove from computational system with improved performance . this survey identifies and removes gray sheep users and analyzes the recommendation according to it.	1) It increases overall customer trust as RS provide the essential input in the digital marketing. 2) It has seen an unexpected rise in the practice of cross domain RS and context aware RS is seen. 3) It leads to better overall performance.	1) It has not examined the potential of combining different proposed approaches in the accuracy of GS identification. 2) The personality attributes of GS and non-GS users are not considered in this. 3) For each domain, attributes of the identified GS items are not studied in this. 4) Effect of presence of GS users in group RS settings are not examined.
2.	Can in-store recommendations for online-substitutive products integrate online and offline channels?	An increasing number of multi-channel retailers are adopting offline-to-online recommendation (OORS) strategies, in which information about products sold online is shared with in-store shoppers through recommendation systems using in-store technology, offered to customers.it Investigates the impact of OORS on cross-channel integration for retailers who primarily are selling interchangeable products through online and offline channels. It considers	1) It is very beneficial for Centralized Organization Customers. 2) OORS, also shows improvement in social welfare. 3) OORS can also achieve higher synergies, especially in mixed markets with a high proportion of offline shoppers. 4) OORS can perform better than	1) It creates a negative cannibalization effect on the online channel. 2) Customers can be negatively affected by the implementation of OORS in a decentralized organization. 3) It ignores the customer's showroom-to-showroom behavior of hands-on with the product in the store and purchasing another related, interchangeable product online.

		omnichannel buyers (choosing shopping channels strategically) and offline buyers (preferring to shop in stores), the pricing game model with and without OORS is, is developed for decentralized retailers that operate offline and online channels as a separate company.	multichannel centralization. Thus it increases online and offline profits. 5) OORS allows offline channels to cannibalize more omnichannel buyers from online channels.	
3	Economic corollaries of personalized recommendations	Through randomized field experiments, it investigates the impact of two major recommendation systems, neural collaborative filtering, and deep content filtering, on sales diversity. It clarifies that RS design is the determining factor in homogenizing or diversifying product sales. It amplifies homogenization. collaborative filtering also increases the sales of already bestsellers whereas Content-based recommenders smooths the distribution of sales and introduce users to niche items.	1) It reduces individual-level consumption diversity. 2) Both major recommendation system help in enhances sales. 3) Marketers can leverage a combination of these two matchmaking approaches to find the best suits of their needs.	1) But collaborative filtering creates concentration bias.
4	How online reviews and coupons affect sales and pricing: An empirical study based on e-commerce platform	A three-stage least-squares (3SLS) model is used to estimate the impact of online reviews and coupons on online product sales and prices. The negative impact of negative reviews on sales is mitigated by price, making consumers more tolerant of negative reviews of expensive products. Consumer perception of coupon utility mitigates the negative relationship between negative reviews and sales. Sellers believe that negative reviews of experiential products are not very helpful and use ineffective coupons to respond to negative reviews.	1) It provides a richer understanding of the effects of negative reviews on customer behavior. 2) It adds to coupon utility to influence purchase decisions, as it influences consumer utility.	1) It analyzes only indirect valuations, excluding direct sales. 2) It combines multiple promotional coupons without considering different levels of customer participation. 3) It doesn't include proprietary data or employ other complementary research methods such as experiments and surveys.
5	Acceptance of recommendations to buy in online retailing	A modified technology acceptance model is used to measure customer acceptance. Volunteers are provided with an online shopping experience using individually generated purchase recommendations. The results demonstrate the high level of acceptance of the recommendations generated and how closely this acceptance correlates with the quality and purchase relevance of the recommendations. Even if the results are limited to the	1) It perceives usefulness and perceives ease-of-use. Shopping relevance and output quality have an influence.	1) It doesn't include group-specific differences between users and non-users of recommendations. 2) It doesn't include the effects of recommendations on consumer's satisfaction.

		specific recommendation types used, they have important implications for the proper design of modern online shops.		
6	A collaborative user-centered framework for recommending items in Online Social Networks	In this paper, we propose a novel collaborative user-centered recommendation approach in which various user-related aspects like Preference, Opinion, Behavior, Feedback can be utilized in online social networks. In this a recommender system can use sentiment analysis to improve performance. A mixture graph of terms can be effectively used for sentiment detection.	1) It improves effectiveness of recommendations 2) It overcomes limits of collaborative learning approaches due to the availability and quality of user profiles and ratings.	1) The main current limitation of this work is the relatively small size of the datasets used for the experiments, both in terms of the number of items and the number of users involved in the analysis. 2) It doesn't include the other kinds of data from heterogeneous collections.
7	Improving the quality of predictions using textual information in online user reviews	It proposes a method to derive a text-based rating from the body of the rating. We then use soft clustering techniques to group similar users based on the topics and opinions presented in the reviews. Our results show that using textual information leads to better predictions of rating scores than those derived from users' rough numerical star ratings.	1) These techniques make better ratings predictions using the textual data. 2) They make fine-grained predictions of user sentiment towards individual restaurant features.	1) It doesn't utilize temporal factors and other available metadata to guide its analysis.
8	Research on personalized hybrid recommendation system	Traditional recommendation systems are based on user collaborative filtering algorithms, and Amazon proposed collaborative filtering algorithms to achieve excellent results. By examining two types of traditional algorithms, this paper proposed a personalized recommendation system model based on users and articles. Then they conducted an experiment using the MovieLens 100K dataset to analyze the recommendation results.	1) It's an effective tool to solve the information overload problem. 2) It improves the accuracy of the recommended system. 3) It is an improved UB-CF and IB-CF recommendation algorithm.	1) Its best results may not be achieved in data processing. 2) It needs improvements that can be made in this study to achieve optimal results in subsequent studies.
9	Product Recommendation Algorithm Combining Network Structure and Text Attributes	Based on the user's purchase records, the algorithm uses representation learning techniques to build a user-product network, preserves low-dimensional embedded semantic relationships between user and product nodes, and uses cosine similarity to measure semantic similarity. Next, the topic features of the products are obtained according to Dirichlet's hidden topic distribution model, and cosine similarity is used to compute the similarity of topic features	1) It effectively alleviates the data sparse problem and cold start. 2) It improves the recommendation performance. 3) It solves the limitations of traditional algorithms.	1) The recommendation results are inaccurate.

		between products.	
10	A Review of Text-Based Recommendation Systems	<p>These are systems that use text as the main feature and allow you to find relevant information in the shortest possible time. There are several techniques for building and evaluating such systems. This overview mainly describes her four main aspects of text-based recommendation systems used in the reviewed literature. Aspects are datasets, feature extraction techniques, computational approaches, and metrics.</p>	<p>1) It deduces that hybridization of text features with other features that enhances the recommendation accuracy.</p> <p>1) It has lack of comprehensive literature review about the text-based recommendation systems.</p>

IV. PROPOSED MODEL

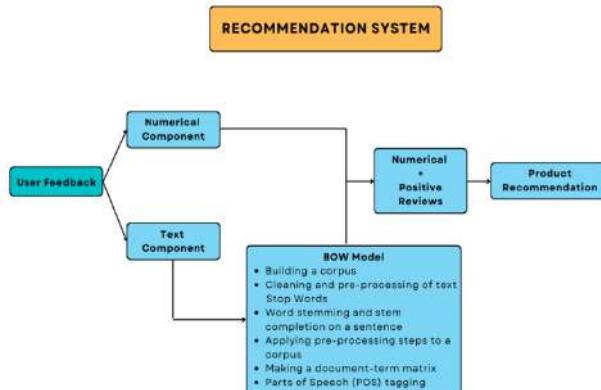


Figure 1. Flowchart of the proposed model

The above flowchart, as shown in Figure 1., represents the proposed model for the process of implementation of all our objectives which we have defined in section II of this paper.

Python - Python is an interpreted, object-oriented, high-level programming language with dynamic semantics.

Collections - Collections in Python are containers used for storing data and are commonly known as data structures, such as lists, tuples, arrays, dictionaries, etc.

Pandas - Pandas is a software library written for the Python programming language for data manipulation and analysis.

Matplotlib - Matplotlib is a cross-platform, data visualization and graphical plotting library for Python and its numerical extension NumPy.

Seaborn - Seaborn is a library for making statistical graphics in Python. It builds on top of Matplotlib and integrates closely with Pandas data structures.

NLTK - The Natural Language Toolkit (NLTK) is a platform used for building Python programs that work with human language data for application in statistical natural language processing (NLP). It contains text processing

libraries for tokenization, parsing, classification, stemming, tagging and semantic reasoning.

Scikit-learn (Sklearn) - It provides a selection of efficient tools for machine learning and statistical modeling including classification, regression, clustering and dimensionality reduction via a consistent interface in Python.

V. IMPLEMENTATION AND RESULTS

We have implemented Bag of Words Model on the most recent reviews of 6 different products from a leading e-commerce website- Amazon. Below are the steps we performed to reach the optimal rating based on customer reviews as well as numeric ratings.

The steps below are for our first product- an Earring Set, taken from Amazon.com:

1. EARRING SET:

PYTHON

We have implemented the entire code in Python with the help of Jupyter Notebook. Various libraries which have been mentioned above have been used to implement the Bag of Words model on our dataset to acquire the results.

PANDAS

We utilize Pandas to display the data in a tabular format as shown in Figure 2.

	title
0	It's very very beautiful. I loved all the desi...
1	Poor quality. One time used products
2	The studs look good and pretty classy
3	Not bad
4	Damaged product received. Looks beautiful on t...
5	It is all plastic and break easily even the ho...
6	Nice studs
7	Not as I expected. All the studs are tiny and ...
8	Exactly as shown. The studs were small but exa...
9	Made up of plastic. Easily broken up. Even I p...
10	Worth for money. Nice product.
11	Like it. Highly recommend for kids who love to...
12	Looking good but colour is not long lasting
13	Its good bt different designs should keep,silv...
14	Its the worst quality of earrings. Unless its ...
15	It was awesome. Very good quality, perfect fin...
16	It looks expensive but I got at cheaper rate.T...
17	The earrings look really pretty. They are ligh...
18	Quality not good
19	Good product... however the earings are loosel...

Figure 2. Data in tabular format

NLTK

We utilize this library to convert all strings into lower-case, remove all punctuations, tokenize strings into individual words, remove stop words, and perform word stemming on the dataset.

COLLECTIONS

This Python module was used to calculate the frequency of individual words appearing in the corpus that is shown in Figure 3.

```
Counter({'beautiful': 2,
         'loved': 2,
         'design': 3,
         'thank': 1,
         'much': 2,
         'shining': 1,
         'diva': 1,
         'poor': 2,
         'quality': 6,
         'one': 4,
         'time': 2,
         'used': 1,
         'product': 9,
         'stud': 4,
         'look': 7,
         'good': 8,
         'pretty': 2,
         'classy': 1,
         'bad': 1,
         'damaged': 3,
         'received': 1,
         'picture': 1,
         'reality': 1,
         'old': 1,
         'polish': 1,
         'golden': 3,
         'hoop': 2,
         'almost': 1,})
```

Figure 3. Frequency of individual words in the corpus

SCIKIT-LEARN

We used this tool to convert individual strings into vectors along with Pandas library we utilize them together to obtain the document-term sparse matrix, as shown in Figure 4.

	10	advised	amazing	available	awesome	bad	beautiful	blush	break	broken	...	used	value	variations	wear	wearing	week	weight	worst
It's very very beautiful. I loved all the products. Thank you so much Shining Diva	0	0	0	0	0	0	1	0	0	0	...	0	0	0	0	0	0	0	
Poor quality. One time used products	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	
The stud look good and pretty classy	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	

Figure 4. Document term sparse matrix

We utilize the Parts of Speech (POS) tagging technique and tag the various chunks which are formed into their individual categories. This is shown in Figure 5.

After Chunking (5
(mychunk
It's very very beautiful. I loved all the designs. Thank you so much Shining Diva/NNP
/NNP
Poor quality. One time used products/NNP
/NNP
The studs look good and pretty classy/NNP
/NNP
Not bad/NNP
/NNP
Damaged product received. Looks beautiful on the picture but in reality it's looks old and damaged and there's no good polish over the product . Golden hoops are almost rusty which looks very poor. Packaging was okay but as soon as I opened the pack the damaged hoop pop out . Quality is zero. Advised to not purchase/NNP
/NNP
It is all plastic and break easily even the hooka are of plastic not value of money from my perspective/NNP
/NNP
Nice studs/NNP
/NNP
Not as I expected. All the studs are tiny and quick to loose color with one wear./NNP
/NNP
Exactly as shown. The studs were small but exactly as shown in the pic./NNP
/NNP
Made up of plastic. Easily broken up. Even I put request for returning after 10 days not any kind of information available for picking up product. Totally disappointed/NNP
/NNP
Worth for money. Nice product./NNP
/NNP
Like it. Highly recommend for kids who love to wear earrings matching to dresses./NNP
/NNP
Looking good but colour is not long lasting/NNP
/NNP
Its good bt different designs should keep,silver and golden looks same there is no difference only/NNP
/NNP
Its the worst quality of earrings. Unless its for a one time use for a group of kidsdon't even think of this thing lasting even for a week. Changed colour on wearing it once/NNP
/NNP
It was awesome. Very good quality, perfect finish. But same patterns repeated in both silver and golden. It would be double happy if both had different designs./NNP
/NNP
It looks expensive but I got at cheaper rate.The earrings are worth more than the mention prices./NNP
/NNP
The earrings look really pretty. They are light weight too. Although there's a repetition of a particular colour (blush-green) the variations make up for it. But the earring stoppers are really small, small I mean minuscule, so it's quite a task to wear it. But other than that I am very happy with the product as well as with the packaging./NNP
/NNP
Quality not good/NNP
/NNP
Good product.... however the earrings are loosely screwed/NNP
/NNP
The case was broken. Very low quality product/NNP

Figure 5. Chunks generated using Part of Speech tagging

As we can see from the results most of the chunks are categorized in either the NNP category or the NN category in the dataset meaning the words with the highest frequency are either Nouns or Pronouns pointing to an object or a

person. Since the words with the maximum frequencies are neither positive nor negative, hence we flag the group to be neutral.

SEABORN AND MATPLOTLIB

We utilize these libraries to plot a word-frequency bar graph that is shown in Figure 6.

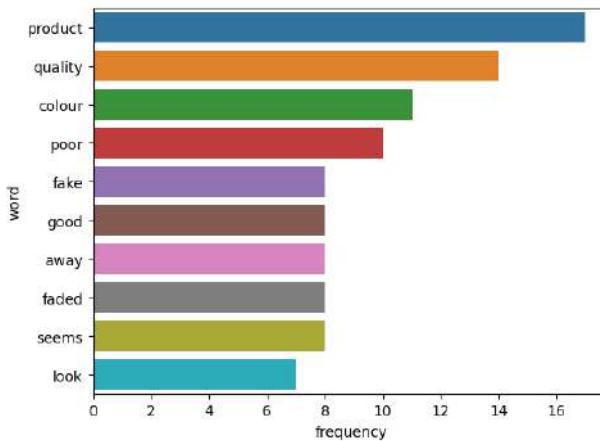


Figure 6. Word frequency bar graph

The initial star rating for this product was 4 out of 5, but as we can clearly see, one of the most frequent word is a positive word which is “good”, but on the other hand, we have many negative words which are also occurring in the reviews such as “poor”, “fake”, “faded”. This shows that even though the product has a positive numeric rating of 4 but the reviews are mostly negative. Based on our model, since the written reviews are mostly negative, we subtract 1 from the initial star ratings and the final rating comes out to be 3 out of 5. This analysis was for an earring product, similarly we have analyzed 5 other products and below are the results based on our analysis.

CROCS

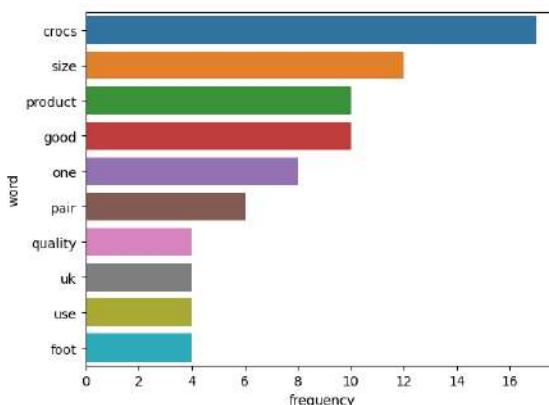


Figure 7. Word frequency bar graph for CROCS

The initial star rating for this product was 4.3 out of 5. One of the most frequent words is a positive word which is “good”. This shows that the product overall has a positive review. Based on our model, since the written reviews are mostly positive, we add 1 to the initial star ratings and the final rating comes out to be 5 out of 5. (Since addition of 1 to 4.3 leads to a sum of 5.3 and our rating system is on the scale of 1 to 5, anything in excess to 5 automatically leads to a perfect rating of 5 out of 5.) This is shown in Figure 7.

LIPSTICK

The initial star rating for this product was 3.9 out of 5. As we can notice, most of the frequent words which occur in reviews are of descriptive kind showing their neutral nature. This shows that the product overall has neutral reviews. Based on our model, since the written reviews are mostly neutral, no change will be done to the initial star ratings and the final rating comes out to be same as initial rating i.e., 3.9 out of 5 as shown in Figure 8.

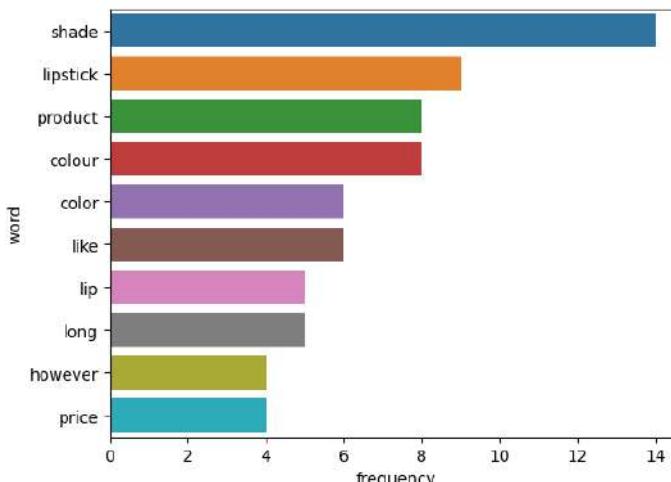


Figure 8. Word frequency graph for LIPSTICK

MIXER GRINDER

The initial star rating for this product was 3.8 out of 5. One of the most frequent words is a positive word which is “good”. This shows that the product overall has a positive review. Based on our model, since the written reviews are mostly positive, we add 1 to the initial star ratings and the final rating comes out to be 4.8 out of 5. This is depicted in Figure 9.

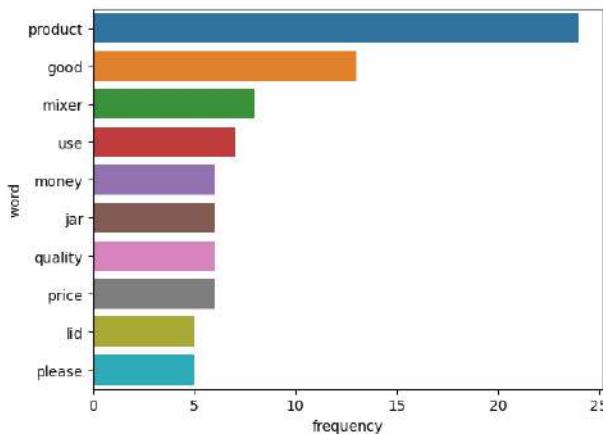


Figure 9. Word frequency graph for MIXER GRINDER

PERFUME

The initial star rating for this product was 4 out of 5. We notice that the reviews have both positive and negative words showing their mixed nature and hence we conclude it as neutral. This shows that the product overall has neutral reviews. Based on our model, since the written reviews are neutral, no change will be done to the initial star ratings and the final rating comes out to be same as initial rating i.e., 4 out 5. This is shown in Figure 10.

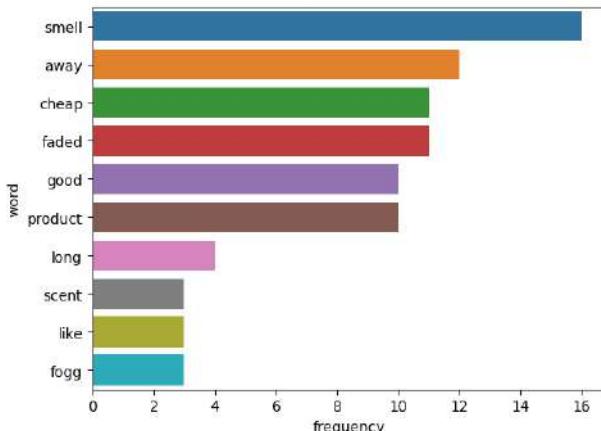


Figure 10. Word frequency graph for PERFUME

POT STAND

The initial star rating for this product was 4.2 out of 5. The most frequent words are positive words which are “good”, “nice”, “sturdy”. This shows that the product overall has a positive review. Based on our model, since the written reviews are mostly positive, we add 1 to the initial star ratings and the final rating comes out to be 5 out of 5. (Since addition of 1 to 4.2 leads to a sum of

5.2 and our rating system is on the scale of 1 to 5, anything in excess to 5 automatically leads to a perfect rating of 5 out of 5.) This is shown in Figure 11.

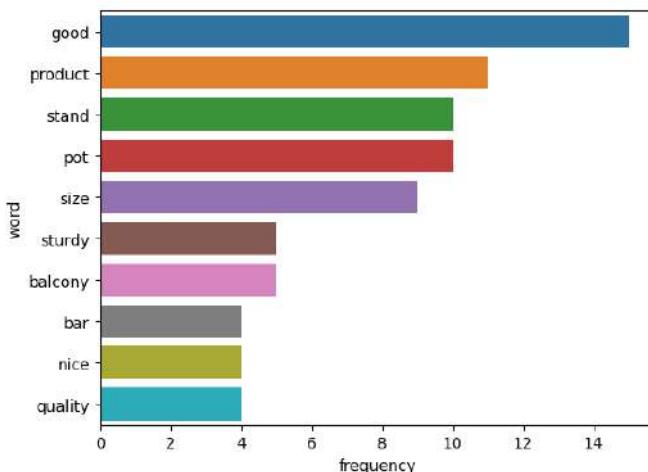


Figure 11. Word frequency graph for POT STAND

V. CONCLUSION

Recommendation Systems are being used extensively these days and a lot of work has been done on them. But need for a more efficient and accurate Recommendation System increased after the Covid-19 pandemic, as large chunk of population shifted from offline shopping to online shopping for every big and small item. Frequency of purchasing increased and e-commerce websites started putting more efforts than before to meet the demands and demands are growing ever since.

One of a major factor to increase their sales and income is their dependability on Recommender Systems, more accurate these systems are, more profit the company gains. This project of ours concentrates on several issues prevalent and provides an enhanced system which could be utilized further for making better purchases, keeping in mind the need for the consumer to be aware about the product. We took a combination of numerical rating and text reviews to generate a more accurate rating, using which we recommend products to the user which has good rating and positive feedbacks as well. Through our results above, we can see how this proposed recommendation system can be a boon for the customers, as they get their desired products in a better way as well as for companies, by increasing their sales and profit.

In future, we will try to implement our model on a dynamic dataset for multiple languages and take into consideration, various reviews containing images and videos posted by the reviewers.

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Project Innovations in Distributed Computing and Intelligent Technology

This proceeding focuses on innovative research projects in the field of Distributed Computing and Intelligent Technology presented during the 12th Project Innovation Contest- 2023. The selected research projects enrolled in this book are relevant to the current trends of distributed computing and its application to real- world problems. Undergraduate and Post Graduate students have demonstrated the working of their proposal technique using models/ prototypes. The projects presented would have an effective way to connect the academic and the industry with practical problems and their realistic solutions. This book will be helpful for the researchers, students and developers who are seeking for new and relevant research problems in the filed of distributed computing and its applications.

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