Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Permanently Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

DJS STRIKE

2022-23

PROCEEDINGS EDITED By,

Prof. Amit A. Deshmukh

Dr. Ameya A. Kadam

Mrs. Yukti S. Bandi

Mr. Tushar V. Sawant

ORGANISED BY

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

About D. J. Sanghvi College of Engineering



Shri Vile Parle Kelavani Mandal "SVKM" to the society at large grew out of a humble seed planted during India's freedom movement namely by Shrimati Gokalibai Punamchand Pitamber High school – to nurture socially relevant education. Today SVKM has grown into a mega education nucleus with distinguished achievements. SVKM's Dwarkadas J. Sanghvi College of Engineering (DJSCE), was established in the year 1994. In the span of more than 25 years, DJSCE has come a long way and has made its impact felt not only in the country, but also abroad. The college runs several undergraduate programs, such as Electronics and Telecommunication Engineering, Information Technology, Computer Engineering, Mechanical Engineering, Chemical Engineering, Electronics Engineering, Production Engineering and Biomedical Engineering and these undergraduate programs are accredited by the National Board of Accreditation. The Institute is NAAC accredited with an 'A' grade (CGPA: 3.18) and recently started programs, such as Computer Science and Engineering (Data Science), Artificial Intelligence and Machine Learning, Artificial Intelligence and Data Science, Computer Science and Engineering (IoT and Cyber Security with Block Chain Technology) and is an autonomous institution permanently affiliated to the University of Mumbai. Along with the undergraduate program, DJSCE also runs post-graduate and Ph.D. programs in Electronics and Telecommunication, Computer and Mechanical Engineering departments, affiliated to the University of Mumbai. Our students have performed exceedingly well in national and globally competent multinational companies and, also in the universities in India and abroad as they pursue their higher education. Today, DJSCE has grown into a premier institute of technical education and has a stimulating educational environment with distinguished faculties and state-of-the-art facilities.

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The manuscript has not been sent to any other research journal for publication.

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From the Editorial Desk

Electronics and Telecommunication Engineering has always played a major role in the advancement of the latest in the technology arena. As technology progresses rapidly, it has become essential for engineers and technologists to keep up with the changes in their respective areas of expertise. The IETE- Student Forum (IETE-SF) was formed in the year 2005 under the Department of Electronics and Telecommunication of D.J. Sanghvi College of Engineering, to not only facilitate the flow of ideas and information but also to encourage the advancement in the field of electronics and telecommunication engineering. To keep up with new technologies, IETE-SF conducts technical workshops and seminars to encourage them to work on their technical skills. This forum paves a way for students to gain knowledge apart from their academic curriculum. In addition to conducting workshops and seminars, IETE-SF runs the book-bank facility where students can avail a wide range of technical books. Two years a new initiative was taken by the student forum to run a component-bank facility, which enables students to avail themselves of various electronic components, which can be used for building technical projects. 'DJS Strike', a project mentorship program, which encourages students from the second, third, and fourth years to team up together to build technical projects was continued this year as well by the IETE-SF. Over the last nine years, the EXTC Department has organized various technical events like STTP on Microwave and Antenna, Image Processing, and Wireless Networks. The department also organized, National conferences like NCCT-2011 in the year 2011 and International Conferences like ICCT-2013 and ICCT-2015 in the year 2013 and 2015. Since, 2017 the department has been organizing the International Conference on Wireless Communication (ICWiCOM 2017, ICWiCOM 2018, ICWiCOM 2019, and ICWiCOM 2021) where the conference addresses only narrow topics in the domain of Wireless Communication. Proceedings of the conferences are available on the Springer Digital Library.

For the last five years, IETE-SF has been organizing 'DJS Strike', a project competition. This competition aims to provide a platform for students to showcase technical skills as well as technical paper writing skills. After a vigorous review process, the research papers of the best projects are published in the 'DJS Strike' Journal, which has a recognized ISBN Number. Due to the overwhelming response received for DJS Strike, IETE- SF has been motivated to organize 'DJS Strike 2023'. The best technical projects, in coherence with the field of Electronics and Telecommunication, built by undergraduate and postgraduate students, will be displayed during the competition.

We hereby appreciate the efforts taken by all the faculty members of the department of EXTC and the IETE-SF student committee members for organizing 'DJS Strike 2023'.

Congratulations to all the participants of DJS Strike 2023!

Best wishes!

Prof. Amit A. Deshmukh
Professor & Head, EXTC, DJSCE

About DJS STRIKE

DJS STRIKE is a novel initiative of the Electronics and Telecommunication Engineering Department organized by the student's committee of IETE-SF. It is collaborative learning where students from various departments are working together, sharing their knowledge to develop a product. Product development is an essential and integral part of the competition. DJS Antariksh is a key outcome of the DJS Strike Mentorship Programme. It is the official rover challenge team of DJSCE, and it was pioneered by the students of the Department of EXTC and aims to build next-generation Martian Rover. Students are encouraged to continue the development of the project to an industry level product by allowing them to continue it as the final year project as well as a project for the subsequent year of the competition, to ensure sufficient time for students to work upon it and develop it into an industry level product. DJS strike starts with floating projects in various domains, followed by forming groups of Second and Third-year students mentored by a final-year student and guided by a faculty member. Certain groups have also sought the guidance of the esteemed alumni; this has provided them a perspective of the current industry level demand for products. Each group gives three project topic preferences, exploring topics across a range of subject boundaries; this motivates students to pursue further knowledge in different subject areas that are part of the curriculum, thus motivating curriculum-based learning with practical exposure. One topic is allotted after discussion with faculty coordinators. After finalizing the topic, each group goes through various stages of the review process at regular intervals displaying their progress, and are evaluated based on different criteria by faculty coordinators. Each review consists of 25 marks. This review is executed over a span of eight to nine months. The structure of the review and guidance given by reviewers; helps in the timely submission and systematic approach in completing the project in all aspects. The first review which is a documentation review primarily focuses on the ability of the student to apply basic knowledge, analyze the problem, and propose a model tool to execute the project. In the second and third reviews which are progressive reviews, each group is required to complete about 30% and 70% of the project respectively and write the first draft of the technical paper based on the work done. Students are guided on how to write a technical paper; a video has also been shared for the same. In the fourth review which is a final review, each group is required to demonstrate the full product and submit the final draft of a technical paper. Each technical paper undergoes plagiarism check by Turnitin software and based on the report, the paper with minimum plagiarism is accepted for publication in DJS strike magazine with ISBN number.

DJS Strike is a yearlong academic activity where students share and apply their knowledge of engineering fundamentals and an engineering specialization to achieve success in product development. Strike provides an opportunity to further enhance the project in the subsequent academic year, which enables the prototype to turn into a product. Each student learns how to function effectively as a team member as well as a team leader. This project-based learning holds great weightage in any resume and can help boost the career of the student. It reflects their practical knowledge and enhances the prospect of the student not only to get a job or admission for higher studies but also benefits them while securing better internships of their choice having worked on projects of that caliber. It allows more in-depth exploration of topics, issues, and problems within and across subject areas and disciplines. It helps students to nurture themselves as an engineer, giving them a chance of finding the solution to a similar problem that they might carry out in their future profession. The projects made a great impact in the form of Industrial as well as from a social perspective.

Dr. Ameya A. Kadam, Prof. Yukti S. Bandi, Prof. Tushar V. Sawant
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Smart Blind Stick

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***Abstract*— The Internet of things (IoT) is the concept of devices and appliances, such as lights, security systems, etc being connected through a network and acting 'intelligent'. Devices utilizing IoT are able to make decisions based on received inputs and act automatically without the need of human involvement. They need not be connected directly to an internet, but must have some kind of network for data transfer between individual systems. This field of study has shown enormous growth due to the emergence of technologies such as embedded systems, machine learning and sensor design. The most notable applications of IoT in today's world are in smart appliances, home and building automation, control systems, etc. A smart device is an electronic device that can operate autonomously to an extent, generally using the help of wireless communication with other devices on a network. Most devices used readily nowadays, such as smartphones, refrigerators, watches, air conditioners, etc. are incorporated with smart device technology in order to help with ease of use and convenience.**

Keywords*— Medical Technology, Smart Blind Stick, Blind Stick, Smart Medical Devices, Visually impaired, Blindness aid, Arduino project, Arduino Uno, Ultrasonic sensor circuit.

I. INTRODUCTION

In only a handful of years, smart technology has taken the world by storm: smartphones are a major part of our daily lives, intelligent voice assistants such as Amazon's Alexa and Google Home have become staples in every household. There is no doubt that automation and smart devices can in the near future, have the some of the biggest markets both nationally and globally. In fact, the Indian 'internet of things' market is estimated to reach a size of $9 Billion by the year of 2025. Many countries such as Sweden, Japan, South Korea, etc. have already begun incorporating intelligent technology into various domains such as traffic control, natural resource conservation, digitalization of services, pollution control among many others. The Indian government intends on developing 100+ smart cities throughout India in the upcoming years, and has even allotted a budget of around Rs. 7000 crore towards this project. In addition, private companies such as Tata communications have also invested $100 million in efforts towards digitalization and intelligence integration in cities, services and improving public safety. Smart technology is employed heavily in healthcare applications, be it disease diagnosis, prevention, monitoring or each treatment. Smart devices use the internet, cloud computing, big data, 5G technology and various other concepts in order to aid both doctors and patients in all fields of healthcare. Smart surgical robots can conduct precise surgery, while diagnosis of diseases can be done independently by clinically intelligent decision making support systems. RFID technology is readily used for management of personnel and materials, and machine learning can also find an application in automated screening. Through these applications, not only is the actual labour work of doctors assisted, but costs can also be cut and efficiency can be improved greatly.

II. PROJECT OBJECTIVE

The objective of this project is to design and implement a smart stick for the visually impaired using the Arduino Uno development board. The smart stick will be equipped with a sensor circuit using an ultrasonic sensor. The circuit regularly checks the surroundings through the sensor inputs and alerts the user through an audio cue when the sensor detects a nearby obstacle. In addition, a vibration cue is also available which will inform the user of obstacles even if the buzzer were to stop working or malfunction. The main aim is to develop an alternative and conceptually innovative device in order to aid the blind, using modern technologies such as IoT, smart technology, etc.

III. SCOPE OF THE PROJECT

Conventional sticks for the blind require the user to hit an obstacle with the end of the stick and sense a recoil force themselves in order to identify if an obstacle is present or not. These sticks are extremely inconvenient and taxing for the visually impaired to use, and have limited areas of use. In addition, they do not have any auditory indication when an obstacle is nearby, which can be an inconvenience to use as the person would have to rely on their own judgement and would have to keep flailing the stick to locate nearby obstacles. By using smart technology, all the inconveniences of a conventional stick can be eliminated by using an ultrasonic sensor based detection and alerting circuit. The smart blind stick that will be designed in this project is capable of alerting the user with a buzzer when an obstacle is near the end of the smart stick. This response can be programmed with a delay so that the user is alerted way before the object is present, which can find use even when an obstacle is moving. Furthermore, the proposed design will have a secondary measure i.e. a vibration cue. The smart blind sticks also have a great scope for future research and development: machine learning can be incorporated in order to make object identification possible. Furthermore, by integrating GPS into the stick, it is possible to make travel even easier for visually impaired people.

IV. PROPOSED DESIGN

The project is based on an ultrasonic sensor circuit. The ultrasonic sensor detects the distance between the end of the stick and an obstacle. The information is sent to the Arduino Uno, which processes it according to the program. If the

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distance is below the threshold value, the vibration motor and the buzzer are given a high output, and current flows through them, thereby alerting the user when the distance is less.
A detailed description of all components used in this project is given below:

Arduino Uno CH340G

Arduino is an open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices.Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.In this project, we are using Arduino Uno CH340G development board which will be the main brain of the model.

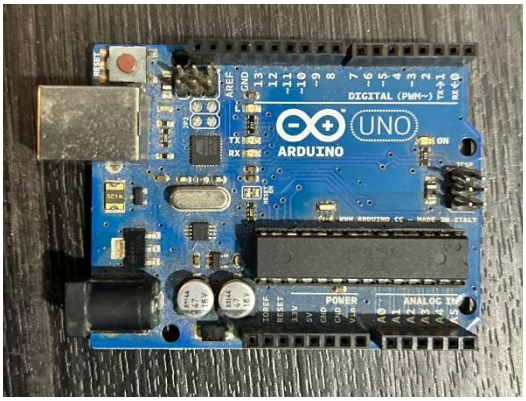


Fig.1 Arduino Uno R3 Development Board

HC-SR04 Ultrasonic Sensor

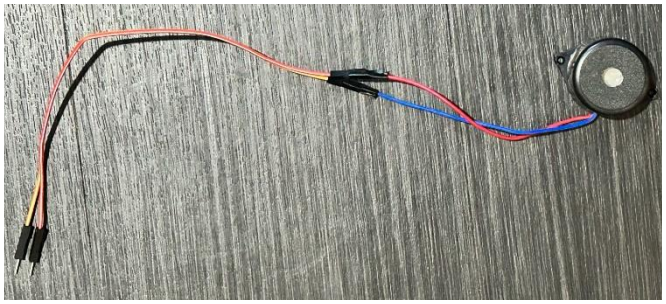
An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. The HC-SR04 ultrasonic sensor is used for detecting the distance object using sonar. This sensor is capable of detection in the range of 2 cm-400 cm and consists of 4 pins: echo, trigger, ground and Vcc.



Fig.2.HC-SR04 Ultrasonic Sensor

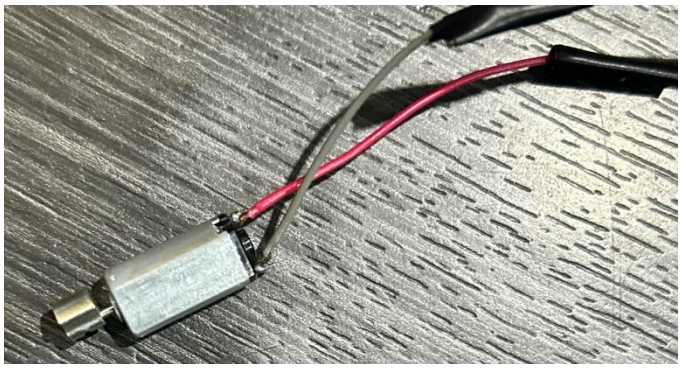
5V Active Buzzer

This buzzer is an active buzzer, which basically means that it will buzz at a predefined frequency (2300 ±300 Hz) on its own even when you just apply steady DC power. We are using a buzzer as the main auditory output, which will warn the blind person when an obstacle is within the specified range.


Fig.3.Active Buzzer

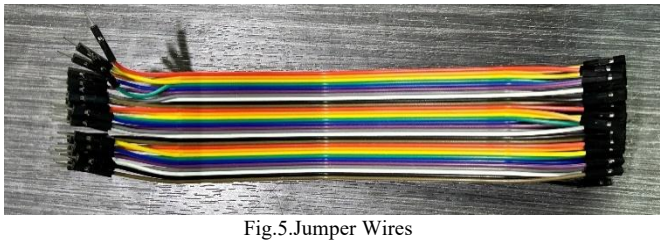
Vibration Motor

A vibrator motor is used for a secondary indication of a nearby obstacle. The motor used operates in voltage ranges of 3V-6V and is compatible with the Arduino Uno used.


Fig.4.Vibration Motor

Jumper Wires

Jumper wires are used for making connections between items on your breadboard and your Arduino's header pins. In this project, we have mainly used male-to-female jumper wires to make connections.


Fig.5.Jumper Wires

PVC Pipe

We are using a PVC pipe to hold the entire circuit and act as the stick. The sensor will be fit onto the bottom tip of the pipe for detection of objects directly in front of it. We have selected a 3 feet (36 inches) stick to act as the backbone of the circuit.


Fig.6 PVC Pipe

USB A to USB B Cable

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The USB A to USB B cable is used for 2 primary operations: Establishing a connection between the Arduino Uno and a desktop/laptop computer for programming of the board and connecting to the power bank as a power supply to the Arduino.



Fig.7.USB-A to USB-B Cable

Power Bank

The power bank used in this project gives an output voltage of 5.1 volts and an output current of 2.4 amperes. The power bank will provide power supply to the Arduino, and in turn, the entire circuit. The USB A – B cable will be used to connect the power bank to the Arduino Uno.



Fig8.Power Bank

V. IMPLEMENTATION AND WORKING

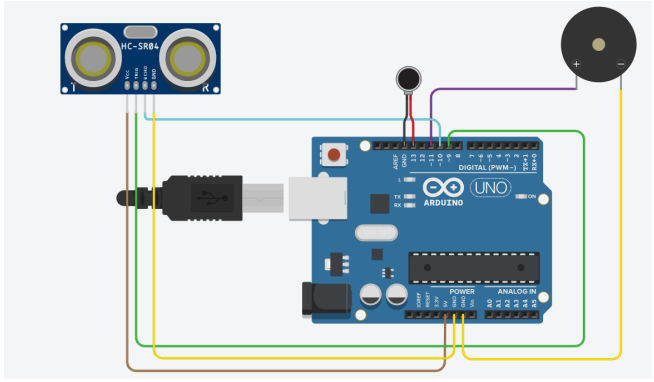


Fig. 9 Circuit Schematic

Working of the circuit:

As seen from the schematic, the main part of the circuit is the Arduino UNO board. The ultrasonic sensor has 4 ports: Vcc, TRIG, ECHO and GND. The Vcc pin will be attached to the 5V supply pin on the Arduino UNO. The trigger pin is connected to the ground pin on Arduino, which is then connected to pin 9 on the Arduino. The echo pin is connected to the 10 pin on the Arduino. The ground pin of the ultrasonic sensor is connected to the negative terminal of the buzzer. The positive terminal of the buzzer is then connected to the 11 pin on the Arduino. The secondary output comes from the vibration motor, which is connected to the ground as well as pin 13 on the Arduino.The circuit takes constant readings for the distance between a nearby object and the sensor. While this value is above 30cm, the buzzer pins as well as the vibration motor pins are programmed to receive no power supply. Using a simple IF function, we are able to program the circuit to give a positive output to the buzzer and the vibration motor once the object comes within the range of 30cm.

Working of the program:

Firstly, the pin numbers are defined for led, buzzer, trigger and echo pins. 'Distance', 'duration' and 'safetyDistance' variables are defined, to be used by the circuit to detect proximity. Now we start with void setup() to initialise Input Output pins. In our program, the Buzzer and Trigger pins are output devices and the Echo pin is an Input device. We also initialise the serial monitor for debugging. Inside the main loop, we are reading all the sensors data. We begin by clearing the trigPin data. We set the trigPin on HIGH state for 10 microseconds. The duration variable is defined in terms of echopin. It will read the echoPin value and return the sound wave travel time in microseconds. Now we start reading the sensor data of Ultrasonic sensor for distance. The distance can be calculated using the following formula: distance= duration*0.034/2. Finally, the distance is printed on the Serial Monitor, and if the distance is less than safetydistance, buzzer and vibration motor are turned on.



Fig.10 Arduino Code

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VI. RESULT AND CONCLUSIONS

A smart blind stick was implemented, which used Arduino programming and an ultrasonic sensor circuit to detect and warn users of a nearby obstacle. The designed model is built for detection under 30cm of distance. Arduino Uno CH340G ATMEGA328P was used as the brain of the project, and HC-SR04 Ultrasonic Sensor was selected for sensing distance. We used a 5V active buzzer and a vibration motor to get an output. This product can be extremely helpful and convenient to a blind person as it is preemptively able to give an output so that the person does not have to actually make contact with the obstacle for identifying if it is present.

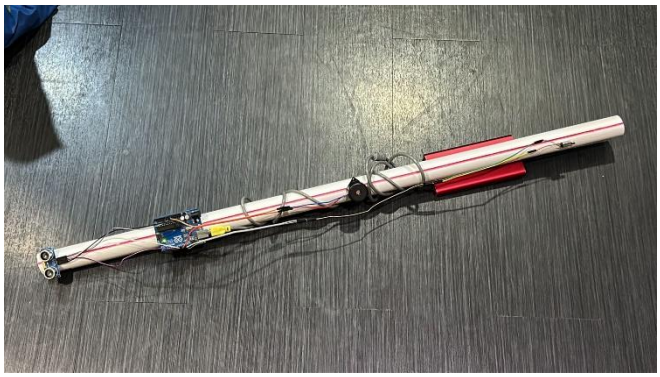


Fig.11 Completed Model

ACKNOWLEDGEMENT

This project and technical paper was greatly supported by Prof. Tushar Sawant. His comprehensive knowledge, regular assistance and expert guidance was a key contributor to both the construction of the working model and the compiling of this technical report. We thank our fellow teammates for their active participation and eagerness to make this project succeed. We would also like to show appreciation to our B.E. mentor, Manav Mody, for his advice and involvement towards our project.

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Drowsiness Detection System Using Eye Blink Sensor And Arduino

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***Abstract*—The drowsiness detection system is designed to create a structure that ensures vehicle safety and driver alertness while driving. This is a system which uses an eye blink sensor to keep a watch on the driver's eye movements. While driving, the driver wears glasses equipped with an eye blink sensor, this eye blink sensor detects the driver's eye movement and sends a signal to the Arduino Nano. When the driver closes their eyes, the blink sensor detects this eye movement and, when processed, notifies the driver with the sound of a buzzer. If the driver does not open his/her eyes even after the warning sound, another message is sent to the L293D motor driver. This driver is connected to the BO Motor. Even if the driver doesn't open their eyes after the alarming sound, the wheels will gradually slow down and come to a halt and the car won't move. This will prevent accidents and keep drivers and their vehicles safe. The main purpose of this system is to make driving safer, more efficient and more enjoyable. By providing drivers with information, warnings and other assistance, these systems help drivers avoid accidents, make better driving decisions and generally have more driving pleasure.**

Keywords—Arduino Nano, Eye Blink Sensor, Drowsiness Detection, Piezo Buzzer, L293D Motor Driver, BO Motor

I. INTRODUCTION

A driver assistant system is a technology designed to help drivers navigate their vehicles safely by providing information and warnings when necessary.[1] One such driver assistant system has an Arduino microcontroller and blink sensor as its main components. The eye blink sensor is a small device that is placed near the driver's eyes and counts the number of times the blinking takes place. The Arduino microcontroller processes this information and provides feedback to the driver via a series of visual and auditory signals.[2] For example, if the system detects that the driver is becoming drowsy or distracted and their blink rate decreases, it can sound an alarm or flash a warning message on a dashboard display. This can prevent accidents caused by driver fatigue or negligence. Overall, driver assistance systems using blink sensors and Arduino are useful tools for developing safe driving skills and preventing traffic accidents.[3]

II. OBJECTIVE

Most traffic accidents at night are caused by impaired vision of the driver due to the constant glare from the headlights of oncoming vehicles. The cause of poor vision is the depletion of visual pigment in the eye, which induces sleep to restore pigment. With a busy schedule these days, it's also very difficult to stay active all the time. Imagine a person driving home from work exhausted after all the troubles of the day. My hands are on the steering wheel and my feet are on the pedals, but suddenly I start to feel drowsy, my eyes start to close, my vision blurs, and I fall asleep before I know it. Drowsiness while driving can have serious consequences, leading to accidents and even death. This situation is much more common than we think, so it is very important to address this issue.[4] An anti-drowsiness device was devised to solve this problem. This system prevents accidents and saves lives by alerting users if they fall asleep while driving. This system is especially useful for people travelling long distances and driving late at night.

III. LITERATURE REVIEW

As per the present scenario, the vehicle utilization rate continues to increase. As a result, the number of accidents has grown. The majority of accidents are thought to be caused by careless driving. Car accidents are responsible for 1.24 million deaths per year. Drunk driving, tiredness, and poorly designed speed bumps are the root causes of these incidents in India. A viable n006F system exists that guards against these primary drivers. Our suggested framework presents an imaginative, practical, and logical solution to automobile accident prevention. This article provides a completely distraction-free and consistent atmosphere. [6] To detect driver tiredness, our proposed approach employs eye closure rate as an informative indicator. If the eye closure ratio is less than the where standard ratio, A chime warns the driver of the usual ratio. A Pi camera was utilised to photograph the driver's eyes for our frame, and a Raspberry-Pi was used to incorporate the complete frame. Lastly, an SMS reminder is sent to the owner's phone. According to police data, there were at least 218,253 accidents in Indonesia between 2007 and 2010. Human error is responsible for around 65% of all accidents. During the Hari Raya holiday, which lasted from August 23 to September 7, 2011, sleepy driving was the leading cause of accidents (1,018), followed by roadworthy cars (449), driving on the road (387), and speeding (387). (up 155). The sleepiness detection system is intended to lessen the likelihood of car accidents. The system takes a picture of the driver and detects the face and eyes next. The findings of eye detection will be examined if the eyes are closed for 4 seconds. If the driver's eyes are closed for 4 seconds, the system detects drowsiness and sounds a warning. Experiments show that the average detection time is 954ms,

and the ideal camera position is above the driver on the dashboard and in good light.

IV. BLOCK DIAGRAM

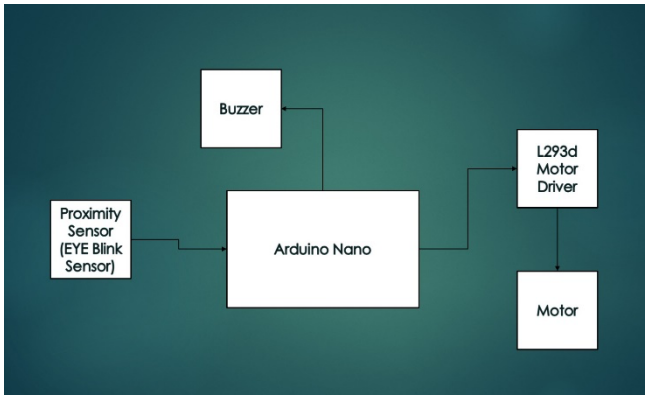


Fig.1 Drowsiness Detection System

As shown in this block diagram, we have used the proximity sensor i.e. the eye blink sensor as the input to the nano controller. As the input is received by the arduino, it gives the output accordingly. The output components i.e. the buzzer and motor driver react as per the input they receive from the arduino controller. And on the basis of input to the motor driver, the motor rotates accordingly.

V. FLOW CHART

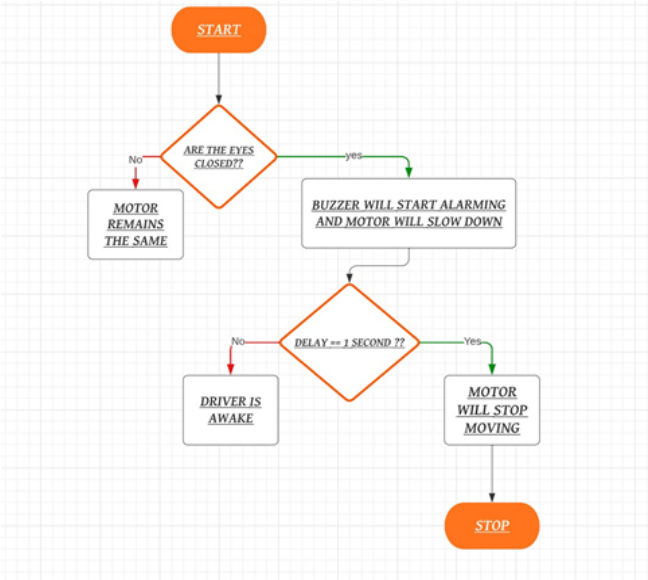


Fig.2 Flowchart of Code Execution

The above diagram represents in which flow the code will be executed. It begins with the detection of eyes and ends at the state of the motor.

VI. METHODOLOGY

We have developed a drowsiness detection system, which ensures safety to the driver. This drowsiness system uses budget friendly components like arduino nano, BO motor, etc. When the eye is closed, the driver is alerted with a continuous alarming sound. Further if the eyes remain closed, the motor driver sends a message to the motor and the motor gradually reduces the speed and comes to a halt. This makes it different from the traditional method of sudden breaks which can prevent accidents from happening. To implement this method, we used various hardware components and also used a couple of software tools for developing the web page. Below we have mentioned the list of components and tools that have been used.

Arduino Nano

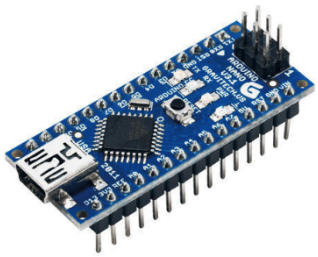


Fig.3 Arduino Nano

Arduino Nano is a small and versatile development board based on the ATmega328P microcontroller, which is designed for quick prototyping. It is similar to Uno but is smaller in size and has a lesser number of I/O pins. The board consists of a USB interface, power regulator, and voltage level shifters, which makes it easier to connect to computer and peripheral devices.

Piezo Buzzer



Fig.4 Piezo Buzzer

A piezo buzzer is a type of buzzer which uses piezoelectric elements to produce sound. One receiving the electric signal, the piezoelectric element vibrates at high frequency which produces a sound wave. Thus buzzer can be used for various applications like watch timers, alarm clocks, notification system, etc. It is usually smaller in size and has low power consumption.

L293D Motor Driver

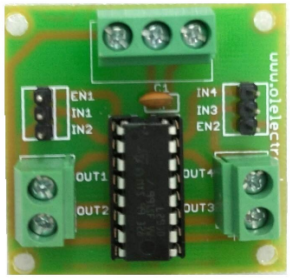


Fig.5 L293D Motor Driver

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This is a famous integrated circuit (IC) motor driver which is commonly used to control small DC motors or stepper motors. It can drive up to two DC motors in both directions, or one stepper motor with bi-directional control. The L293D IC has four input pins, two output pins, and two enable pins. Each input pin corresponds to a motor direction, and the enable pins are used to turn the motor on or off. This motor driver is widely used in automation, robotics and many other related fields. It is a reliable motor driver and is easy to use.

BO Motor



Fig.6 BO Motor (150 RPM)

BO motors typically have a simple construction consisting of a rotor, a stator, and a commutator. They are known for their high torque output and low power consumption, making them a popular choice for low-power applications. When selecting a BO motor, it's important to consider the voltage and current requirements, as well as the load that the motor will be driving. Additionally, factors such as the operating environment, motor size, and noise level should also be taken into account.

Jumper Wires

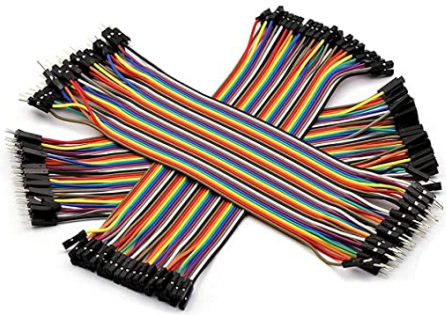


Fig.7 Jumper Wires

Jumper wires are a type of electrical cable used to create connections between electronic components on a breadboard or a printed circuit board (PCB). They are often made of flexible, insulated wires with pre-stripped ends that can be easily inserted into the holes of a breadboard or the sockets of a PCB. Jumper wires come in various lengths and colors, allowing for easy identification and organization of connections. They are commonly used in prototyping, testing, and troubleshooting electronic circuits. Jumper wires can be used to connect different components such as resistors, capacitors, LEDs, and microcontrollers, among others.

VII. DESCRIPTION OF THE PROJECT

Our project consists of 2 parts, i.e. creating a web page and implementing the working of hardware. The details regarding the same are mentioned below.

Software (Web Page)

For the software implementation the languages used in the project at the front-end development and the back-end development are as follows:

Front-End

1. HTML: HTML is the markup language for documents that are intended to be viewed in a browser. It has a few predefined set of tags which can be used to create the webpage. Each tag has a certain number of elements which can be used for purposes like heading, images, paragraphs and other many. For web development, it is essential to know about the basics of HTML.
2. CSS: Cascading Style Sheets is stylesheet language which is used for designing the presentation of web pages. Using CSS helps us to make web pages more accessible and responsive. CSS with the help of HTML and Java can be used to develop dynamic web pages. CSS can be used to develop a wide range of visual styles.
3. Bootstrap: Bootstrap is a famous front end development skeleton that helps to create reactive and accessible websites. It has a few predefined sets which include components like forms, navigation and many others which can be easily customized. It also helps to ensure consistency across different web pages.

Back-End

Django: Django is a free web framework written in Python which allows developers to create high-quality web applications quickly and easily. It is mainly used for complex and data-driven applications. It also has a robust ecosystem of third-party packages and integrations that can extend its capabilities.

Packages

The packages used in our project are:

1. TensorFlow: It is an open source platform for building and training of machine learning models in various domains like predictive analysis, speech recognition.
2. Keras: It is used to enable faster experimentation for neural networks. It is easy to use and has a user-friendly interface. It can be used to build and train models for a variety of tasks which include translation of language, classification of image and many others.
3. OpenCV: OpenCV is a powerful tool for anyone working with images or videos, providing a range of tools to help analyze and process visual information.
4. DLib: It is a famous open source library which is widely used for machine learning. It is known for its cross platform compatibility and high performance which makes it popular among developers working on computer vision projects.
5. Ipywidgets: It is a strong tool for making interactive and engaging notebooks that can help in better understanding and visualization. We can make excellent interfaces which

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can be used to explore and analyse data in real time. It allows the user to create GUIs for their Jupyter notebook.

Libraries

The libraries under the above mentioned packages used in this project are:

1. Cv2: It is a well known open source computer vision library. It is used for various computer vision applications which include facial recognition, image segmentation and more.
2. NumPy: It is a powerful tool for working with multidimensional arrays and matrices and has a wide range of mathematical operations.
3. Matplotlib: In python, this is used for data visualisation and plotting various plots like line plot, histograms, bar plot and many others.
4. Os: It mainly acts as an intermediary between the software applications and the hardware of the system.
5. Parameters: It is a collection of variables which are packaged and defined together in a particular system. We can modify and manage them as and when needed.
6. SciPy: This library is mainly used for technical and scientific computing. It has a wide range of functions for engineering, mathematics, signal processing, stats and many more.
7. Imutils: This package mainly focuses on image processing and computer vision tasks. It can perform functions like resizing, rotating, cropping images. It also includes simulating basic geometric transformations.
8. Pygame.mixer: pygame.mixer is a module that is part of the Pygame library. This module is mainly developed to handle sound and music and modulate the playback.
9. Tqdm: Tqdm is a Python library that provides progress bars for loops and other iterative processes. It is particularly useful for visualizing the progress of time-consuming operations, allowing users to track how much of a task has been completed and how much time remains.
10. Random: This module allows us to generate pseudo-random variables. It can be used to carry out various operations randomly, such as getting a random numeric value, randomly selecting items from a list, randomly moving items, etc.
11. Shutil: The shutil package is a Python standard library module that provides a set of utility functions for copying and moving files and directories.

Here is the image of how the home of our web page looks like:

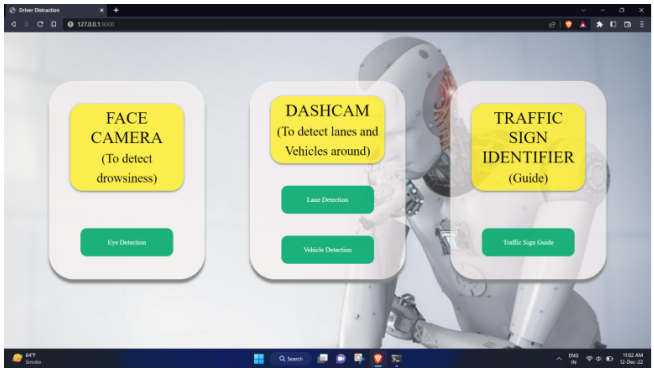


Fig.8 Webpage

Working of hardware

The above mentioned components are the main ones which are used in designing this system. A drowsiness detection system is designed to help prevent drivers from remaining awake behind the wheel of a vehicle. In this system, the eye blink sensor is used as an input and the motor and buzzer are used as an output. So, to begin with, we have used an eye blink sensor to the arduino which will keep a track on the eye motion of the driver. This eye blink sensor consists of a Tx and a Rx. The eye movement is detected and the message received by the sensor is sent to the Arduino for processing. The connections made here are done by connecting gnd and providing them power at their respective ports and the output of the sensor is connected to D8. On the basis of the input from the sensor, arduino will execute the next step. When the input from this sensor is high i.e. the eyes are open, it will continue to track the movement until the input becomes low. As soon as the input is low, i.e. the eyes are closed, a buzzer will start alarming and it will alert the driver to wake up. This buzzer will continue to alarm until the driver opens his eyes back. The positive terminal of this buzzer is then connected to the D11 pin of the nano and negative is connected to the GND pin. In Spite of the alarming sound, if the driver fails to open his eyes, the high value of the vehicle motor will gradually slow down and after a delay of certain seconds, it comes to halt. This is done by using a BO Motor, which uses the output terminal of the motor driver. Further, the motor driver is interfaced by connecting the motor driver with the Arduino controller by connecting the EN pin of the motor driver to the D3 pin of Arduino. As soon as the driver opens his eyes i.e. when the input is detected high by the sensor, the motor value will gradually increase to a certain value and later on with a time delay, the vehicle will start moving at a decent speed.

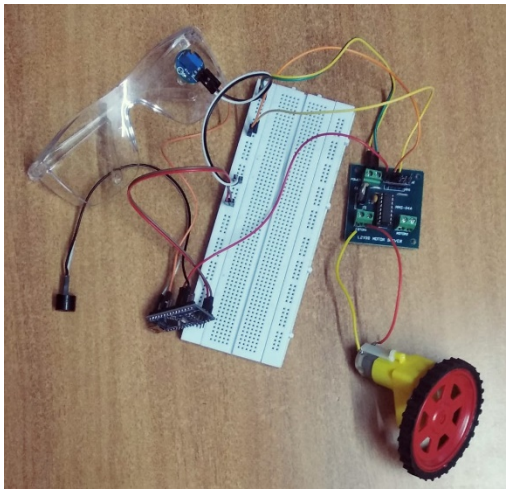


Fig.9 Hardware Circuit

VIII. CONCLUSIONS

In conclusion, a driver assistance system is a technology that helps drivers by providing them with information, alerts, and other features to make driving safer and easier. These systems often use sensors, cameras, and other advanced technology to monitor the vehicle and its surroundings, and they can provide a range of assistance such as lane cut warnings, collision prevention, and adaptive cruise control. Some drowsiness assistance systems are designed to fully

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automate certain driving tasks, such as parking the vehicle, while others are intended to simply provide additional information to the driver. In general, drowsiness assistance systems are intended to help drivers avoid accidents and make driving more efficient and enjoyable. The scope of a driver assistance system can vary depending on the specific system and the vehicle it is installed in, and the capabilities of these systems are constantly improving as the technology continues to advance.

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Implementation of 6th Order Maximally Flat Stepped Impedance Low Pass Filter

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***Abstract*—This paper presents the design and implementation of a Stepped Impedance Low Pass Filter using microstrip transmission line. The low pass filter is made to attenuate high frequency transmissions while permitting low frequency signals to flow through with very little loss. By using the stepped impedance technique, it is feasible to develop small filters that perform more effectively than lumped element low pass filter. The characteristic impedance and physical length of each segment of the filter is computed as part of the design process. The maximally flat filter response, which works well for applications requiring a fast transition between passband and stopband frequencies, is used during the design phase. Stepped impedance structure is used in the filter's implementation, which minimizes the filter's size while retaining its superior performance. The filter is constructed on a low cost FR-4 substrate and developed and simulated using IE3D software. The filter has more than 20 dB insertion loss at 4 GHz and a passband frequency of 2.5 GHz. The filter can be used in numerous variety of applications, including satellite communication systems, radar systems, and wireless communication.**

Keywords—Low Pass Filter, Maximally flat response, Stepped Impedance.

I. INTRODUCTION

In modern communication and electronic systems, the usage of high-frequency transmissions has increased in significance. These signals can, however, also contribute unwanted noise and interference, which can reduce the system's performance. Filters are frequently used to reduce noise and enhance signal-to-noise ratio in order to address this problem. One of the many types of filters is the low pass filter, which attenuates high-frequency frequencies while allowing low-frequency information to pass through. In this paper, we describe the preparation and implementation of a microstrip-based stepped impedance low pass filter. In contrast to conventional low pass filters, a small filter size may be achieved using the stepped impedance approach. Modern communication systems depend on low pass filters, which allow low-frequency signals to flow through while restricting high-frequency signals. For many years, the design of low pass filters has been a subject of active research, with several methods being put out to improve filter performance. Since they may perform more effectively than conventional low pass filters while maintaining a compact size, stepped impedance low pass filters have recently garnered considerable interest. The design and implementation of a stepped impedance low pass filter in a microstrip environment has been studied using a particular design method, the characteristic impedance and physical length of each segment of the filter are calculated as part of the design process. In order to, verify the low pass filter's performance, a full-wave electromagnetic simulator IE3D is used. The developed low pass filter is put into action on a printed circuit board, then its effectiveness is assessed. A fast and effective solution for applications requiring high-performance filtration at high frequencies is solved using the recommended stepped impedance low pass filter. The cutoff frequency, or the frequency at which the filter's attenuation starts to grow, and the stopband attenuation, or the amount of signal suppression outside the passband, are utilized to assess the filter's performance.

II. OBJECTIVE

The paper aims to provide an efficient and effective method for creating a compact, high-performance low pass filter (LPF) leveraging stepped impedance methodology. With microstrip technology, the major objective is to create a sharp cut-off frequency with a wide stopband attenuation. The paper describes the design method, which involves using a specific design algorithm to determine the values of the characteristic impedance and physical length of each section of the filter in order to achieve this objective. In order to verify the low pass filter's performance, a full-wave electromagnetic simulator IE3D is used. The developed filter is then put into practice on a printed circuit board and tested to verify its effectiveness. Overall, by presenting a concise and viable solution for applications that require high-performance filtration at high frequencies, the study is aimed at functioning as a useful resource for researchers and engineers who work in the field of high-frequency filter design.

III. PROPOSED DESIGN

Microstrip low-pass filters can be implemented using alternating sections of very high and low characteristic impedance (Z_o) lines. These filters are categorized as stepped-impedance, and are extensively used in various circuit designs as it is easier to design and consumes a very little space. But, they are prone to poor electrical performance, such filters are typically only used in situations where a sharp cut-off is not required.

The relative circuits for a short transmission line that has either a very high or very low characteristic impedance. ABCD parameters are given below:

Z - parameters are derived as

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$Z_{11} = Z_{22} = A/C = -jZ_0 \cot\beta l$, (1A)

$Z_{12} = Z_{21} = 1C = -jZ_0 \csc\beta l$, (1B)

The T-equivalent circuit's series components are

$Z_{11}-Z_{12} = jZ_0 \tan(\beta l/2)$ (2)

The Shunt element of T-equivalent is Z_{12}. Different types of reactive components can be designed on the basis of βl value; if $\beta l < \pi/2$ then its series element acts as inductors or positive reactance, while in shunt it is capacitor or negative reactance.

For high Zo and small βl, X_L = Zo βl. While for low Zo and small βl, the equivalent circuit becomes B_C = Yo βl. In order to realize a lumped element low pass filter in transmission line format, short transmission line segments are used. The greatest and lowest transmission line impedances, Z_h and Z_l, must be known in order to utilize this approximation. Thus using alternate segments of extremely high and very low characteristic impedance lines cascaded to form a ladder is the concept of the stepped impedance. A low-pass prototype's series inductors are swapped out for high impedance line segments, while the shunt capacitors are swapped out for low impedance line segments.In this process, the Z_h/Z_l ratio should be as high as possible.

$Z_h = LR_{0l}$ and $Z_l = R_{0l}C$ (3)

In this design, 120Ω and 20 Ω are used as the greatest and lowest line impedances, respectively. Source impedance Zo = 50 Ω and filter order N = 6. The filter is printed on FR-4 substrate of dielectric constant 4.3 and thickness of 1.6 mm. The problem statement is to design a stepped-impedance lowpass filter having a maximally flat response and a cutoff frequency of 2.5 GHz. It is desired to have more than 20 dB insertion loss at 4 GHz. The filter impedance is 50 Ω.
Formula for n is :

$$n = \frac{\left(10^{\frac{A}{10}} - 1\right)}{2\left(\frac{\omega_1}{\omega_c}\right)}$$

Where A = 20dB, ω_c = 2*π*fc, ω_1 = 2*π*f1

Substituting fc = 2.5 GHz and f1 = 4 GHz, thus n = 6. Normalized values of the components are calculated using $g_0 = g_{n+1} = 1$ & $g_k = 2\sin\{2(k-1)/2n\}$, where k = 1, 2, 3,…..,n

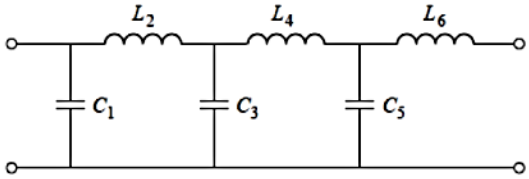


Fig. 1 Realization of filter using LC components

Sections	g_i	Zi = Z_l or Z_h	l_i (deg)	W_i (mm)	l_i (mm)
1	0.517 = C_1	20 Ω	11.8	11.3	2.05
2	1.414 = L_2	120 Ω	33.8	0.5	6.63
3	1.932 = C_3	20 Ω	44.3	11.3	7.69
4	1.932 = L_4	120 Ω	46.1	0.5	9.04
5	1.414 = C_5	20 Ω	32.4	11.3	5.63
6	0.517 = L_6	120 Ω	12.3	0.5	2.41

IV. IMPLEMENTATION

Figure 5 illustrates how the Ansoft Designer SV programme implements the stepped impedance low pass filter utilising microstrip line that was created in the previous section. The a forementioned circuit is simulated at frequencies between 0 and 8 GHz. Figure 6 displays the response. As seen in Figure 7, the CST2019 software also employs the stepped impedance low pass filter architecture. Across the frequency range of 0.6 to 4GHz, the circuit is simulated. Figure 8 displays the simulated response of the filter. The filter's cut-off frequency is 2.504 GHz, and its insertion loss at 3.9 GHz is less than 20 dB, as can be seen from the S21 response. On the inexpensive FR-4 substrate, the filter is constructed. The filter's prototype can be seen below. In the lab, the Vector Network Analyzer ZVH-8 is made accessible by Rhode and Schwartz for measuring the filter's response. This is an illustration of the measurement process. This is a representation of the filter's measured magnitude response: The cut-off frequency is almost 2.4 GHz, and the insertion loss at 3.96 GHz is around 23 dB, according to the two markers in the diagram. The filter's phase response was also measured and is depicted in Figure.

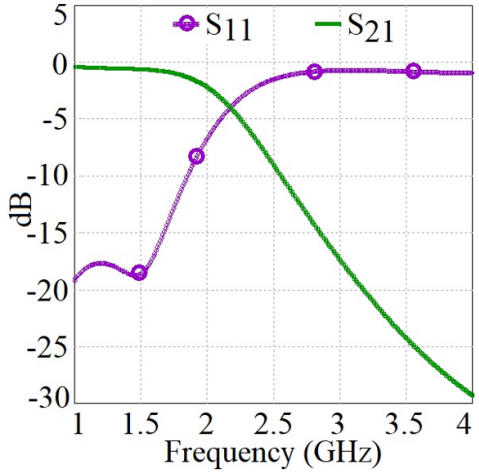


Fig. 2 Circuit is simulated at frequencies between 0 and 8 GHz. Figure 6 displays the response.

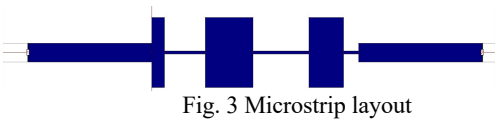


Fig. 3 Microstrip layout

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V. RESULTS AND CONCLUSION

This paper successfully illustrates the designed and implemented stepped impedance low pass filter utilizing microstrip technology. The low pass filter offers a narrow stopband attenuation and a sharp cutoff frequency. The filter has a stopband attenuation of more than 40 dB up to 10 GHz and a 3-dB cutoff frequency of 2.4 GHz. The evaluated results demonstrate that the designed LPF performs better than conventional low pass filters. As a conclusion, the proposed stepped impedance low pass filter offers a quick and efficient solution for uses that require powerful filtering at high frequencies. As compared to conventional low pass filters, the filter design that uses microstrip technology and a stepped impedance method has shown to perform better. The characteristic impedance and physical length of each part of the filter are calculated throughout the design phase using a specific design methodology. A full-wave electromagnetic simulator is used to simulate the filter in order to verify its performance. For researchers and engineers working in high-frequency filter design, the described LPF design and implementation method might be a useful resource. The proposed filter architecture is easily adaptable to various applications and cutoff frequencies. Overall, the technique is straightforward, efficient, and useful for designing high-frequency filters.

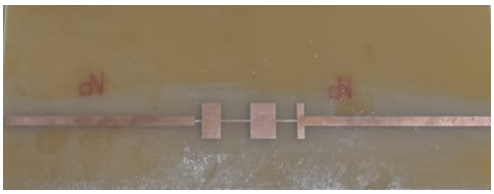


Fig. 5 Fabricated prototype of stepped Impedance Low Pass Filter

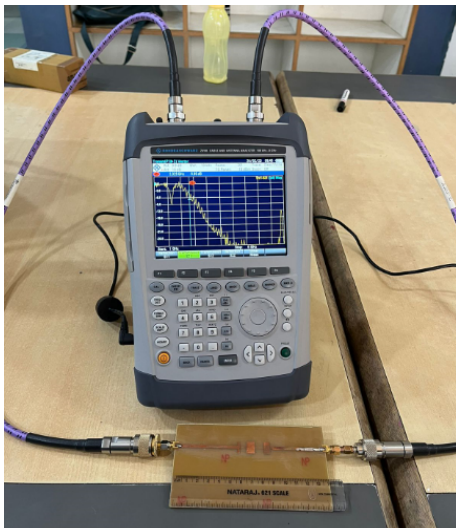


Fig. 6 Measured Filter Response

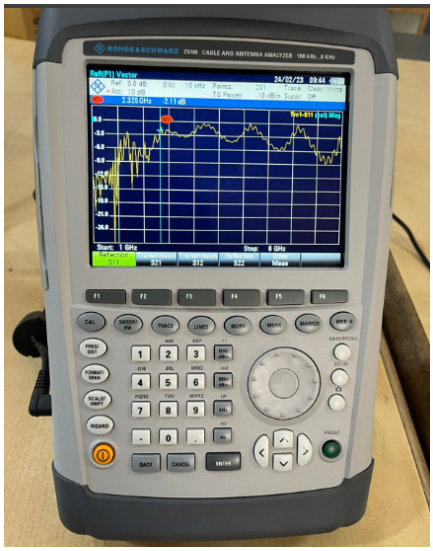


Fig. 7 Filter's measured magnitude response

ACKNOWLEDGEMENT

We would like to express our gratitude to everyone who assisted this research work on the Design and Implementation of Stepped Impedance Low Pass Filter be completed successfully. We extend our thanks to the technical staff who provided us with technical support and assistance during the implementation of the Low pass filter.

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Face Recognition System

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***Abstract*—In recent years, facial recognition systems have gained popularity as a biometric technology that uses algorithms to identify individuals based on their unique facial features. These systems find applications in various fields, such as security, law enforcement, and personal device access control. Building an effective facial recognition system involves carefully considering the hardware and software components, such as high-resolution cameras, powerful computers, and large searchable databases. However, the use of facial recognition systems raises concerns about privacy and data protection, and it is crucial to address these ethical and legal issues as the technology continues to evolve and spread. Therefore, it is essential to ensure that facial recognition systems are employed responsibly and ethically.**

Keywords—Facial recognition, Cascade method, Security, Ethics, OpenCV, Algorithms, Haar Cascade classifier, Neural Network, Python

I. INTRODUCTION

Facial recognition is a cutting-edge process of identifying or verifying an individual's identity by analyzing various facial features. This sophisticated system operates by scrutinizing numerous facial attributes, including the contours of the eyes, nose, mouth, and jawline. In the proposed project, we employ the Haar Cascade classifier algorithm, which is a state-of-the-art machine learning-based object detection algorithm utilized to identify objects in images or videos. The Haar Cascade algorithm derives its name from the Haar wavelets utilized as the foundation for the features computed in the algorithm. These wavelets possess several critical properties that render them ideal for signal and image processing. By analyzing and comparing different patterns, one or more individuals are identified during the face recognition process. This is achieved by computing the correlation coefficient and Euclidean distance of scaling coefficients of wavelet transformed images.In the face recognition process, typically facial features are extracted and compared to a vast database for finding the best match. OpenCV (Open Source Computer Vision Library), a widely popular open-source library for computer vision, machine learning, and image processing, offers a broad range of face recognition algorithms, including the Haar Cascade algorithm and other deep learning-based face methods. The OpenCV architecture comprises software, databases, and plugins that are pre-programmed with support for integrating computer vision applications. Face detection is a form of computer vision that assists in identifying and visualizing facial features in captured images or real-time scenarios. Facial recognition technology has the potential to revolutionize distance learning and education by improving the quality and efficiency of online learning environments. This technology offers a secure and engaging learning experience tailored to meet the unique needs of each student. With the implementation of facial recognition technology, distance learning institutions can enhance the learning experience, reduce the risks of identity theft, and improve overall security.

II. OBJECTIVE

Facial recognition is a rapidly growing interdisciplinary field with significant security implications, as it allows for the identification of individuals in photographs. The process of face identification and recognition involves biometric programming, which analyzes patterns in a person's facial features to accurately identify and describe their unique characteristics. The goal of our project is to develop a model that can detect faces, analyze emotions, and track eye movements in real-time. While face detection is a key component of facial recognition, not all techniques for detecting faces are suitable for this purpose. In addition to identifying individuals, face detection can also be used for facial motion capture, where cameras or laser scanners track facial movements and translate them into digital data for creating computer-generated animations. Face detection can also be utilized for counting the number of people entering a space, adjusting camera focus automatically, and for marketing purposes, such as displaying personalized ads based on recognized faces.

III. PROPOSED DESIGN

The proposed system looks to utilize a combination of Python, Haar Cascade and Convolutional Neural Network (CNN) algorithms to accurately identify a person's face and emotions.First, the system would use the Haar Cascade algorithm to detect a face in the image. The Haar Cascade algorithm works by detecting certain features in the face and measuring the differences between them. It is an effective way of detecting faces and it is fast as well. Next, the system would use the Convolutional Neural Network (CNN) algorithm to detect the eyes in the image. The CNN algorithm works by training the network to recognize certain features in the image and then using those features to identify eyes. This algorithm is also fast and accurate. Finally, the system would use the CNN algorithm to detect the emotion of the person in the image. The CNN algorithm works by training the network to recognize certain features in the image and then using those features to identify certain emotions. This algorithm is very accurate in detecting emotions. Once all the features

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have been detected, the system can then use the data from all these algorithms to accurately recognize a person's face and emotions. This data can be used to build an accurate facial recognition and emotion detection system. By using the combination of these algorithms, the proposed system is able to accurately identify a person's face and emotion. The system can then be used in various applications such as facial recognition, video surveillance, and emotion recognition. This system can also be used to build robots that are capable of recognizing and responding to human emotions.

IV. METHODOLOGY

Methodology of the Haar Cascade algorithm for face recognition:

Collect images

Collecting positive and negative images for training the classifier. Positive images contain faces, while negative images do not. The Haar Cascade algorithm needs a large set of these images to train the classifier.

Train the classifier

The Haar Cascade algorithm uses a machine learning technique called AdaBoost to select a small number of important features from the training images. These features are called Haar features, and they capture the contrast between adjacent regions of an image.

Construct and Apply a cascade of classifiers

The Haar Cascade algorithm uses a series of classifiers in a cascade, where each classifier has a higher detection rate but a lower false positive rate than the previous classifier. The Haar Cascade algorithm scans the input image at various locations and scales. At each different location and scale, the algorithm applies the cascade to check if there is a face. If a face is detected, the algorithm returns the location of face.
Post-processing: Once the faces have been detected, the algorithm may perform post-processing to improve the accuracy of detection.This may include filtering out false positives or adjusting the location and size of the detected faces.

Overall, the Haar Cascade algorithm is an effective method for face detection in images and videos, with many practical applications in security, surveillance, and biometrics.

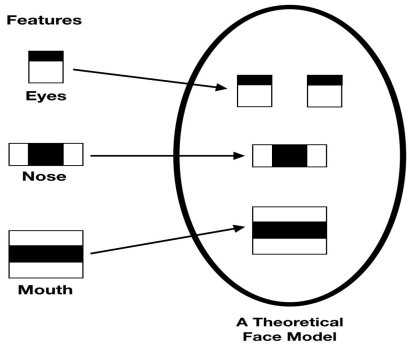


Fig.1

The methodology of using a Convolutional Neural Network (CNN) in an emotion detection involves :

Data Preparation

This step involves collecting or selecting a dataset of facial images that are labelled with the corresponding emotion they represent. The dataset should be large enough and diverse enough to train the CNN effectively. In addition, the images may need to be pre-processed to normalize the lighting, orientation, and size.

CNN Architecture Design

The next step is to design the architecture of the CNN. This involves selecting the number of layers, the type of layers (e.g., convolutional, pooling, fully connected), and the activation functions. The architecture should be designed to effectively extract relevant features from the input images.

Training

Once the CNN architecture is designed, the network is trained on the dataset. This involves feeding the images into the network and adjusting the weights of the network to minimize the error between the predicted output and the actual label. The training process can be accelerated by using techniques such as mini-batch processing, data augmentation, and transfer learning.

Testing and Evaluation

Once the CNN is trained, it is tested on a separate test dataset to evaluate its performance. The performance can be evaluated using metrics such as accuracy, precision, recall, and F1-score. If the performance is not satisfactory, the CNN architecture may need to be adjusted or the dataset may need to be modified.

Deployment

Finally, the trained CNN can be deployed to make predictions on new images. This typically involves pre-processing the new images and feeding them into the trained network to obtain the predicted emotion.
Overall, the methodology of using a CNN in an emotion detection project involves designing an effective network architecture, training the network on a dataset, evaluating the performance, and deploying the trained network for

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prediction. The key to success is to carefully design the network architecture and train the network on a diverse and relevant dataset.

V. IMPLEMENTATION

Face Detection

The process of identifying human faces in images or videos is commonly known as face detection. In Python, we can employ the Haar Cascade classifier, a machine learning-based approach that uses a cascade function to recognize specific object features. For the purpose of detecting faces, the cascade function is trained to identify key facial features such as the eyes, nose, and mouth.

To implement face detection using the Haar Cascade classifier in Python, we can leverage the OpenCV library, which offers pre-built functions to execute this task. The following are the fundamental steps involved in implementing face detection using this approach:

1. Import the necessary libraries, including OpenCV and NumPy.
2. Load the Haar Cascade classifier for face detection using the 'cv2.CascadeClassifier' function.
3. Read the image or video file on which we want to perform face detection.
4. Convert the image to grayscale using the 'cv2.cvtColor' function.
5. Use the 'detectMultiScale' function to detect the faces in the image. The function returns a list of rectangles containing the coordinates of the detected faces.
6. Draw a rectangle around the detected face using the 'cv2.rectangle' function.
7. Display the resulting image using the 'cv2.imshow' function.

Eye Detection

Eye detection is a similar process to face detection, where we detect the eyes in an image or video. We can use the Haar Cascade classifier to detect eyes in Python. Here are the basic steps to implement eye detection:

Import the necessary libraries, including OpenCV and NumPy.

Load the Haar Cascade classifier for eye detection using the 'cv2.CascadeClassifier' function.

Read the image or video file on which we want to perform eye detection.

Convert the image to grayscale using the 'cv2.cvtColor' function.

Use the 'detectMultiScale' function to detect the eyes in the image. The function returns a list of rectangles containing the coordinates of the detected eyes.

Draw a rectangle around the detected eyes using the 'cv2.rectangle' function.

Display the resulting image using the 'cv2.imshow' function.

Emotion Detection

Emotion detection refers to the process of detecting human emotions in images or videos. In Python, we can use Convolutional Neural Networks (CNN) to classify images into different emotions such as happy, sad, angry, etc. Here are the basic steps to implement emotion detection using CNN:

1. Import the necessary libraries, including TensorFlow, keras, and NumPy.
2. Load the dataset for emotion detection, which contains images labelled with different emotions.
3. To partition the dataset for training and testing purposes, we employed the 'train_test_split' function.
4. Pre-process the image data using techniques such as normalization, resizing, etc.
5. Build a CNN model using the Keras library. The model should have several convolutional layers, max pooling layers, and fully connected layers.
6. Train the CNN model on the training set using the 'fit' function.
7. Evaluate the trained model on the testing set using the 'evaluate' function.

Use the trained model to predict the emotions in new images. The predicted emotion can be displayed using the 'imshow' function.

V. RESULTS AND CONCLUSION

Various Cascade classifiers were utilized in this project to recognize a person's face and to anticipate a person's real-time expression accurately. The model can make the predictions using a few parameters and a real-time webcam. It can accurately recognize many faces at a time but can only detect the emotion of 2 at a time correctly. However, research is being done to integrate subjective characteristics in the model, such as speech tone recognition or gesture recognition, in order to improve the model's accuracy. The goal of this study is to use external parameters of the body to understand a person's emotions as well as how our mind interprets those emotions. Our results demonstrate that the model is able to detect basic emotions such as anger, happiness, sadness, surprise, and neutrality with a high degree of accuracy. The potential applications of this technology are numerous, including video surveillance, human-computer interfaces, security, and robotic vision. In conclusion, this study demonstrates the potential of using external parameters of the body to accurately predict human emotions in real-time, and lays the groundwork for further research in this exciting field.

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The Experimental Demonstration is as follows:

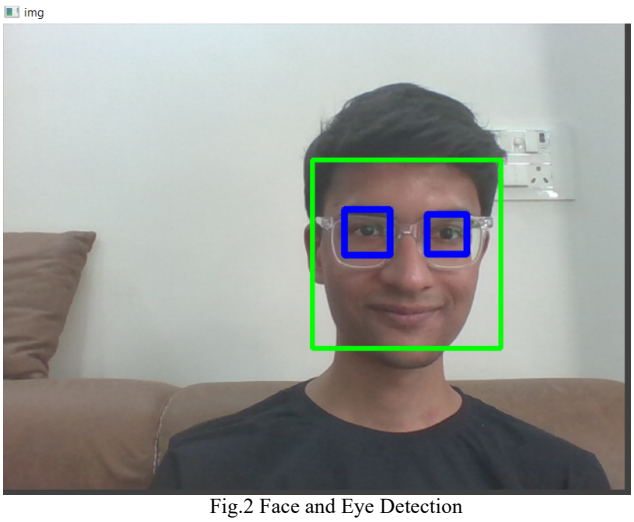


Fig.2 Face and Eye Detection

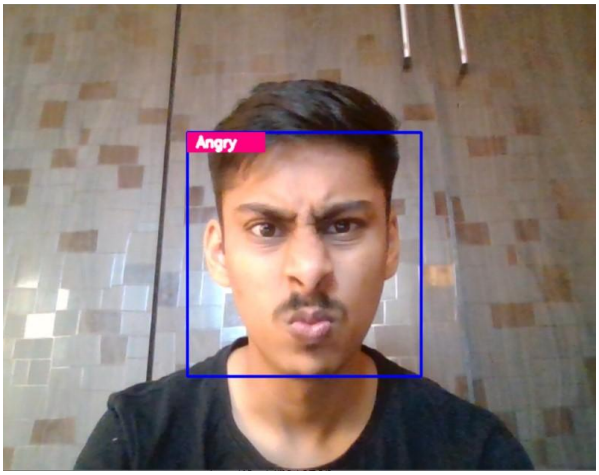


Fig.3 Emotion Angry

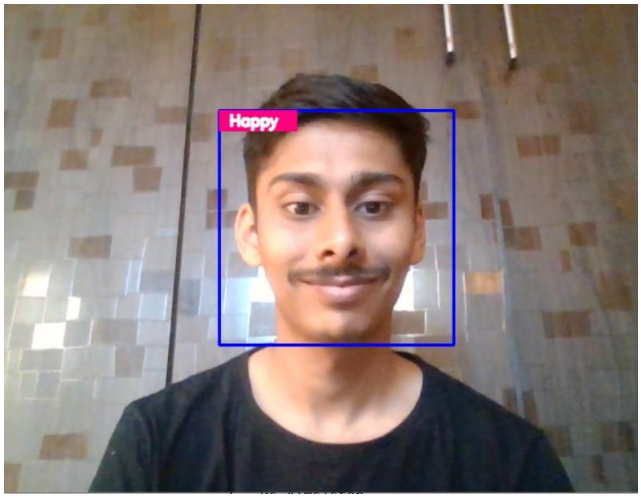


Fig.4 Emotion Happy

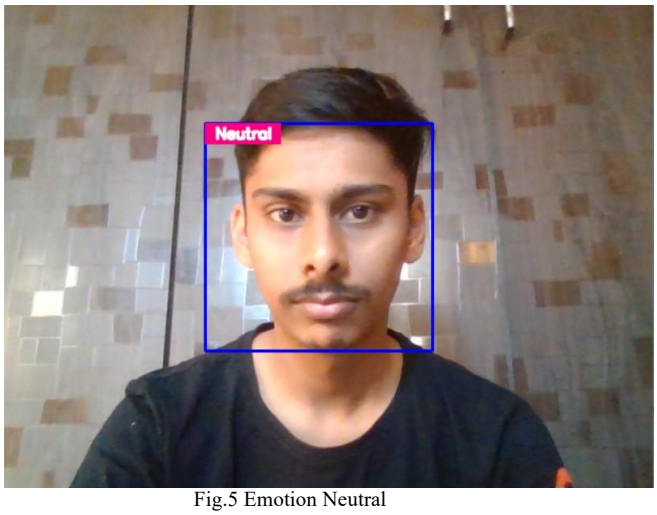


Fig.5 Emotion Neutral

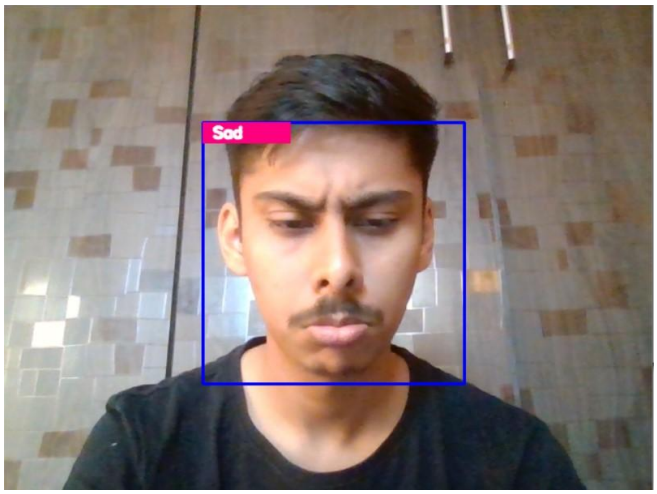


Fig.6 Emotion Sad

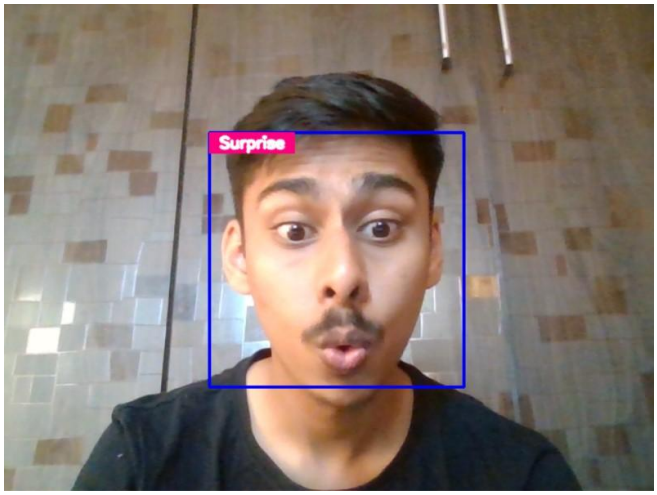


Fig.7 Emotion Surprise

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VI. SOCIAL IMPACT

Face and emotion recognition systems have the potential to bring significant social benefits in various areas, including security, healthcare, and customer service. These technologies can be used to identify individuals who may pose a security risk, monitor patients' well-being, and personalize customer experiences. However, the social impact of these systems is complex and multifaceted, and there are also significant concerns that need to be addressed. One of the primary concerns is privacy. The use of face recognition systems may violate individual privacy by collecting and analyzing personal data without consent. Additionally, there are concerns about the potential for mass surveillance and monitoring of individuals through the use of these technologies. Such monitoring could result in a loss of privacy and autonomy. The accuracy of face and emotion recognition systems is also a significant concern. There is evidence to suggest that these systems are less accurate when identifying individuals from certain racial or ethnic groups or in different lighting conditions. Inaccurate identification could lead to false accusations, wrongful arrests, and other negative consequences. In conclusion, while face and emotion recognition systems have many potential benefits, there are also significant social concerns associated with their use. As such, it is essential to carefully consider the ethical and social implications of these technologies before deploying them in any context. Measures must be put in place to address privacy concerns, mitigate biases, and ensure the accuracy of these systems. Additionally, efforts must be made to minimize the psychological effects of these technologies on individuals and to avoid their potential use for discriminatory practices.

ACKNOWLEDGEMENT

We extend our deepest gratitude to Professor Ranjushree Pal for her invaluable guidance, support, and expertise throughout the development of our technical paper on face, eye, and emotion detection. Her insights and advice have been fundamental in shaping the direction of our research and ensuring its success. We are immensely grateful for her unwavering dedication and commitment to our project. Furthermore, we would like to express our heartfelt appreciation to our colleagues who generously contributed their time and effort to our study. Their participation has been instrumental in helping us achieve our research objectives and delivering high-quality results. We are deeply grateful for their unwavering support and would like to express our sincere thanks to each and every one of them.

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Broadband Gap Coupled Circular Microstrip Antenna

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***Abstract*—This Paper has analysis of how does the circular microstrip antenna work. The basic structure and the designing of the single Circular Microstrip patch. Further, we have taken the gap coupled Circular patches along the X-axis and optimized the same. After the previous configuration we designed and optimized circular patches located at 45 and 135. All the above configurations are designed at 900MHz. This antenna provides the large bandwidth.**

Keywords— Microstrip Antenna, Circular Polarization, CO-Axial feed, Gap coupled, Broadband Microstrip Antenna.

I. INTRODUCTION

Microstrip antenna (MSA) in its simple form consist of a radiating patch on one side of a thin dielectric substrate backed by ground plane. The radiating patch can be of any random shape, but it is generally taken as a regular shape for ease of analysis and understanding of the antenna. For the fundamental TM10 mode, length L should be slightly less than λ/2, here λ is the wavelength in the dielectric medium. MSA. Microstrip antennas have grown in popularity in recent years as a result of their benefits such as low profile, lightweight, ease of fabrication, and integration with microwave integrated circuits. Because of their low profile, ease of integration, and compatibility with microwave integrated circuits, microstrip antennas are widely used in modern wireless communication systems. Microstrip antennas, on the other hand, have poor impedance matching, a narrow bandwidth, and a low gain. We have studied Gap Coupled Circular Microstrip Antenna. A CMSA excited at its fundamental TM11 mode exhibits a one-l/2 cycle variation in the field along its half-circumference. At the diametrically opposite points along the feed axis the field is maximum. The coupling is greatest when the parasitic patches are placed parallel to the feed-axis, whereas the coupling is negligible when the patches are placed perpendicular to the feed-axis due to the null of the electric field. To produce a broad BW, the parasitic circular patches placed along the feed axis could be gap-coupled, directly coupled, or hybrid-coupled.

II. SELECTION OF SUBSTRATE

For our antenna design at 900 MHz, we used a FR4 substrate with a dielectric constant of 4.3 and a loss tangent of 0.02. We chose this type of substrate for our design after evaluating various factors and comparing it to other substrates available in the market. FR4 substrate is a low-cost, widely available material, making it an economical choice for antenna fabrication. It has good dielectric properties, such as a low loss tangent of 0.02 and a high permittivity, allowing for efficient energy transfer between the antenna and free space. As a substrate, it is simple to handle and fabricate, making it a popular choice for prototyping and low-volume production runs. The FR4 substrate has high mechanical strength and stiffness, making it resistant to bending and deformation during fabrication and operation. Because it is widely used in the electronic industry for a variety of applications, there is a wealth of data on its properties, making it easier to predict and simulate the antenna's behavior. Overall, the combination of low cost, good dielectric properties, ease of fabrication, mechanical strength, and widespread use makes FR4 substrate an appealing choice for fabricating antennas, particularly for applications requiring low-to-medium performance.

III. DESIGNING OF A MICROSTRIP ANTENNA

There are several steps involved in the designing process of the microstrip antenna which are as follows:

1. Specification Required: For designing a microstrip antenna we need to mention the system requirements which include the bandwidth, gain, radiation pattern, polarization, operating frequency and size. All these information is important for selecting the substrate material and determining the patch dimension and feed location. In our Designing we have our operating frequency at 900 MHz.
2. Selection of substrate: This is one of a critical parameter that affects the antenna's efficiency and performance. The substrate is selected keeping in mind the various factors such as dielectric constant, dielectric loss, thickness, cost, and availability. Commonly used substrate materials include FR4, Rogers, Duroid, and Teflon. We have used FR4 as our substrate as it has relatively good behaviour and it is cost effective.
3. Patch Shape and dimensions: The patch shape and size determine the operating frequency and polarization. Using the below formula we have determined the radius of our CMSA center patch.

$$Fr = \frac{1.8911c}{2\pi a\sqrt{\epsilon r}} \qquad (1)$$

Doing this accurately we get the desired resonance matching and required impedance matching.
4. Feeding Mechanism: Feeding is used to excite the patch and release the electromagnetic wave into the free space. The different types of the feeds are Microstrip line feeding, Co-axial probe feeding, Aperture coupling and proximity coupling feeding. In our project we have used co-axial feeding. Coaxial-line feeds, which connect the coax's outer

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conductor to the ground plane and its inner conductor to the radiation patch, are also often utilized.

5. Ground plane: For MSA ground plane serves as a reflector and counterpoise. To reduce surface wave losses and provide a low return path for the antenna current, the ground plane must be sufficiently large.
6. Simulation and optimization: After the design parameters are established, software like Zeland can be used to simulate the performance of the antenna. To improve the design parameters and make sure the antenna satisfies system requirements, simulation results are employed.

In order to obtain the desired performance and efficiency when constructing a microstrip antenna, several design parameters and simulation tool must be carefully taken into account.

IV.CONFIGURATION AND OPTIMIZATION OF OUR MICROSTRIP ANTENNA

In our design we have first designed and optimized the X-configuration and then optimized the 45° and the 135° configuration. We have calculated the radius of the center patch using the previous mention formula and then according adjusted the dimensions of the parasitic patches to get optimized output.

X-Configuration

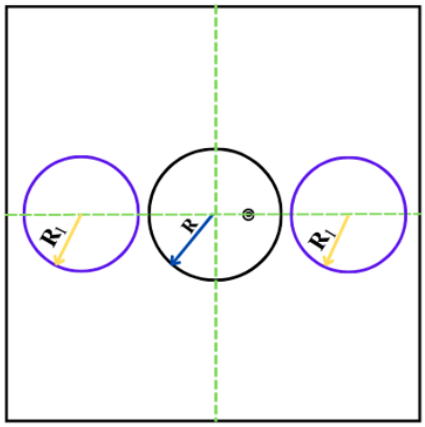


Fig.1 X-Configuration

In this configuration the radius R of the center patch is 49mm and the side patches are of radius R_1 are of value 47mm this dimension of the parasitic patches are obtained after optimization of this current configuration. The gap between the Center patch and the parasitic patch is of 1mm and the height of the substrate is 1.6mm. loss tangent is 0.02. the feed point is at 30mm. The coupling between the parasitic and the fed patch is weak due to the curved surfaces.

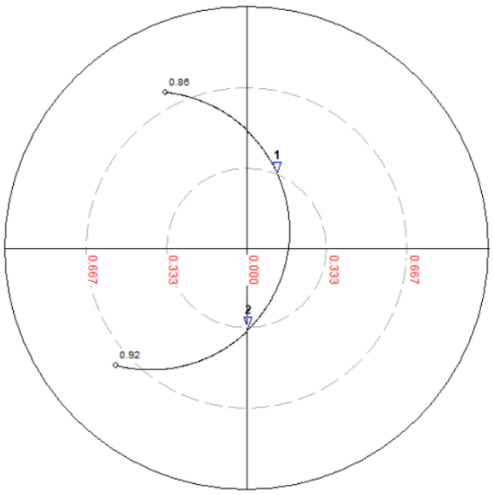


Fig.2 X-Configuration

This is the optimized smith chart of the given configuration in which the points which are cutting the VSWR circle is at 882 MHz and 900 MHz that means it has a bandwidth of 18 MHz. Now, keeping in mind these results we can increase the bandwidth by using the five patch design.

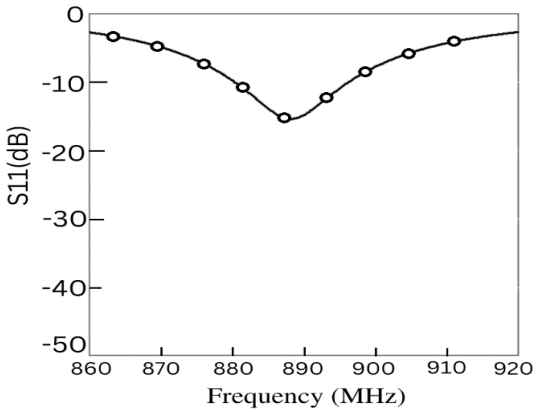


Fig.3 S11 curve.X-configuration

Five patch configuration

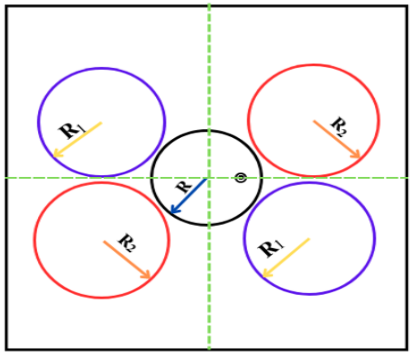


Fig.4 Five patch configuration

In this configuration the bandwidth is improved as compared to the x-configuration. Initially all the five patches of the same radius are selected. The parasitic patches are kept along the orthogonal to the positive and negative direction of the Y axis. There will be no coupling due to these additional two patches because of the null voltage of the fed patch along this

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axis. For our design we have dimension of R as 49mm R_2 as 50mm and R_2 as 52mm.

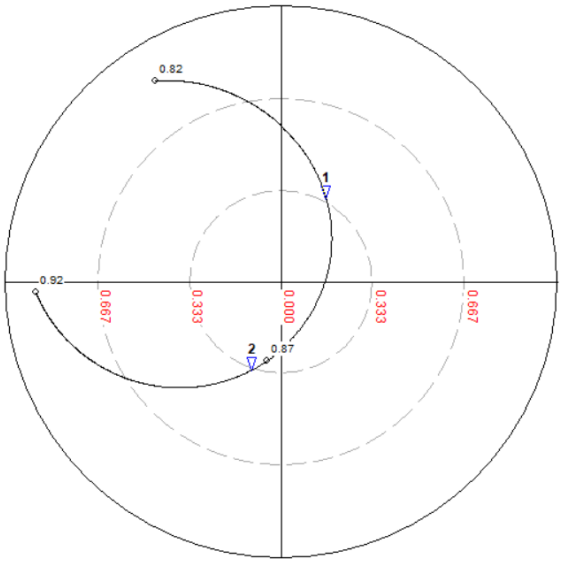


Fig.5 Five patch-Configuration smith chart

The VSWR circle is cut at frequency 850 MHz and 871 MHz so the bandwidth is 21 MHz so we can see that there is slight increase in the bandwidth compared to the X-configuration.

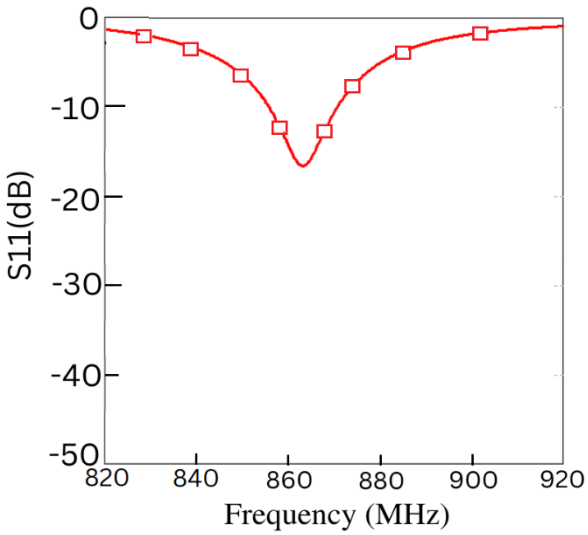


Fig.6 S11 curve Five patch-Configuration

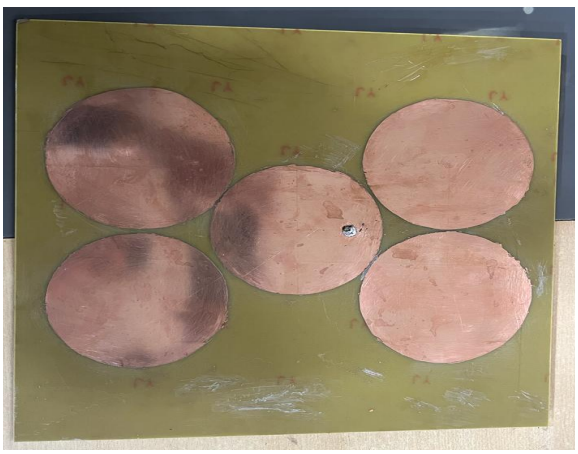


Fig.7 Five patch-Configuration Prototype

This is the actual design which was fabricated using the Fr4 substrate and then its impedance measurement was done using ROHDE & SCHWARZ ZVHB – cable and antenna analyzer. Which has frequency range from 100KHz to 8 GHz.

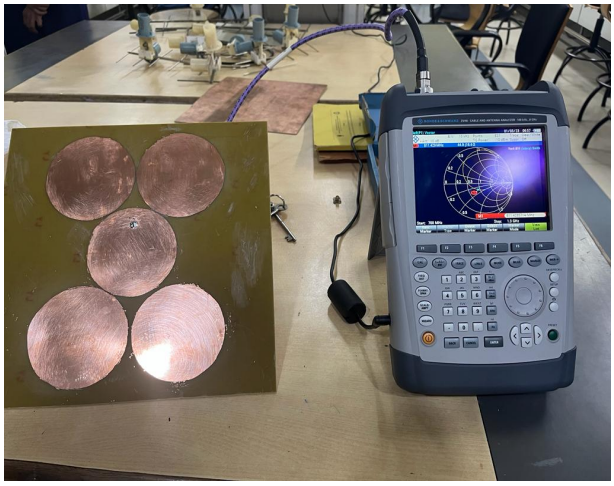


Fig.8 Five patch-Configuration impedance measurement

ACKNOWLEDGMENT

I would sincerely thank my guides Prof. (Dr.) Amit A Deshmukh, Dr. Aarti Ambekar and Dr. Venkata Chavali for their valuable time guidance and efforts for this work done by us. At each and every step they have been our guiding lamp and comprehensive direction, which supported us at every level. We would like to express our gratitude towards them.

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AI Based Face Recognition For Surveillance Application

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***Abstract*—In order to improve security, the "AI Based Face Recognition for Surveillance Application" project seeks to develop a system that employs deep learning algorithms to detect human faces in real-time. The system may be used for forensic investigations, access control, and security systems because it is made to function in a variety of lighting and camera angles. The project offers a dependable solution for security and surveillance applications with a user-friendly interface for system control and monitoring .**

Keywords—Face Recognition, Deep Learning, Artificial Intelligence.

I. INTRODUCTION

To create and put into use a computer vision system that can accurately and quickly identify people in real-time surveillance film by their faces in order to help security officers spot people of interest and follow their whereabouts. The system must be able to function in a variety of lighting and environmental situations, as well as manage issues like partial occlusions and other difficulties that frequently occur in surveillance footage. The project's ultimate goal is to provide a useful tool that can increase the efficacy of monitoring operations while also lightening the workload of security personnel. Technology for facial recognition is one of the most widely used uses of computer vision, which has seen enormous progress in recent years. Create an AI-based facial recognition system for surveillance applications is the goal of this research project. To develop a reliable and effective facial recognition system, the project will investigate several machine learning and deep learning techniques, such as Convolutional Neural Networks (CNNs)[1]. The system will be built to recognise people in a video stream and compare them to people in an existing database. The project will concentrate on creating a scalable and effective system that can be used for security and surveillance reasons, such as identifying suspects or tracking missing people, in real-world settings. In addition to addressing privacy issues, the research will examine the ethical implications of facial recognition technologies. The approach and implementation of the AI based face recognition system, as well as an assessment of its performance using benchmark datasets, will all be included in the study article. The system's possible uses, its drawbacks, ethical issues, and the future directions of face recognition technology for surveillance purposes will all be covered in this study.

II. METHODOLOGY

Initial research into facial recognition software and the algorithms they use. Identify the most efficient algorithm and develop the machine learning model. Find an adequate data set to avoid overfitting and set that as the training set. Finetune the CNN model using this selected training set.
Apply the model parameters to the test set and find the accuracy of the model. Implement the model on hardware for adaptation to surveillance applications.

III. WORKPLAN

Identify the specific goals and objectives of the project, including the desired outcomes and any constraints or limitations. Conduct a thorough literature review to identify existing approaches and techniques for AI based face recognition, and to identify potential challenges and limitations. Design a data collection plan to gather a sufficient quantity and quality of training data for the face recognition algorithm. This may involve setting up cameras at strategic locations to capture images of individuals in different lighting conditions and from different angles[3].Develop a face recognition algorithm using machine learning techniques, such as deep learning, to train the algorithm on the collected data. Test and evaluate the performance of the algorithm, using a variety of metrics to assess its accuracy, speed, and robustness. Optimize the algorithm based on the results of the evaluation, and fine-tune it to improve its performance. Implement the face recognition algorithm in a surveillance system, and test it in a controlled environment to ensure that it is functioning as intended. Conduct a pilot study to evaluate the effectiveness of the system in a real-world setting, and make any necessary adjustments based on the results of the pilot study. Roll out the face recognition system in the target surveillance environment, and monitor its performance to ensure that it continues to function as expected. Conduct ongoing evaluations and assessments of the system to identify any potential improvements or enhancements that could be made to further improve its performance.

IV. LITERATURE SURVEY

The research on neural networks and the applications that stem from them is competitive. The application that has had the most impact across all industries—used in data analysis, security, and surveillance applications—is image analysis and recognition. There are a number of architectures in both

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supervised and unsupervised learning that can be customised for picture recognition in particular. As compared to biometric and iris recognition, facial recognition methods were first investigated in security systems to recognise and compare human faces. This technology has been used in image detection, iris recognition, and other applications. These techniques have recently been investigated in various academic domains and have evolved into commercial identification and marketing tools. The various facial recognition algorithms are discussed in this work along with a comparison of their recognition accuracy. The study aimed to evaluate the accuracy of Eigen faces with PCA, SVM, KNN, and CNN in terms of facial identification.[2] The face is recognised using the Haar Cascades technique[2], which is saved into a database. There are two steps to any biometric system, including facial recognition: training and testing. The calibre of the four extra stages that make up these two phases determines how well these systems work. Image acquisition, preprocessing, feature extraction, and classification are the four further steps. Traditional machine learning techniques are used for the classification stage in a number of recent studies. As we've seen, CNN produced the best validation accuracy whereas KNN produced the lowest recognition accuracy. The accuracy of the system is impacted by both facial recognition and face views. The difficulty is that all of the photos must have the same dimensions and colour depth in order to ensure accurate feature extraction. The number of images is CNN's major problem because a lot of training images are necessary for the system to acquire a high level of recognition accuracy.

Siamese Networks

One kind of neural network architecture called a siamese network compares two input data points and assesses how similar they are. For applications like speech recognition, text analysis, and image recognition, this kind of architecture is frequently employed. Two identical sub-networks that share the same set of weights and are trained together make up siamese networks. One input data point is sent into each subnetwork, which then processes it through a number of layers to create a feature vector that serves as the data point's representation. A similarity function is then used to compare the two feature vectors and get a similarity score. Siamese networks have the benefit of being able to compare two inputs in a fashion that is unaffected by changes in rotation, scaling, and lighting. This is due to the fact that the same set of weights is applied to both inputs, assisting in the consistent and comparable extraction of the feature vectors. Siamese networks have been applied to a number of tasks, such as text matching, face recognition, and signature verification. The Siamese Recurrent Neural Network (SRNN) and Siamese Convolutional Neural Network (SCNN)[4], which combine the strength of Siamese networks with that of other types of neural networks to achieve even higher performance in some tasks, are two examples of more complex architectures in which they have been used.[4]

V. ALGORITHMS USED

Based on these studies, we chose VGG-16 as the model to implement. VGG face was developed by the oxford group in response to the imagenet challenge and now is considered one of the foremost facial recognition algorithms. VGG uses a 16 layer convolutional neural network for image processing. In our implementation, we are using the transfer learning concept. Transfer learning consists of freezing the parameters (weights and biases) [3]of a pretrained model and retraining for the current task only the last layer(s).[3] The intuition behind why this approach makes sense is that models trained on images learn features that are useful in any visual classification task, regardless of the particular images on which they were trained.

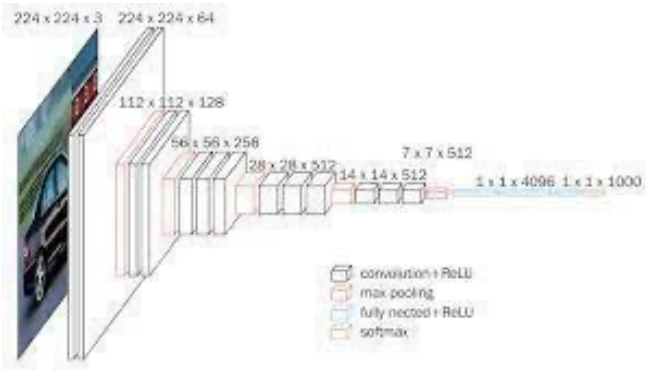


Fig.1 Schematic diagram of VGG 16

VI. COMPARISON OF VGG16 WITH OTHER MODELS

In this section, four cutting-edge facial recognition models are evaluated based on a number of criteria, including accuracy, precision, mistake rate, and verification time. From the 5000 photographs that are accessible, 6384 pairs of images are randomly selected so that there are an equal number of positive and negative pairs (pairs of images that belong to the same person) (pair of images belonging to different individuals). These pairs are checked to see if they belong to the same person. Based on the models' error rates, the first comparison was made. The error rate is determined as (100-Accuracy). It can be concluded that among all the models evaluated, VGGFace has the lowest error rate (31.83%), followed by Facenet(32.52%), DeepFace (36.22%), and OpenFace (36.81%).It is clear that VGGFace performs best based on the model's error rates. Of the four models, VGGFace has the highest precision (60.17%), followed by FaceNet (59.48%), DeepFace (55.42%), and OpenFace (52.55%). Also, we contrasted how long it took each model to confirm a single pair of faces. As can be observed from the bar graph, VGGFace takes the shortest amount of time for a single verification (0.32s), followed by OpenFace (0.34s), DeepFace (0.36), and FaceNet (0.41s). We may conclude that VGGFace outperformed other models in terms of error rate, precision, and processing time. [1]

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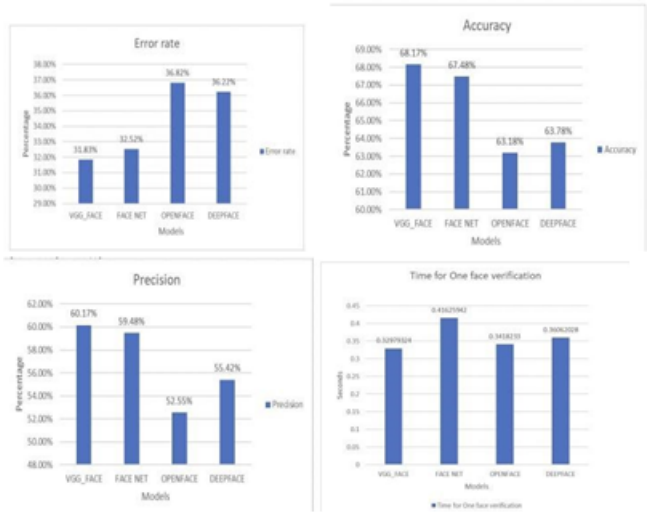


Fig.2 Comparison Charts of VGG_16 with other Algorithms

VII. TESTING AND RESULTS

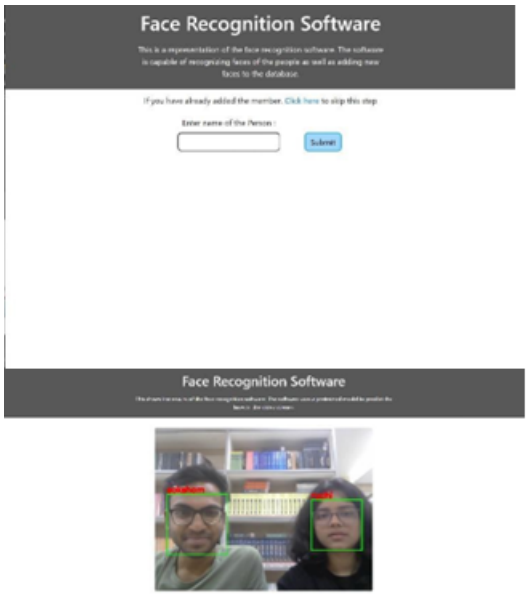


Fig.3 The User interface and the face recognition in Flask app

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This project and technical paper were greatly bolstered up by Professor Archana Chaudhary. Her constant support and valuable suggestions helped us to accomplish our goal. This would not have been possible without her pearls of wisdom. We are grateful to our seniors who contributed their knowledge and experience throughout the project.

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Smart Agriculture using IoT

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***Abstract*—IoT is a rapidly expanding field that has made several contributions to industries and has proven itself to be highly significant in its applications. It is observed that IoT can also be quite useful in assisting farmers by designing a Smart agriculture system. This method is modern, more efficient, economical, and easy to use. The objective of this paper is to develop a smart agriculture system that operates on IoT. The proposal includes development of a system which can monitor soil moisture content, temperature, humidity, and the level of water in agricultural fields through sensors using Arduino Uno board. The data obtained from the sensors can be wirelessly sent to the farmers using a GSM module. This compilation of data thus allows the farmers to inspect the agricultural fields and it can be operated from anywhere with the help of network topology. The use of highly reliable sensors and other electronic gadgets helps reduce human efforts to a great extent. Such a major transformation eliminates current farming methods and generates new opportunities as well as some challenges.**

Keywords—IoT (Internet Of Things), Arduino Uno, GSM, economical, reliable.

I. INTRODUCTION

A new concept known as “Smart agriculture” has greatly emerged because of the advancement in IoT over the past few decades. It is a new concept since IoT sensors can give us readings about agricultural fields and then take action based on the conditions. The primary aim of an intelligent irrigation system is to provide and maintain the optimum conditions for the crop. The term “Smart Agriculture” refers to the implementation of the regular agricultural practices using modern methods which could make the tasks easier and faster. The benefits which farmers are obtaining by adapting the IoT program are innumerable. The quality and the quantity of the soil can be increased using Smart Farming. An IoT-based smart agriculture is used to automate the irrigation system and monitor the crop field using sensors (humidity, temperature, soil moisture, etc.). Several studies and researches have enabled advancements in the field of IoT which have proved highly beneficial in the field of agriculture as well. Most of these smart agriculture projects have been designed in the past which only differed in the techniques and components for obtaining the necessary data with the same primary objective. Smart farming makes it necessary to address the issues of population growth, climate change and labor that has gained a lot of technological attention, from planting and watering of crops to health and harvesting. We need smart agriculture to expand from its current state. Through cultivating in an environment with sufficient water supply and ideal temperature, the growth of plants can be improved. This leads to an increase in productivity of the agricultural products as well.

II. PROJECT OBJECTIVE

The idea of making Smart Agriculture using IoT was inspired by the motive of assisting the farmers in irrigation tasks using modern methods. Around 65% of the Indian population engage themselves in the primary sector and hence there need to be major changes in the planting style and new methods need to come up to make a good connection of agriculture with the upcoming technology. In India, the major source of water is groundwater which is a non-renewable resource and over-use of this groundwater not only reduces the availability of it but also makes the soil more alkaline in nature and this leads to low crop productivity and reduction of the rich and fertile top soil in the country. This is seen quite often in the states of Punjab and Haryana where the top soil is reducing and the fertility is reducing in the soil. This is the major problem which this project will be focusing on and will be giving a unique solution to the problem by using IoT. Also, the farmers face other problems which are natural like the floods and droughts, which cannot be stopped. But still in that situation, the app will be suggesting a good cultivation option after the disaster. The project will also be cost efficient. It will also overcome the manpower required to operate the pump as the project will be working in both manual and automatic mode. Moreover, measurements of the soil's parameters, such as its temperature and humidity levels and moisture content, can be performed.

III. LITERATURE SURVEY

Today, we can see the use of IoT in almost every field. It has brought wonders in the field where it has been installed. The example of it is the industrial sectors where it has reduced the manpower on workstations and reduced the errors that have taken place. This paper provides a smart solution to agricultural problems using IoT. Agriculture requires a large amount of manpower to make it efficient but with times we have seen changes that have reduced the manpower like replacing plough with tractor. Day by day, the improvement of agriculture is leading to smart agriculture. Also, the waste being produced on agricultural sites is reduced. The objective of this paper is that the user must be provided with the real-time data of the soil (data like Temperature, Soil Moisture, Humidity) and also for the

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fair and efficient environment, a monitoring screen is kept where we can see the data of the soil and also message and a mail can be sent on the phone. Also the pump can be controlled by using a website and also autonomously.

IV. IMPLEMENTATION

The Arduino Uno development board is used in the project as the main controller. A dual channel relay module, an LCD display, a DHT 11 temperature and Humidity sensor, a Capacitive Soil moisture sensor and a Sim800L GSM Module will be used to perform the respective functions. The Arduino board will take sensor readings such as temperature, humidity, moisture etc. and they will be displayed on a 16x2 LCD display. Depending upon the readings, the condition in the code is checked and it will decide whether to switch on the pump or not. The pump will be switched on for 5 seconds and again the conditions will be checked and if there is need again, then the same process will be repeated. This pump can also be switched on by just making a phone call using GSM and relay module. The pump can also be controlled using website. MQTT protocol will be used for machine-to-machine communication. This protocol requires minimal resources, so it can even be made using small microcontrollers. It is more secure, reliable, and efficient. The Webpage is designed using HTML and CSS. The webpage will also provide guidelines for farmers in case of natural calamities such as drought, flood etc.

Arduino UNO

Arduino development board based on ATMEGA328P.It requires 5V supply for its operation. It has 14 Digital I/O and 6 Analog pins. It can provide up to 20mA current per digital pin. This board operates on 16 MHz clock frequency. It supports UART, SPI and I2C communication protocol. It has 2KB SRAM and 32KB Flash memory.

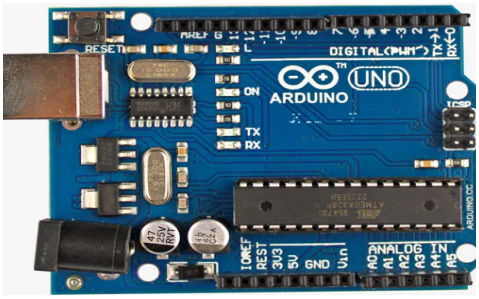


Fig.1 Arduino Uno Microcontroller Board

Relay module

It is a dual channel relay module having operating coil voltage of 5V and an optocoupler used to provide electrical isolation between control signal and the AC voltage. It is used for switching ON the pump through the output pin signal of Arduino. It has a contact rating of 250V AC and 10 A, which is sufficient for operation of the pump. The relay can be easily turned on using 5V output signal of the digital pin of microcontroller. It has three contacts, one is the pole where the 230V AC mains wire is connected and Normally Open and Normally Closed, depending upon the signal these contacts are switched in order to control the appliance.

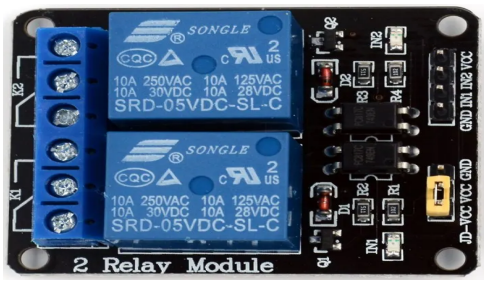


Fig.2 Dual Channel Relay Module

LCD Display

A 16x2 LCD display is used for displaying the soil moisture, temperature, and humidity readings. It includes two rows where each row can display 16 characters. The current required for its operation without backlight is 1mA with no backlight. It is used to indicate whether the pump is on or off. It uses the I2C protocol for communication with UNO using the I2C module.

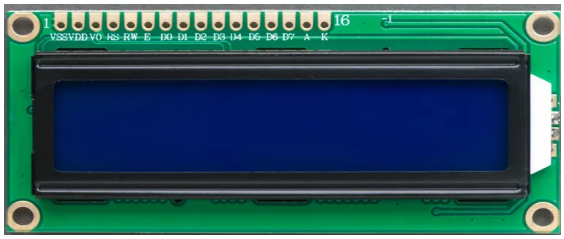


Fig.3 16x2 LCD Display

GSM Module SIM 800L

A GSM module is used for sending, receiving SMS or making a phone call, connecting to the internet through GPRS, TCP/IP protocol. It can perform all the functions, which a normal cell phone can. It requires 2G SIM card for its operation. It can be directly connected to microcontroller without the need of MAX 232.It supports bands like Quad-band: GSM850, EGSM900, DCS1800 and PCS1900 This can also control an appliance using relay module by just making a phone call.



Fig.4 GSM Module

DHT11 & Capacitive Soil Moisture Sensor

It is a NTC temperature and humidity sensor that provides excellent reliability and long-term stability. This can measure temperature from 0°C to 50°C and humidity between 20% to 90%. Soil moisture sensor is used for measuring soil moisture using capacitive sensing. It measures the change in capacitance by the change in

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dielectric It is made up of corrosion resistant material, so it will last for a longer lifetime.

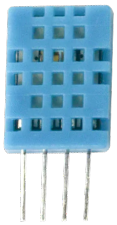


Fig.5 DHT 11

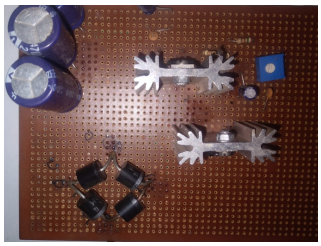


Fig.6 Power Supply PCB

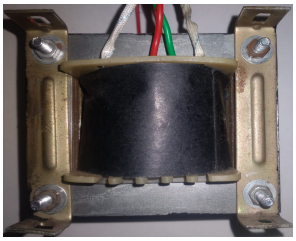


Fig.7 Transformer



Fig.8 Soil Moisture Sensor

Power Supply

Transformer is used to step-down voltage from 230V AC to 9V AC. It is further converted to DC using bridge rectifier as shown in figure 6. In order to obtain constant 5V, LM 317 regulator is used. Since it can provide only 1.5A current which is not sufficient for our project so it is boosted using TIP 122 transistor, which can provide an output current up to 5A.

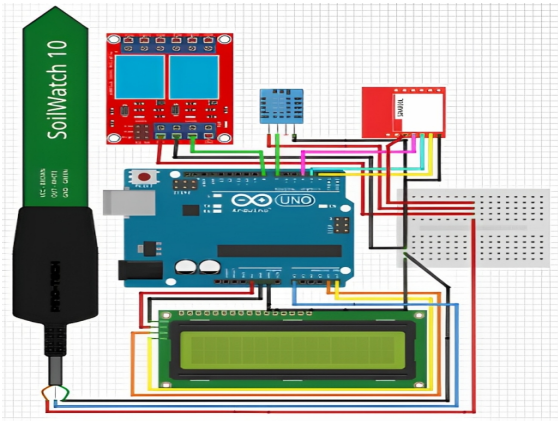


Fig.9 Circuit Diagram

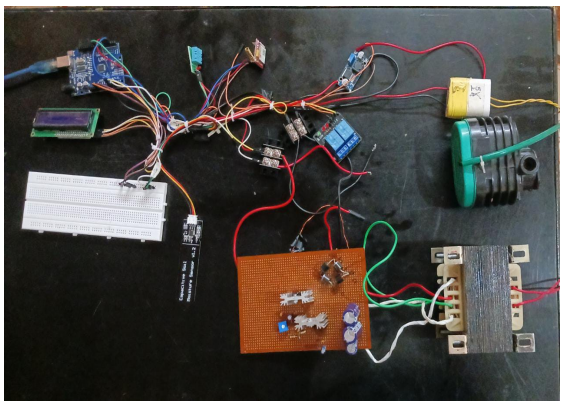


Fig.10 Implementation

V. RESULTS AND CONCLUSIONS

The project focuses on the use of IoT in agriculture and how it can be made more technologically useful and can provide ease to the farmers. The project also helps the farmer in predicting the soil moisture, temperature and humidity in the soil through which a proper crop with suitable conditions can be selected, and will also suggest solutions to natural disasters like drought, flood etc. It will help farmers to cultivate crops in a better modern way rather than traditional ways.

ACKNOWLEDGEMENT

We would like to thank our project guide Prof. Archana Chaudhari for her guidance and counsel. We would also like to show our gratitude towards Dr. Amit Deshmukh (Head of Department) and also to teaching and non-teaching staff of Electronics and Telecommunication Department for their support and motivation.

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Android Controlled Remote Password Security

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***Abstract*—In today's digital world, access control systems have become an essential part of securing homes, offices, and other sensitive locations such as nuclear systems or crime scene. Traditional access control systems such as mechanical key-based systems can be inconvenient and pose security risks due to the chance of keys being lost or stolen. Consequently, many access control systems have transitioned to more advanced and convenient solutions. This project proposes a door security system that is controlled by entering a password on an appropriate Android phone connected with Bluetooth. The system aims to provide a secure and convenient access control solution for homes, offices, and other sensitive locations. When the user enters a password into the Android app, the data is sent via Bluetooth to the door's security system. The system then checks the password and opens the door if it matches. The proposed system provides enhanced protection against various physical threats and provides a more convenient way to access secure locations. All in all, the project offers a solution to improve the security of access control systems by providing an easy-to-use and potential door security system controlled by an Android phone via Bluetooth.**

Keywords— Bluetooth module, Microcontroller, Keil, Android, Encryption Access control.

I. INTRODUCTION

Physical security has become a major concern in the modern digital world where technology is advancing at a remarkable rate. The necessity for protected access control systems has become increasingly necessary in homes, offices, and other sensitive locations. Traditional access control systems such as mechanical key and locks are inconvenient and pose security risks due to the possibility of lost or stolen keys or mechanism malfunctioning. As a result, many access control systems have transitioned to more advanced and convenient solutions. In this project, we propose a door security system that is controlled by entering a password on an Android phone. The door security system uses an 8051 microcontroller as its primary processing unit. The system also uses an HC-05 Bluetooth module to establish communication between the Android phone and the microcontroller. To ensure stable power supply, the system utilizes a voltage regulator IC7805. The motor driver is used to control the speed of the door opening motor to allow smooth and controlled operation. The user must connect to the door security system using Bluetooth on their Android phone and enter the password through the Bluetooth terminal application. If the password matches, the door opens, and the user is granted access else, if password is wrong then the door remains closed. This system offers enhanced security against various physical cyber threats and provides a more convenient way of accessing sensitive locations. By allowing users to control access through their Android devices, it eliminates the need for physical keys and mechanical locks and the associated security risks. Overall, this project provides a solution to strengthen the security of access control systems by providing an easy-to-use and robust door security system controlled by an Android phone via Bluetooth v3.0.

II. WORKING

The main focal point of this project is 8051 microcontroller. It is connected to a BT module via Rx Tx pins. EEPROM (64 Kb) is used for storing and for changing password. Motor driver LM293D is used for controlling the speed and motion speed of the motor. We are attaching the LCD display to display the status of password entered. The system works in following way:

1. Power on the device. It will wait for password.
2. Android phone should be connected to Bluetooth module. Enter the password in Bluetooth terminal app (preferably Bluetooth SPP pro).
3. After entering the password, the microcontroller verifies it with the password stored in EEPROM.
4. If the password matches with the one in EEPROM, the microcontroller sends the signal to motor driver and the door opens with a delay.
5. If the password is incorrect, then the door won't open.

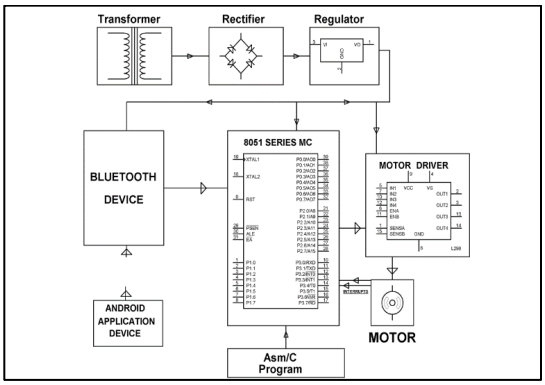


Fig.1 Working diagram

III. HARDWARE REQUIREMENTS

Voltage regulator (IC7805)

Voltage regulator IC7805 is a popular linear regulator that is used to regulate the voltage in electronic circuits. It provides a fixed output voltage of 5 volts, regardless of variations in the input voltage or load conditions. The IC7805 is designed to be easy to use, with only three pins: input, output, and ground. It can handle input voltages up to 35 volts and provides a maximum output current of 1 ampere. It is commonly used in electronic devices such as power supplies, battery chargers, and audio amplifiers to ensure a stable and reliable power

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supply. We are using it for converting 12V DC supply to 5V DC supply.

Rectifier

A rectifier is an electronic circuit that converts alternating current (AC) to direct current (DC). The process of rectification involves the removal of the negative part of the AC signal, leaving only the positive part. This is achieved using a diode or a group of diodes, which only allow current to flow in one direction. Rectifiers can be classified as half-wave or full-wave depending on whether they only use the positive or both positive and negative parts of the AC signal. Rectifiers are widely used in electronic devices that require DC power, such as power supplies, battery chargers, and motor controllers.

Microcontroller (AT89C51)

The AT89C51 is a low-power, high-performance CMOS 8-bit microcontroller designed by Atmel. It features a versatile 8-bit CPU with 8K bytes of in-system programmable flash memory, which can be reprogrammed by a conventional non-volatile memory programmer or in-system using the on-chip Flash. The device is compatible with the industry-standard 89C51 instruction set and pin-out and can be programmed using various languages, including C and assembly. The AT89C51 is manufactured using Atmel's high-density non-volatile memory technology, making it a reliable and efficient solution for many embedded control applications. It offers 256 bytes of RAM, 32 I/O lines, two data pointers, a full-duplex serial port, and three 16-bit timer/counters. It also features a six-vector two-level interrupt architecture, a watchdog timer, and an on-chip oscillator and clock circuitry. The AT89C51 is designed with static logic for operation down to zero frequency and supports two software-selectable power-saving modes, including idle mode, which stops the CPU while allowing the RAM, timer/counters, and serial port to continue functioning.

LED

An LED, or Light Emitting Diode, is a semiconductor device that emits light when a current is passed through it. LEDs are highly efficient, consuming very little power and generating very little heat compared to traditional incandescent bulbs. They are also long-lasting, with a typical lifespan of over 50,000 hours. LEDs are available in a wide range of colors and brightness levels, and can be easily controlled with simple electronic circuits. They are used in a variety of applications, including lighting, displays, and indicators. Due to their efficiency, longevity, and versatility, LEDs are becoming increasingly popular as a replacement for traditional lighting sources.

DC motor

A DC motor is an electric motor that converts electrical energy into mechanical energy using a magnetic field. It operates using direct current (DC) and is widely used in a variety of applications such as industrial machinery, robotics, and electric vehicles due to its simple design and easy control.

L293D

The L293D is a popular motor driver IC that is used to control DC motors and stepper motors in electronic circuits. It has four high-current half-bridge drivers, each capable of driving currents up to 600 mA. The L293D also has built-in flyback diodes to protect the circuit from voltage spikes generated by the motors. It can be controlled using simple digital signals from a microcontroller or other digital device, making it easy to integrate into a wide range of applications. The L293D is commonly used in robotics, motor control circuits, and other applications that require precise and reliable motor control.

Capacitors

A capacitor is an electronic component that stores electrical charge in an electric field between two conductive plates separated by an insulating material. It is used in electronic circuits to store energy, filter signals, and block DC while allowing AC to pass through. Capacitors are rated in farads.

Resistors

A resistor is an electronic component used to oppose an electric current by producing a constant voltage drop between two terminals.

EEPROM (N24C64)

The N24C64 is an EEPROM (Electrically Erasable Programmable Read-Only Memory) IC that can store 64 kilobits (8 kilobytes) of data. It can be easily interfaced with microcontrollers and other digital devices, and can be used in a variety of applications such as data logging, security systems, and remote-control systems. In our case we are using it for storing the password.

HC-05

It is basic Bluetooth module with approximate range of 10 meters. It is used to establish connection between phone and the system.

IV. SOFTWARE REQUIREMENTS

Keil µvision5

Keil μ vision5 cross compiler is a popular software development tool that allows developers to create and test code for microcontrollers and microprocessors. It supports programming languages such as C and assembly and comes with a range of features, including a code editor, debugger, and simulator for output ports. The cross-compiler is used to test code for a specific architecture and is optimized to generate efficient code for memory-constrained devices. Keil cross compiler supports a wide range of microcontrollers from various manufacturers, including ARM, 8051, and AVR. It provides an easy-to-use interface, making it an ideal choice for both experienced and novice developers. Additionally, Keil cross compiler is widely used in the industry and is compatible with various operating systems, including Windows, Linux, and macOS. In summary, cross compiler means it can compile a high language code to machine readable code on another platform. In our instance, we wrote code on computer having Intel i7 11th generation processor (x86 family) and we compiled the code for AT89C51 (8051 family).

Proteus

Proteus is proprietary software used for designing PCB, simulating circuits and test the circuits designed. Proteus software provides a user-friendly interface that allows users to

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create circuit schematics and simulate the circuit behaviour with ease. The software comes equipped with a vast library of pre-designed components, including microcontrollers, sensors, and other commonly used electronic components, which makes the design process quicker and more efficient. Proteus software also features a powerful simulator that can simulate and test the designed circuit before it is implemented in hardware. Additionally, Proteus software allows for real-time debugging and fault-finding, making it an essential tool for troubleshooting complex electronic systems. Overall, Proteus software is an indispensable tool for electronics enthusiasts and professionals alike, providing a comprehensive suite of features that make designing, simulating, and testing electronic circuits efficient and hassle-free.

V. ALGORITHM

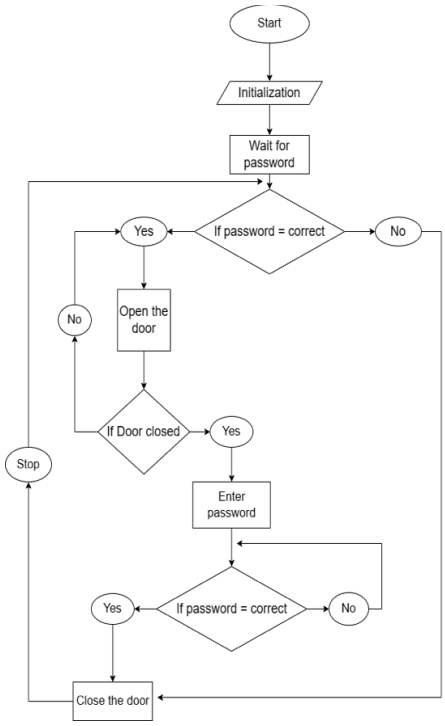


Fig.2 Flowchart

1. START
2. Initialize for baud rate 9600 bps.
3. Wait for password.
4. If the password is correct the door opens, else the door remains closed.
5. Go to step 3 again
6. STOP

VI. HARDWARE TESTING

Continuity test

A continuity test is an important technique used in electrical and electronic hardware testing to verify the presence of a complete path for electrical current flow between two points in a circuit. This test is useful in identifying faults or breaks in a circuit, which can cause equipment malfunction, safety hazards or other issues. To perform a continuity test, a digital multimeter is commonly used, which measures the resistance between two points in a circuit. The continuity function of a multimeter emits a small voltage, and if a complete path exists between the two points, the voltage will flow through the circuit and the multimeter will indicate a low resistance or a beep sound. If there is a break or fault in the circuit, the multimeter will show a high resistance value or no beep sound. The continuity test can be used to check a variety of components in a circuit, such as wires, switches, fuses, and other electronic components. It is especially useful in identifying faulty connections or damaged wires, which can be easily overlooked during a visual inspection. It is important to note that a continuity test should be performed only when the power source of the circuit is turned off, as testing a live circuit can be dangerous and can cause damage to the equipment or harm to the user. Additionally, the test should be conducted in a controlled environment to avoid interference from other electrical sources, which can affect the accuracy of the test results. In conclusion, continuity testing is an important technique in hardware testing, as it can help identify faults or breaks in a circuit and ensure the safe and reliable operation of electrical and electronic equipment.

Power test

This test is done to determine whether the voltage at the various terminals complies with the specifications. A multimeter was used, and voltage mode was selected. This experiment was conducted without a microcontroller. Initially, we determine whether the output of the AC to DC converter produces the necessary 12 v AC voltage. The power supply circuit will then receive this voltage. It should be noted that we conduct this test without a Microcontroller because too much voltage could harm the Microcontroller. We check to see if the voltage regulator is receiving a 12 volt input and a 5 volt output. The Vcc pin on microcontrollers and Bluetooth modules receives this 5 volt output. We similarly verify that the other terminals have the necessary voltage. We can ensure that the voltage is appropriate at all terminals in this way.

VII. CONCLUSIONS

This technical paper has presented a door security system controlled by an Android phone. This system provides a more secure and convenient solution for access control in homes, offices, and other secure locations. The use of this door security system, providing protection against cyber and physical threats. By eliminating the need for physical keys and mechanical locks, the system reduces the security risks associated with traditional access control systems. The project trots out the effectiveness of using modern technologies to improve security and convenience in access control systems. This system was made using various hardware components, including an AT89C51 microcontroller, HC-05 Bluetooth module, voltage regulator IC7805, and a motor driver L293D. The use of Proteus software facilitated the design, simulation, and testing of the system, making it easier and more efficient and Keil µvision 5 was used to compile the program from C language to machine level language for 8051 family. The propounded system could be further developed and optimized to incorporate additional features such as biometric authentication, 2 factor authentication and remote monitoring. With the continued advancement of technology, it is essential to continue exploring and implementing

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innovative solutions to address security challenges in various fields, and this project is a throughfare in that direction.

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Footstep Power Generation with Energy Storage, Monitoring and Management System

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Abstract— **This documentation presents the power generating system which generates electrical power from the kinetic energy of footsteps. The purpose of this technology is to make public places such as offices, colleges, and airports energy efficient by generating power that is sufficient for street lamps and inductive charging of phones. This technology also provides the facility of remote monitoring. A Li-ion battery is fully charged by this system within 10 minutes of mechanical stress by a person's footstep with the capability for battery protection and Power generation monitoring. Using the power generated in a real-world application like charging phones for people in public places makes the Project more ready for use. The Paper also includes a case study that gives information about the utility of our product in places like malls.**

Keywords— Current sensor, Dual Micro USB Power Bank DIY 18650 Li-ion Charger, LCD, Piezoelectric Material, Rechargeable Lithium-ion battery, Rectifier, Relay module, Voltage sensor..

I. INTRODUCTION

The sector with the most significant increase in CO2 emissions in 2021 was power and heat production, where emissions increased by 900 Mt or more. For 46% of the rise in emissions globally, additional fossil fuels were utilized to assist meet the increased demand for electricity[10]. In order to limit the consumption of fuel, which affects the environment, the world is currently focused on producing renewable energy. This document discusses a low-cost energy-generating electric gadget that must be installed on Heavy footfall areas. Energy is being harvested, which is already present but will be wasted if not utilized. Piezoelectric material that is embedded in the surface can work its magic by converting the pressure applied by people while walking into an electric current. Mounting these tiles in a maximum crowded area will result in maximum power generation.This tile doesn't get affected by any weather. Extensive research is in [9]. Footstep power production has emerged as a viable method for capturing energy from human locomotion in response to the rising demand for sustainable and renewable energy sources. By transforming the mechanical energy created by the footstep into electrical energy, the technology operates. This technique can harness energy from an easily accessible source, it is inexpensive, and it can be incorporated into existing infrastructure, among other benefits. Many low-power devices, such as sensors, lighting, and other low-power gadgets, could be powered by footsteps. It will not only help us bring the CO2 levels down but also promote people to walk and has many applications to it where it can be used to provide the charge saved. For eg., Free charging at public places, LCD displays, led lights, etc.

II. CONCEPT

The main objective is to construct an electric generating tile using piezo to generate energy through pressure exerted by moving people and can be employed in a variety of locations, including malls, public transportation hubs, and other places with heavy pedestrian traffic to produce clean, renewable energy in these locations without incurring any additional costs by installing footstep power generating equipment, which will also inspire people to adopt sustainable lifestyles. There are many applications to the project once the power is stored in the battery.

III. LITERATURE REVIEW

This paper discusses the design and implementation of a footstep power generation system using piezoelectric sensors. The system was designed to generate electricity from the footsteps of pedestrians and with the application in a shopping mall. The results of voltage and current were able to produce a substantial amount of power that could be utilized to run low-power electrical equipments. This report describes the experimental study of a footstep power generation system using piezoelectric transducers. The system was designed to generate electricity from the footsteps of pedestrians and was tested in a laboratory. According to the findings, the system provides a substantial amount of power and can be used to run low-power electronic gadgets. This paper provides a comprehensive review of footstep power generation systems. The review covers the design, implementation, and performance of various footstep power generation systems. The writer also discusses the challenges and future directions of this technology. In addition to these studies, there have been several practical applications of footstep power generation, such as the installation of piezoelectric tiles in public areas, such as train stations and airports, to generate electricity from the footsteps of pedestrians. Overall, footstep power generation is an innovative technology that has the promise of using the motion of people's feet to produce sustainable energy. The research in this field is ongoing, and there is still much to learn about the performance, cost, and scalability of this technology.

IV. TOOLS AND TECHNOLOGIES

The power generating system consists of piezoelectric sensors, a Rechargeable lithium-ion battery, a Dual Micro USB Power Bank DIY 18650 Li-ion Charger with LCD

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display, wooden board, an acrylic sheet, NodeMCU as a microcontroller, IN4007 diode (used for rectifier) and a relay module.



Fig.1 Piezoelectric Sensor



Fig.2 Li-ion Cell

The power bank charging module has two USB type A female output ports which are allied to a device to charge, while there is one USB type B port which allows us to charge the Li-ion battery. This module is attached with an LCD display which shows the charge percentage of the battery along with the received voltage and current.
Arduino IDE was immensely used to code NodeMCU to receive the sensor data and relay it to the cloud. For a good example see [3].

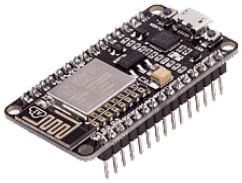


Fig.3 Microcontroller-NodeMCU

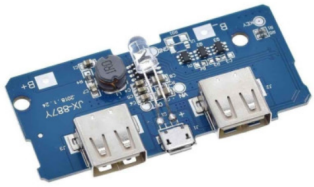


Fig.4 Power Bank Charging Module

Software Simulation tools like Fritzing and Proteus were used to test, select and ensure the connections and configurations of the 25 piezoelectric sensors onto the tile. Graph Visualizations were made with the help of matplotlib library in python. A circuit diagram was made with the help of Draw.io.

V. METHODOLOGY

Piezoelectric material is the main part of footstep power generation; When some materials, such as crystals or ceramics, are mechanically stressed, an electrical charge is produced; this process is known as piezoelectricity. The quartz crystal chosen for the sensor in PZT generates the highest voltage for a given mechanical stress. Software Simulation tools like Fritzing and Proteus were used to test, select and ensure the connections and configurations of the 25 piezoelectric sensors onto the tile. Hence the below diagram shows the connection of 25 piezo sensors in 5 series 5 parallel combinations.

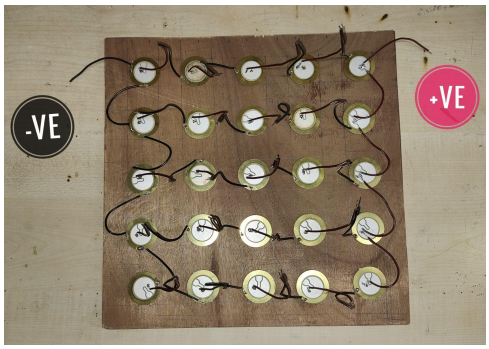


Fig.5 Piezoelectric Tile

This power generated in AC is converted to DC supply via a bridge rectifier. It is then stored in a battery of 2500 Mah. To protect the battery from getting over-voltage and overcharged the voltage sensor, current sensor, and relay are programmed accordingly which is further explained in the working principle[6].

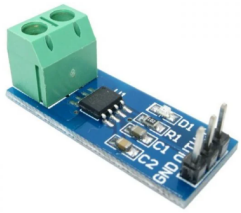


Fig.6 Current Sensor



Fig.7 Voltage Sensor

The power then stored in the battery is used for many applications like powering up the LCD, led, and charging the phone via a USB to c-type cable connected to the power bank charging module. Our project includes graphs that show the V-I characteristic of different connections in the tile. it Also covers a case study of the power that could be generated and the cost that could be saved if this Piezo tile is actually implemented.



Fig.8 Relay Module

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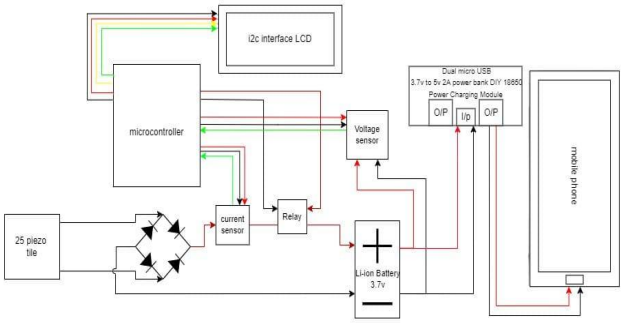


Fig.9 Block Diagram

The piezoelectric tile starts the process of power generation. Each row has five piezoelectric materials connected in series, and these five rows are coupled in parallel under the 32cm x 32cm dimension of the tile to provide the highest current and voltage rating possible[8]. With the stated technique, this piezoelectric can generate about 35AC V at open circuit measurements. With the IN4007 diodes, a rectifier was made which converted the AC supply generated through the piezoelectric sensor to a DC supply. This DC supply is stored in a lithium-ion battery. Li-ion cells are used as they have high charge density compared to other types of cells and their discharge rate is much lower than other rechargeable cells. They also do not require any active maintenance, [4] seemed to be quite helpful in understanding this. We used a voltage sensor to monitor the voltage of the battery and a current sensor to measure the current flow to the battery. The voltage sensor is used to check the overvoltage of the battery.If the voltage given is more than the battery limit then the relay will immediately shift to off mode at the limit set by us in the Arduino ide. If the battery is charged over 90 percent which would be detected by the calculations done using voltage and current from their respective sensors, the relay will get activated and disconnect the supply between the battery and the rectifier from which we were getting a converted DC supply. A display LCD is connected to see the charge percentage of the battery along with voltage and current.
All signal wires of voltage and current sensor, LCD, and relay are connected to NodeMCU which can send this data to the cloud via wifi where further processing can take place. However external power is required for the NodeMCU to analyze the data from sensors and as per this data control it controls the state of the relay. Dual Micro USB Power Bank DIY 18650 Li-ion Charger is connected with a li-ion battery as a supply source and is applicable to charge mobile phones and other applications like microcontroller boards.

VI. IMPLEMENTATION

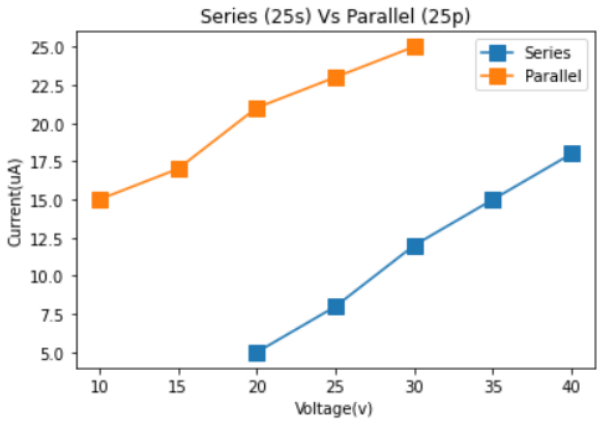


Fig.10 Series And Parallel

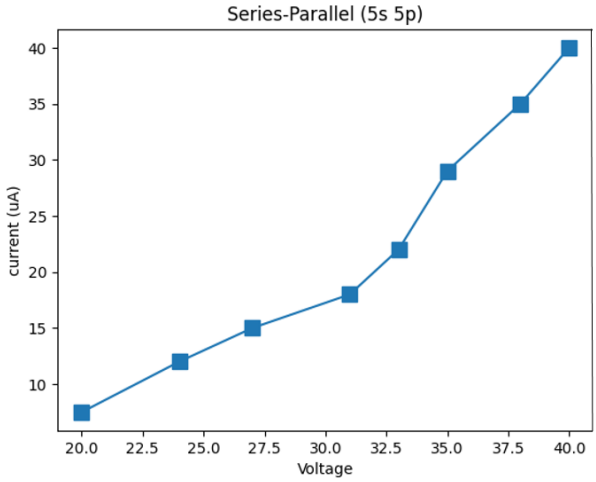


Fig.11 5S 5P connection

The connections of piezoelectric materials are in series parallel. To see the maximum theoretical voltage see [1]. As we can say in the above graph, if the connection is in parallel then the voltage obtained is poor but the current produced is good and, if the connection is in series then the current produced is poor but the voltage obtained is good. As a result, this issue is resolved via a series-parallel connection, which allows for the generation of both, a high voltage and a sufficient current. The observed voltage generated across the tile is 40V, after applying 75 kg of weight to the tile. See [5].

Voltage(V)	Current(μA)	Power(mW)	Range of Output
20	7.5	0.15	Minimum
30	23.75	0.7125	Average
40	40	1.6	Maximum

Voltage(V)	20	24	27	31	33	35	38	40
Current(μA)	7.5	12	15	18	2	29	35	40

The maximum power generate through one step is 40μA x 40V=1.6 x 10^{-3} W.

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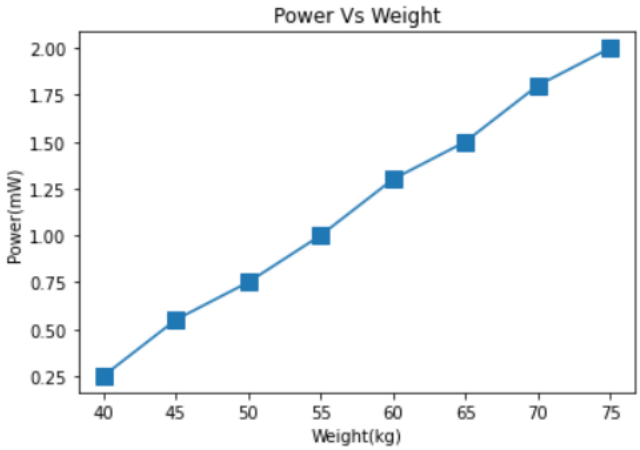


Fig.12 Power vs Weight

People weighing between 40 and 75 kg walked on the piezo tile in order to evaluate the device's power-generating capabilities. The relationship between a person's weight and the amount of power generated can be seen in the graph above. The graph demonstrates that when the most weight or force is applied, the highest voltage is generated. An extensive overview is mentioned in [5]. Therefore, it is observed that the maximum power generated is 2mW whereas the minimum power generated is 0.25mW with varying weights.

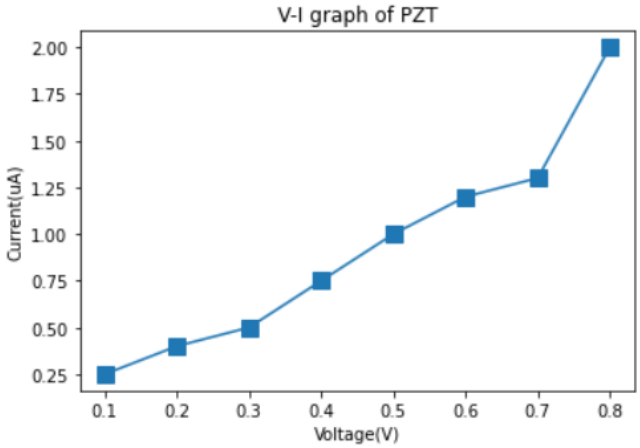


Fig.13 V-I graph of PZT

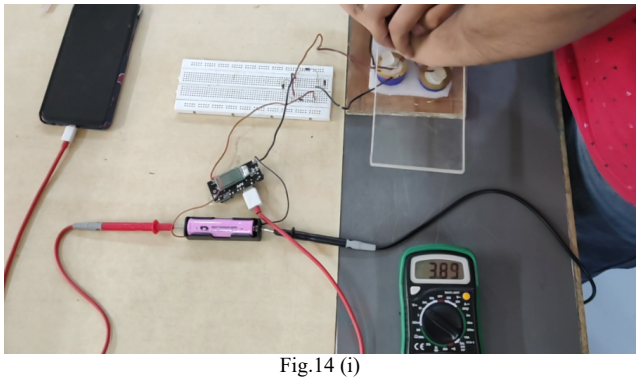


Fig.14 (i)

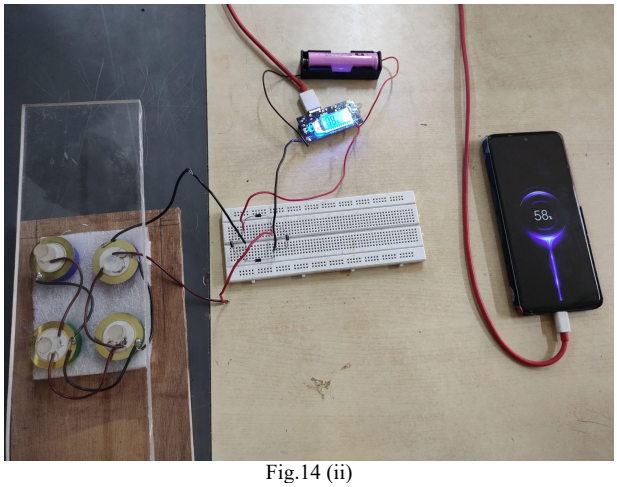


Fig.14 (ii)

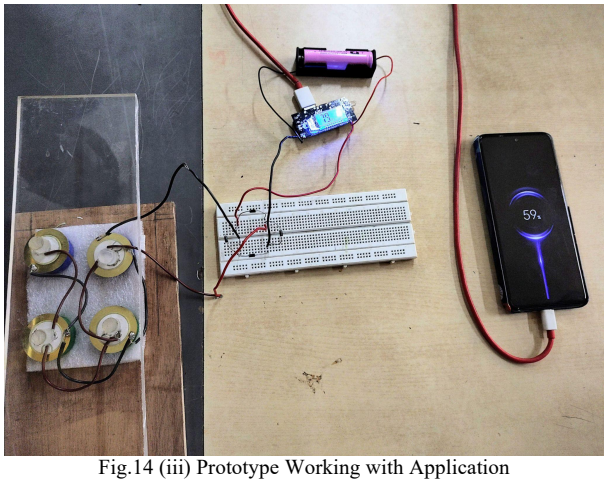


Fig.14 (iii) Prototype Working with Application

From the above pictures we can see the working and application of the prototype model of our piezoelectric tile with 4 Piezo sensors connected in parallel, which charges the phone from 58% to 59%. Also, refer [4].

VII. RESULT AND CONCLUSIONS

Footstep power generation is a promising technology that has the potential to provide clean, sustainable energy. The technology utilizes the kinetic energy generated by people's movement to produce electrical energy. The advantages of footstep power generation include its renewable nature, cost savings, and employment opportunities. However, the technology also has some limitations, including low power output, maintenance requirements, installation costs, and weather dependence[4]. This can be verified by our project as we got a maximum power of 1.6 x 10^{-3} W which is quite low if applied in low footfall areas. But with advancements in technology and more R&D in this field can do wonders. This suggests that the investment in the tiles could be a financially sound decision that could lead to long-term savings. We have concluded that this technology has the potential to revolutionize the way we generate and use energy, particularly in heavy footfall areas like airports, train stations, and shopping centers[2]. We can encourage sustainable energy methods, reduce our reliance on fossil fuels, and lower our carbon footprint. Our project has piezoelectric sensors connected in a series-parallel combination, which makes it better than other current systems as we achieve higher power output with more efficient connections making it error-proof. Even if 1 piezoelectric sensor gets damaged or disconnected it makes

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that particular row redundant, and the rest of the rows still continue to generate energy. With respect to improvement in the current system, we also developed a battery monitoring and management system. A voltage sensor, current sensor, and relay module were used to achieve this[6]. The design of the piezoelectric tile is much more improved making it stable and rigid for rough and tough use, making our product ready for use in public places.

VIII. SOCIAL IMPACT

Footstep power generation systems can help reduce our dependence on fossil fuels and promote the use of clean, sustainable energy sources. This system can help reduce energy costs for public facilities such as parks, train stations, and other public places. This will help redirect funds to other important social programs and initiatives. The installation, maintenance, and monitoring of footstep power generation systems will provide employment opportunities for society.
Using our 32cm x 32cm tiles in heavy footfall areas like Select city walk mall, New Delhi with a total of 120000 sq. ft. area. The average footfall is around 30,000.



Fig.15 Select City Walk Mall, New Delhi

Area covered	200 sq.m
Average footfall	30,000
Almost 70% of individuals walk on the tiles.	
Effective footfall	21,000
In a space of 200 square meters, an average individual takes 200 steps.	
Total steps	21,000x200 = 42,00,000 steps
One step generates (Avg)	1 x10^{-3} W
Total Power	1x10^{-3} x 42,00,000 = 4200W
Energy produced	4200 x 10 = 42.00 kWh
Efficiency of tiles	70 percent
Output power	29.40 kWh

The above table shows the total power generated in 1 day.

Cost of Electricity/ unit	8 Rupees
Cost of electricity produced by tiles	29.40 x 8 = 235.20 Rupees
Electricity saved in 1 day	235.20 Rupees
Electricity saved in 1 month	7,056 Rupees
Electricity saved in 1 year	85,848 Rupees
Electricity saved in 5 years	4,29,240 Rupees

For the Entire Area of 120000 m^2

Number of 200 m^2 in 120000 m^2	600
Electricity saved n 1 day	1,41,120 Rupees
Electricity saved in 1 month	42,33,600 Rupees
Electricity saved in 1 year	5,15,08,800 Rupees

From the above table, it is clear that placing these tiles can lead to more power generation and can give a profitable impact on electric bills.

IX. APPLICATION AND FUTURE SCOPE

There are many applications for using the power generated in various domains. These can be used to not only save power but also boost business, education, and Technology[7].
Retail - Customers can be rewarded for their actions by creating personalized experiences that they can control and trigger. We can transform their footprint into a valuable commodity like redeemable credits that can be exchanged. Customers will be engaged as they continue to shop; by walking on our tiles, they can earn virtual currency that they can subsequently redeem or use in the store, where these tiles are installed. This authentic relationship between action and reward keeps customers coming back.
Smart Cities - These tiles may use the energy generated from each step to instantly produce clean electricity which can be used for display monitors, data screens and ambient lighting. By putting the smart city at the citizen's feet and creating dynamic lighting, gamification displays, wayfinding, and other features, this approach fosters a sense of shared ownership among the populace. This inspires people to adopt new behaviors and perspectives.
Education - It can give anonymous movement and footfall analytics. This can be utilized to impact the curriculum and produce more effective learning opportunities. The embedded low-power Bluetooth beacons reward the pupils and produce highly valuable insights for teachers, via a permission-based system.
We can provide the audience with real-time information about the footsteps on the tiles, which includes data about the amount of energy produced and the number of steps taken. The tiles can use footsteps to power E-Ink screens and trigger LED lighting, creating unique and captivating experiences for people as they walk.

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Technology has the power to completely transform how we produce and consume energy. The following are some potential future developments for footstep power generation:
Scaling up: Scaling up the technology to generate larger amounts of electricity. This would enable the technology to be used in a broader range of applications, such as powering entire buildings or communities.
Improving efficiency: This could be achieved through the use of more advanced materials, better engineering, and more sophisticated control systems, all of which could help to increase the amount of electricity generated per footstep[7].
Integrating with other renewable energy technologies: This might be combined with other sources of renewable energy, such as solar, geothermal and wind energy systems to create hybrid systems that generate even more clean energy.
In conclusion, footstep power generation holds great promise for the future, and ongoing research and development are expected to lead to even more efficient, cost-effective, and innovative systems in the years to come.

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Object Following Robot

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***Abstract*— It is indeed true that robotics is an emerging field that has gained significant attention in recent times and will continue to play a vital role in various operations in the 21st century and beyond. The development of a "Human Following Robot" is a promising area of research, as it can interact and coexist with humans while providing assistance in various situations. This paper describes the prototype design build using Arduino Uno, pixy2 camera module and motor drive. The use of Arduino Uno, Pixy2 camera module, and motor drive is an excellent starting point for the development of such a robot. However, the use of Bluetooth and other technologies can further enhance the capabilities of the robot and make it more versatile.**

Keywords*— *Arduino, DC gear motor, Microcontroller, AI vision, Object shadowing, object following, Robot.

I. INTRODUCTION

The growth of the robotics industry can be attributed to several factors, such as advancements in technology, increasing demand for automation and robotics in various industries, and the development of more sophisticated and intelligent robots. As robots become more advanced, they are expected to become more integrated into our daily lives and work environments. Overall, the growth of the robotics industry and the increasing role of robots in our lives is an exciting development that could bring significant changes and opportunities in the future. Which would help in degeneration of mortal trouble and make work more effective. One potential use case for the robot is in video surveillance. By incorporating a real-time video recorder and using wireless communication, the robot could be used to monitor and survey an area from a remote location, such as a security center or control room. This could be useful in a variety of settings, such as shopping malls, hospitals, and other public spaces. Overall, the prototype described in the paper has the potential to be adapted for a wide range of applications and industries. The addition of wireless communication functionality and the ability to modify the algorithm and structure make it a versatile tool that can be tailored to suit various needs and environments.

II. OBJECTIVE

The main objective of this research is to design and develop an object-following robot that is skilled of detecting and following an object using Pixy cam, Arduino Uno, motor driver shield, pixy2 camera module and two gear motors. The specific objectives are:

- To combine an Arduino Uno and Pixy cam to create an effective object-following robot system.
- To create an algorithm based on the Pixy cam input for object recognition and tracking.
- To programmer the robot's motions so that they may be controlled precisely in any direction using the motor driver shield and two gear motors.
- To assess the object-following robot's performance in terms of precision, quickness, and dependability under various conditions.
- To pinpoint possible locations where the object-following robot might be improved and developed in the future.

The final objective is to build an efficient and dependable object-following robot that can travel in any direction utilizing the two gear motors and can recognize and track an item based on its size, colour, and form. Several metrics will be used to assess the robot's performance. Scenarios to assess its potential applications in various fields such as transportation, surveillance, and entertainment. The discoveries from this examination will subsidize to the improvement of more advanced and competent object-following robots in the future.

III. LITERATURE REVIEW

Object following robots are increasingly being used in various applications such as security, monitoring, and inspection, among others. The robots are equipped with cameras that allow them to detect and track objects. One of the most popular cameras used in object following robots is the Pixy camera. This literature review examines the existing research on object following robots using Pixy cam, and the approaches and techniques that have been used to design and develop such robots. A systematic search was conducted using academic databases such as IEEE Xplore, ACM Digital Library, and ScienceDirect. The keywords used in the search included “object following robot,” “Pixy camera,” and “computer vision.” The inclusion criteria for the search were limited to research papers published in the English language between 2015 and 2021.

Results

Several research studies have focused on designing and developing object following robots using Pixy cameras. These studies have used various techniques and approaches, including machine learning, deep learning, and computer vision. Another study by Y. Matsumoto and A. Zelinsky that shows a prototype that uses Arduino Uno along with basic sensors such as ultrasonic and IR sensor. All the processing is carried out by the microprocessor while the control of the motors is carried out by the controller. This robot can further be modified by using many technologies such as Bluetooth,

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PixyCamera etc[2]. In a study done by H. Takemura, N. Zentaro, and H. Mizoguchi, used for vision based person following which basically used on techniques of IR sensor and Ultrasonic sensor ,which detect object by radiation of ultrasonic waves.[3] In addition to the use of advanced machine learning and computer vision techniques, some studies have also explored the use of simple techniques, such as thresholding, to detect and track objects using the Pixy camera. For example, J. Jung and J. Kim (2016) used a simple thresholding algorithm to enable an object following robot to track objects with high accuracy[5].

Analysis

The studies reviewed demonstrate that the use of the Pixy camera in object following robots is an effective and reliable approach. The studies have shown that the use of machine learning and computer vision techniques can improve the accuracy of object detection and tracking. However, it is important to note that these approaches require significant computational resources, and may not be suitable for low-power and low-cost robot designs.

IV. PROPOSED DESIGN

An Object following robot has two building stages: hardware and software.

Hardware

Arduino Uno

It's the brain of our design. It can give all the command to their sub ordinate factors which should by operated by the mortal gist and it also gives feedback to the other components and human. Arduino Uno is an open-source microcontroller board based on the ATmega328P chip. It is one of the most popular boards in the Arduino family due to its low cost, ease of use, and versatility. The board has 14 digital input/output pins, 6 analog input pins, a 16 MHz quartz crystal, a USB connection, a power jack, and an ICSP header. It can be programmed using the Arduino Integrated Development Environment (IDE), which is a user-friendly software platform that allows even beginners to write and upload code to the board.

Gear Motors

A gear motor is a type of motor that is combined with a gear system to provide high torque output and low speed rotation. The gear system is typically made up of multiple gears of different sizes that work together to reduce the speed of the motor while increasing its torque output. The gears in the gear motor are often made of durable materials such as metal or plastic to withstand the increased torque output.

Pixy Camera Module

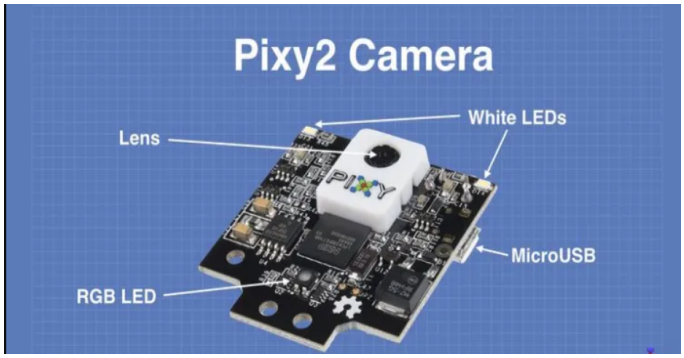


Fig.1 Pixy camera module

The Pixy2 camera module is widely used in robotics applications such as object following robots, line following robots, and color sorting robots. It is also used in automation applications such as quality control and sorting systems. The camera module is easy to program using the PixyMon software, which provides a user-friendly interface for configuring the camera and accessing its output data. Overall, the Pixy2 camera module is a powerful and versatile tool for computer vision applications that can significantly improve the performance and accuracy of robotics and automation systems.

Motor driver (L298N)

The L298N motor driver module is widely used in robotics projects, such as mobile robots, robotic arms, and drones. It can also be used in automation projects, such as conveyor belt systems and machinery control. The module is easy to use and can be easily interfaced with microcontrollers such as Arduino and Raspberry Pi. With its high current handling capacity and built-in protection features, the L298N motor driver module is a popular choice for motor control applications.

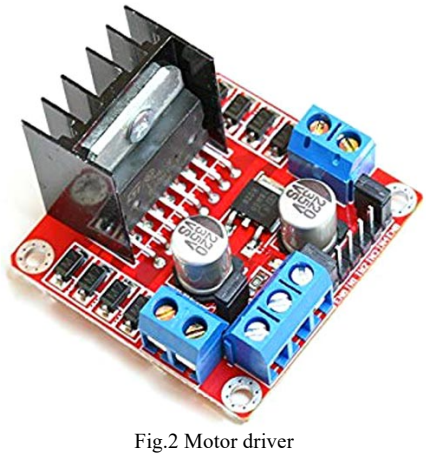


Fig.2 Motor driver

Software

Arduino IDE

To make the robot work or run, it needs to be programmed using software such as the Arduino Integrated Development Environment (IDE). Initially, the microcontroller will not have any program or instructions, so it will not be able to

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work or run. Therefore, a program needs to be written and uploaded to the microcontroller to provide it with the necessary instructions to operate. The robot has three main components: the detector module, the microcontroller chip, and the motor control section. The detector module senses data and sends it to the microcontroller chip, which collects and processes the data. Based on the input data, the microcontroller sends instructions to the motor control section to guide and operate the robot. Since the robot uses an Arduino microcontroller, it needs to be programmed using the Arduino IDE software. This involves writing and uploading the program to the microcontroller, which can then be used to control the robot. Overall, programming the robot is a crucial step in making it functional. It requires a software tool such as the Arduino IDE to write and upload the program to the microcontroller, which then allows the robot to operate and perform its intended tasks.

PixyMon

PixyMon is an application that allows you to configure Pixy and see what it sees. It runs on several different platforms including Windows, MacOS and Linux, as well as other smaller embedded systems like Raspberry Pi and BeagleBone Black.

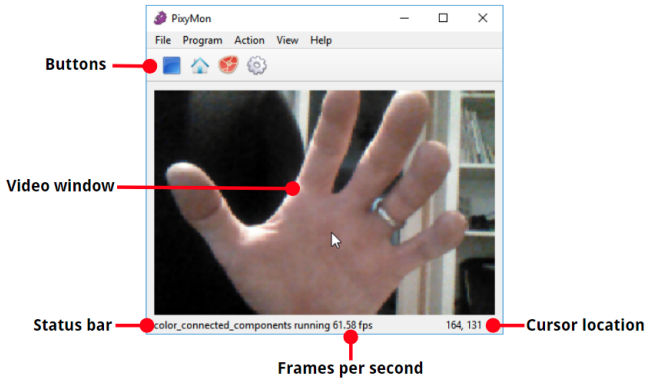


Fig.3 Pixy software interface

V. IMPLEMENTATION

First our pixy camera is made to learn an object. Making pixy learn an object can be done by pixymon software where the object is selected and is made to learn. Second way is to make pixy learn an object manually by pushing the button until it matches the colour of the object, during this time the pixy goes in light pip mode . Hence we have successfully made pixy learn its first object. After learning object pixy is hooked with an Arduino through IDC cable we can see various information it sends to Arduino regarding the object that is been tracked by pixy.



Fig.4 Output

This information received by Arduino is processed and based on that the gear motors is moved accordingly .The Arduino is connected to L298N motor driver and all the gear motors are connected to motor driver. Power supply is provided to Arduino and motor driver.

Arduino code explanation

The code starts by initializing the Pixy camera and setting up the pins for the motor driver. The deadZone variable is used to prevent the robot from moving when the object it's tracking is too close to the center. The loop() function

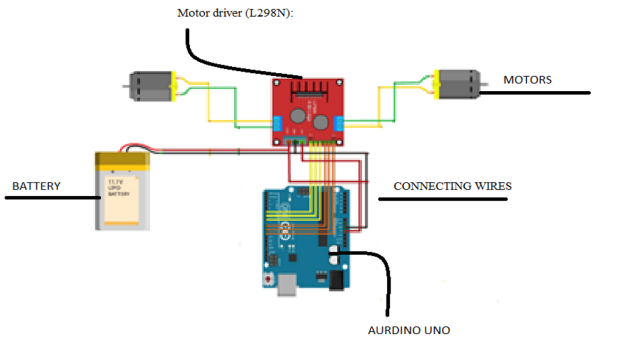


Fig.5 Schematic Diagram

repeatedly checks for objects using the pixyCheck() function. If the object is to the right of center, the robot turns to the right. If the object is to the left of center, the robot turns to the left. If the object is in the center, the robot moves forward. The pixyCheck() function checks if there are any objects in the camera's field of view. If there are, it gets information about the object such as its position, width, and height. It then maps the object's position to a range from -1 to 1 and returns the x-coordinate. If there are no objects, it sets the x-coordinate to 0.The mapfloat() function is used to map values from one range to another. The moveRobot() function takes two parameters, leftSpeed and rightSpeed, which determine the speed and direction of the robot's wheels. The function uses digitalWrite() to set the direction of each wheel and analogWrite() to control the speed. The pixyCheck() function is responsible for detecting objects using the Pixy camera and returning the position information. The function starts by declaring and initializing some variables. It declares an integer variable i and initializes it to 0, a variable j, and a blocks variable of type uint16_t. It also declares a character array buf with a length of 32. Then, it calls the getBlocks() function of the Pixy object pixy to get the number of detected objects. The result is stored in the blocks variable. If blocks is not equal to 0, the function extracts information about the first detected object. It retrieves the object's signature, height, width, x, and y values from the pixy object's blocks array. The x and y values are the coordinates of the top-left corner of the object's bounding box. The width and height values are the dimensions of the bounding box. The function then calculates the center coordinates cx and cy of the object by adding half the width to the x coordinate, and half the height to the y coordinate. It then maps the cx and cy values to a range from -1 to 1 using the mapfloat() function, which is defined elsewhere in the code. The area of the object is also calculated by multiplying the width and height values. If there are no detected objects, the function increments a counter variable cont. If counter reaches 100, it resets to 0

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and sets cx to 0. This is done to prevent the robot from continuing to move in the last known direction when no objects are detected. Finally, the function returns the cx value, which indicates the position of the detected object along the x-axis relative to the center of the camera's field of view. The mapfloat() function takes five arguments: x, in_min, in_max, out_min, and out_max. It maps the value of x, which is expected to be in the range of in_min and in_max, to a corresponding value in the range of out_min and out_max. The formula used in this function is similar to the map() function in Arduino, which maps a value from one range to another. The difference is that mapfloat() returns a floating-point value rather than an integer value. Here's how the formula works:

- Subtract the in_min value from the x value.
- Multiply the result by the difference between out_max and out_min.
- Divide the result by the difference between in_max and in_min.
- Add the result to out_min.

The resulting value is the mapped value of x in the range of out_min and out_max. For example, if we call mapfloat(50, 0, 100, 0, 1), the result would be 0.5. This is because the x value of 50 falls exactly in the middle of the input range of 0 to 100, and the output range of 0 to 1. So, 50 is mapped to 0.5 using the formula described above. The moveRobot() function is responsible for controlling the movement of a robot by sending signals to its motor driver board. It takes two arguments: leftSpeed and rightSpeed, which represent the speed of the left and right motors, respectively. The function first determines the direction of each motor based on the sign of its speed. If the speed is positive, the motor should turn in one direction (forward); if it's negative, the motor should turn in the opposite direction (backward). This is achieved using the digitalWrite() function to set the appropriate pins for each motor. Next, the function uses the analogWrite() function to set the speed of each motor by sending a PWM signal to the motor driver board. The absolute value of leftSpeed and rightSpeed is used to determine the duty cycle of the PWM signal, which determines the speed of the motors. For example, if we call moveRobot(100, -50), the left motor will turn in the forward direction at a speed of 100, and the right motor will turn in the backward direction at a speed of 50. The function sets the appropriate pins and sends PWM signals to the motor driver board to achieve this movement. It's worth noting that the function assumes that the motor driver board is wired in a specific way, with the left motor connected to pins 5, 6, and 7, and the right motor connected to pins 8, 9, and 10. If the wiring is different, the function would need to be modified accordingly.

VI. APPLICATIONS

Autonomous Robots: Object following robots can be used in industries, warehouses, and other areas where humans cannot work efficiently. These robots can be programmed to follow and locate specific objects, move them to the desired location, and even perform some basic tasks. They can follow a predefined path and avoid obstacles to transport goods between different locations.

Security and Surveillance: Object following robots can be used in security and surveillance applications. These robots can follow people or objects of interest and provide continuous monitoring and tracking. They can also be equipped with sensors, cameras, and other equipment to gather data and perform various tasks and it can be used for surveillance purposes, such as monitoring restricted areas or patrolling a perimeter.

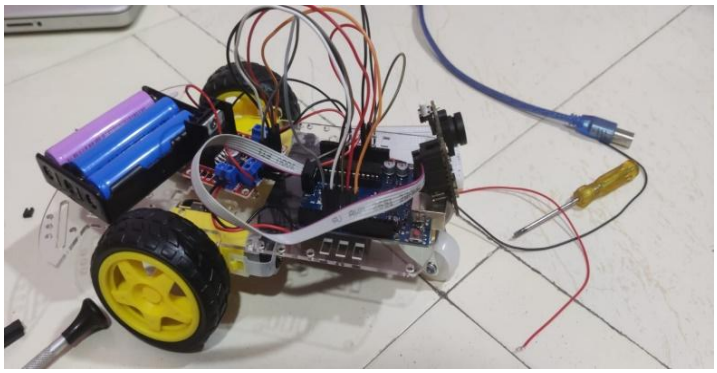


Fig.6 Physical Implementation

Elderly and Patient Care: Object following robots can be used in elderly and patient care applications. These robots can follow patients, remind them to take their medication, and even assist them in performing basic activities. They can also be programmed to detect falls and send alerts to caregivers.

Education and Research: Object following robots can be used in education and research applications. Students can learn about robotics and automation by building and programming these robots. Researchers can use them for data collection, tracking, and monitoring.

Entertainment: Object following robots can be used as toys or entertainment devices. They can follow a person or object and perform different actions, such as playing music or displaying lights.

Overall, object following robots have the potential to revolutionize various industries and enhance our daily lives. With the advancements in robotics and artificial intelligence, these robots will become more capable and sophisticated, leading to even more applications and opportunities.

VII. CONCLUSIONS

Object following robots have been considerably studied in the literature. The studies have used colorful approaches and ways, including machine literacy, deep literacy, and computer vision. The studies demonstrate that the use of advanced ways can ameliorate the delicacy of object discovery and shadowing. Still, simple ways similar as thresholding can also be effective in achieving high situations of delicacy. Unborn exploration should explore the use of cold-blooded approaches that combine advanced ways with simple ways to achieve a balance between delicacy and computational complexity. Before, numerous people were just allowing of such a technology. Moment, we're in a position to make similar bots. New robotics enterprises robotization from love to war. Our robot use aurdino to basically communicate with the other components and the main function or component would be pixy2 camera module used for detection. An object following robot using a Pixy2 camera is an effective and efficient solution for tracking and

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following specific objects. The Pixy2 camera is a compact and powerful device that can detect and track objects based on color codes, allowing the robot to track objects with high accuracy and reliability. The robot can be programmed using various algorithms to perform specific tasks such as following, avoiding, or interacting with objects in its environment. Overall, the object following robot using a Pixy2 camera is a great example of how robots can use advanced sensing technologies to interact and operate in the real world.

ACKNOWLEDGMENT

We would like to thank Prof. Yukti Bandi for guiding us thought out the project and help us for writing this technical paper. Her appropriate mentoring and total supervision assisted us at every phase of this project and this paper would not have been possible without her treasured contributions. We thank our colleagues who provided insight and expertise that greatly contributed to the research and helped us throughout the entire process. And like to thanks the college staff and lab in charge for providing with necessary stuff and provide for a workspace. And lastly I would like to finish it with Saying Thank you to our college For letting us enjoy and letting us dive in Territory of Technology and Caterpillar in innovation.

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Design of Parallel Coupled Microstrip Band Pass Filter

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***Abstract*—A This report details the design, fabrication, and testing of a 2.4 GHz Bandpass Filter using Microstrip Technology. The R&D process involved simulating, analyzing, and verifying the results using a parallel-coupled lines filter topology that was enhanced with the help of various software tools, including ie3d. A sample was fabricated using ie3d to optimize the filter's performance. Comparative filter response analyses were conducted using a vector network analyzer, which aided in selecting the best option for further analysis and development. The optimization of experimental and analytical data collected during the design, simulation, fabrication, and testing process of the bandpass filter was achieved through comparative analyses. The subsequent results from the verification process indicate that the experimental results are comparable in performance to the analytical ones.**

Keywords—Chebyshev filter,Band pass filter, Coupled-line microstrip filter.

I. INTRODUCTION

Filters are an essential component of both microwave and communication systems. There are various types of filters used in communication systems, which include low-pass filters, high-pass filters, band-pass filters, and band-stop filters.A Band Pass filter is a specific kind of filter which permits a particular range of frequencies to pass through with minimal reduction, while preventing any frequencies outside that specified range from passing. Since numerous communication systems are designed to operate within a particular frequency band, they typically employ a band pass filter as a standard feature.When designing a bandpass filter, it is crucial to determine the maximum loss within the passband, the minimum attenuation in the stopband, and to ensure that the filter characteristics in the transition regions are consistent. Band-pass filters are necessary because communication systems often operate within a specific frequency range, and frequencies outside this range can lead to noise, interference, or distortion. A band-pass filter enables the removal of unwanted frequencies, which in turn improves signal quality, reduces interference, and enhances system performance. Additionally, band-pass filters are utilized in diverse applications such as audio systems, signal processing, medical equipment, and scientific research. To achieve optimal filter characteristics such as high return loss and significant rejection band levels, certain parameters need to be given extra consideration, in addition to compactness requirements. In order to reduce the size of filters, various methods can be employed. The current study focuses on the design of a band-pass filter using Microstrip technology. To minimize losses in the filter, a large dielectric constant is not used. The specifications are given below Table 1.

Table 1

Original Specification

Feature	Value or Type
Center frequency fo	2.4 GHz
Bandwidth	10 % = 240 MHz
Return loss	> 10dB
fabrication technology	microstrip
circuit board material	FR4
size constraint	+ /- 3 x 8 cm
substrate thickness	1.6 mm
Er	4.7
characteristic impedance	50 Ω

II. MICROSTRIP FILTER

Microstrip

The microstrip is a type of transmission line that falls into the category of parallel-plate transmission lines. It is made up of a single ground plane and an uncovered conductor strip that are separated by a dielectric substrate. Microstrip lines are widely used in microwave integrated circuits and are the preferred type of transmission line. In addition, microstrips are used as components in circuits such as filters, phase shifters, couplers, resonators, and antennas.

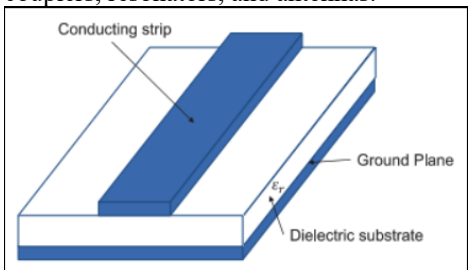


Fig.1 Microstrip Line

The microstrip line allows the electromagnetic field to extend beyond the dielectric due to fringing, meaning that the effective relative permittivity εeff is lower than the substrate's relative permittivity εr. The waves in the microstrip propagate in the transverse electric magnetic mode, which is

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defined by electric and magnetic fields that exist solely in the plane perpendicular to the wave's propagation axis.

Parallel coupled microstrip lines

Parallel couple microstrip lines are a particular arrangement of microstrip lines in which two lines are positioned in parallel with a small gap between them. This design is utilized in microwave integrated circuits for the purpose of transferring power and signals between the two lines. To control the coupling strength and phase, the gap between the lines can be filled with a dielectric substance. Parallel couple microstrip lines have the benefit of being compact, simple to create, and providing a consistent coupling coefficient. They are often employed in power dividers, couplers, and filters.

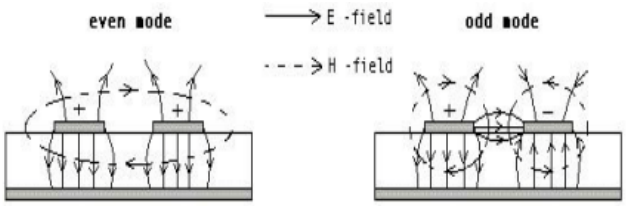


Fig.2 Field Distribution in Coupled Lines

III. METHODOLODY

Design steps

- According to the design specifications the structure of the filter is simulated using IE3D/CST software.
- After optimization of the results the structure is fabricated on low cost glass epoxy substrate.
- The design is printed on the glossy side of the toner transfer paper. The design is then printed on the PCB.
- One side of the PCB plate is covered with a sellotape while on the other side the design is printed using a mixture of Alcohol and Acetone in 8:3 proportion solution and the ink is pasted on the PCB.
- Later, the fabrication of the PCB is done where in PCB is put in a solution of FeCl3 powder. It is observed that the solution reacts with copper and the inked part is left behind. This phenomenon is due to etching that takes place and then the design with a 0.5mm gap is printed on the PCB. Later, SMA connectors are connected on both ends of the filter design and the filter is ready for testing.

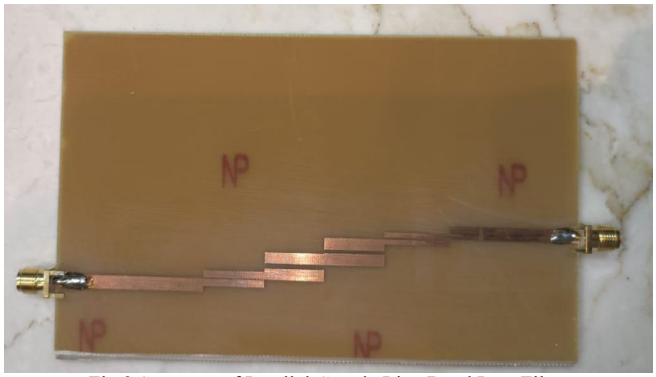


Fig.3 Structure of Parallel Couple Line Band Pass Filter

IV. RESULT AND CONCLUSIONS

The paper discussed the development of a bandpass filter using the Butterworth approach, which utilized concentrated components such as inductors and capacitors. The filter's effectiveness was verified through computational analysis using the Vector Network Analyzer, and it exhibited excellent filter characteristics at the center frequency of 2.4 GHz with a frequency bandwidth of approximately 240 MHz, as specified. At the center frequency, the insertion loss has values of around -3.46 dB.

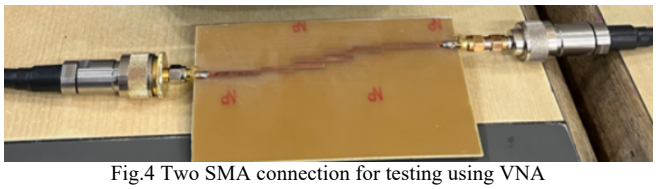


Fig.4 Two SMA connection for testing using VNA

V. SIMULATION RESULTS

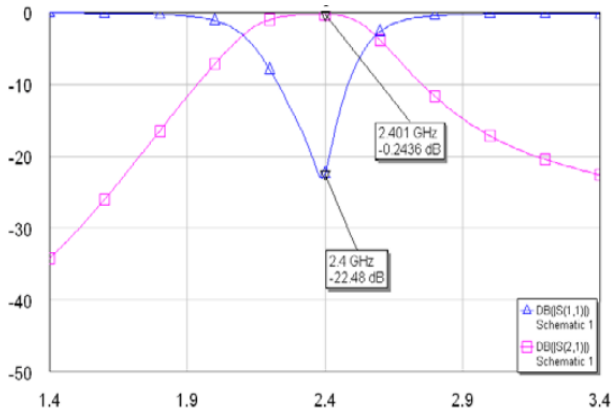


Fig.5 Insertion Loss and Return Loss of Band Pass Filter

Vector Network Analyzer (VNA) results

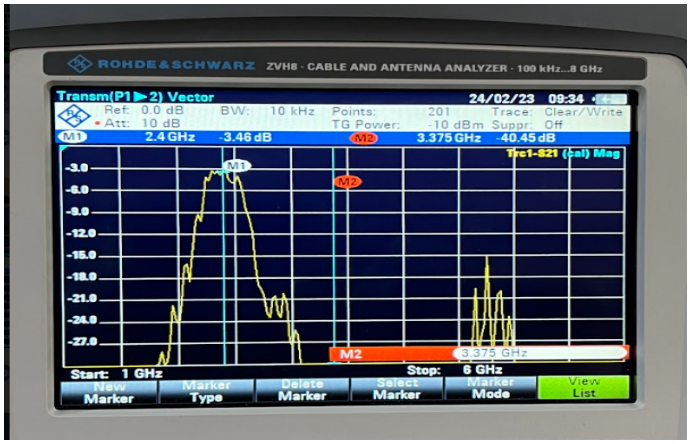


Fig.6 Return Loss(S21) on VNA

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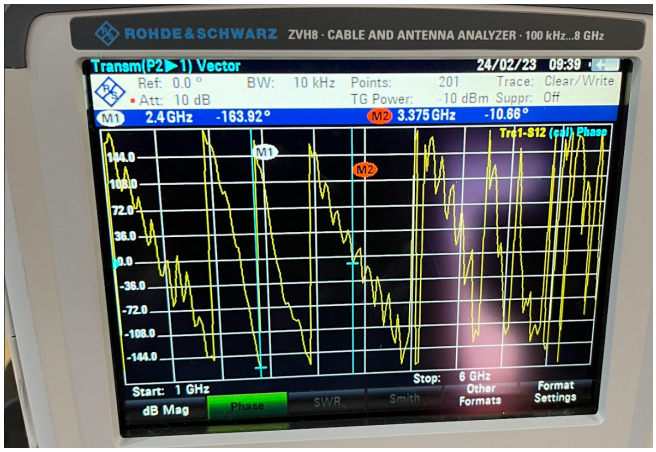


Fig.7 Phase(S12) on VNA

Comparison	Center Frequency(fc)	Band Width (BW)	Return Loss (dB)
Specification	2.4GHz	240 MHz at 3dB Pass Band	>10
Simulation Result (ie3d)	2.4GHz	500Hz at 3dB Pass Band	21.2
Practical Result (VNA)	2.4GHz	260MHz at 3dB Pass Band	20.9
Difference between Simulation and Practical	0%	44%	2%
Difference between specs and result	0%	6%	Better

ACKNOWLEDGEMENT

We would like to thank the technical team of the college for providing us the expertise to simulate and design a parallel coupled microstrip band pass filter. Additionally, we would also like to thank our college staff who contributed to the successful completion of this research project on designing and implementing a Parallel Coupled Band Pass Filter.

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Ultrasonic Glasses For Blind

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***Abstract*—Many activities, including writing papers, using the internet, and checking email, are possible for people who are blind. People who are blind or visually impaired can use computers, smartphones, and other electronic devices on their own thanks to screen-reading software and specialized Braille and voice generating devices. In their everyday lives, people with low vision frequently require assistance getting around the house and outside. Because providing human help has never been feasible, solutions to this issue have long been sought. So, we came up with a clever fix for this issue by fusing ultrasonic gloves and spectacles. Additionally, these gadgets have a vibrator rather than a buzzer because the latter would be more irritating than useful. We are eager to learn what capabilities help technology has.**

Keywords—PCB, Microcontroller, Aids to navigation, visual information, objects, obstacles, vibrations, microcontroller-based navigation, Atmega-328.

I. INTRODUCTION

Two ultrasonic sensors, an Atmega microcontroller, batteries, clear glasses, rudimentary circuitry, and a PCB are all used in the system's development. The blind can now use the glasses to identify obstacles and transmit them. The side of the goggles, which serve as eyes, are affixed with ultrasonic sensors. To gather information about obstructions, the sensors transmit and receive ultrasonic waves continuously. This information is continuously sent from the sensor to the microprocessor. The microcontroller uses this information to regulate the vibrator motors that are mounted on the sides of the goggles. To more accurately determine the distance, the microcontroller analyzes the sensor data and drives the vibrator motor based on the information it receives. As a result, the system enables blind people to use vibration to comprehend obstacles and objects in front of each eye.

II. OBJECTIVE

- Design and creation of a blind guidance kit that uses ultrasonic sensors to aid visually disabled people in navigating new environments.
- Analyze the precision and efficiency of ultrasonic devices in spotting obstructions and directing users in various settings.
- For maximum coverage and usefulness, decide where the best locations are for ultrasonic sensors to be placed and configured.
- Examine the usability and user experience of navigation suites, paying particular attention to comfort, simplicity of use, and user satisfaction.
- Examine possible improvements and additions to the navigation suite, such as the incorporation of extra sensors to enhance obstacle recognition and navigation.
- Evaluation of current assistive technologies for the blind and visually disabled in comparison to navigation systems based on ultrasonic sensors.
- Identify the constraints and possible difficulties posed by navigational tools and suggest solutions.
- Consider other uses for navigation tools besides assisting the blind or visually impaired, like robotics or automation.

III. LITERATURE SURVEY

The capacity to perceive his surroundings is one of man's greatest talents. A person's greatest anguish is vision loss brought on by numerous life factors or issues. A blind person can live freely in many different ways, both with and without help. Giving blind people ultrasonic gloves and glasses to help them avoid these accidents using low-cost modules is one of the ideas to help them avoid deadly accidents and frequent collisions with nearby items. The research also suggests smart walking gloves and glasses that can alert blind people to potholes and other hazards so that the device can facilitate their walking and lower accidents. It explains a more effective navigational aid for blind people. It comprises of easy-to-follow steps that are fitted with sensors that offer environmental data. The microcontroller's GPS functionality enables their loved ones to monitor them. An ultrasonic sensor, a GPS receiver, a vibrator, a PIC controller, and a battery are all utilized in this device. The device's main goal is to give blind people a practical and secure method to handle everyday issues.
Previous research/projects on this topic:

1. A straightforward obstacle detection algorithm based on multi-sensor fusion is proposed in a paper by Jinqiang Bai, Shiguo Lian, Zhaoxiang Liu, Kai Wang, and Dijun Liu. To identify tiny obstacles and transparent obstacles, it makes use of both a depth sensor and an ultrasonic sensor.
2. Susan Sabra and Dania Abdul-Rasool develop mobile incorporated smart guides for the blind. The portable compartment of this smart guide contains a Bluetooth antenna, sensors, a CPU, memory, and speakers in addition to other technological components. The mobile app receives a signal when the device's sensors identify solid objects in the line of movement. The wearer is then alerted by the mobile device, which also sends a warning alert telling them to change course and remain on the correct path.

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3. Rohit Agarwal, Nikhil Ladha, and Mohit Agarwal created a device that consists of goggles and an obstacle sensing module that is placed in the middle. A power source, a buzzer, and a processing unit are all connected. The processing unit is linked to the output device and the obstacle detection module. The primary goal of these glasses is to be simple to use, lightweight, affordable, friendly, and obviously to assist them in avoiding obstacles.
4. A smart glasses system for vocal input of commands and prompts via wireless bone conduction headsets was described in a paper by Feng Lan, Guangtao Zhai, and Wei Lin. They assert that the system will enable individuals who are blind to live more independently.

IV. PROPOSED DESIGN

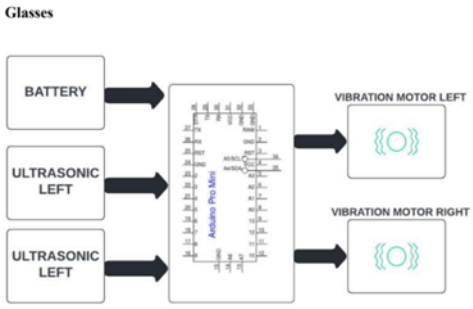


Fig.1 Glasses

The smart glasses will provide the following benefits:

1. Obstacle detection based on ultrasonic
2. No need to carry the system as it is mounted on the laptop
3. Silent vibration warning on the glasses

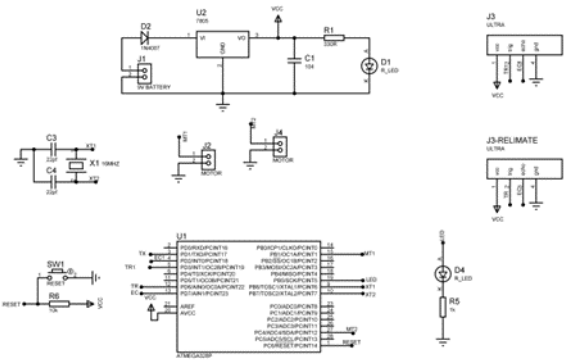


Fig.2 Lightweight system

The system is developed using a PCB, two ultrasonic sensors, an Atmega microcontroller, a battery, clear glasses, and some simple circuitry. The blind can now use the glasses to identify obstacles and transmit them. The goggles' edges are affixed with ultrasonic sensors, which serve as eyes. To gather information about obstacles, the sensor continuously transmits and gets ultrasonic waves. This information is continuously sent from the sensor to the microprocessor. The microcontroller uses this information to regulate the vibrator motors that are mounted on the sides of the goggles.To more accurately determine the distance, the microcontroller analyzes the sensor data and drives the vibrator motor based on the information it receives. Thus, using vibration, the system enables blind people to comprehend obstacles and objects in front of each eye more precisely.

Components used

1. Microcontroller and Development Board: A compact integrated circuit called a microcontroller is used in embedded systems to handle particular tasks. On a single chip, a standard microcontroller houses a CPU, memory, and input/output (I/O) devices. A development board is a printed circuit board with components and circuits intended to make testing a specific microcontroller easier. Buttons and LEDs are examples of hardware circuitry that can make testing and troubleshooting much simpler.
2. Regulators: There are many uses for this line of fixed voltage integrated circuit regulators. Board conditioning is one of these uses, and it eliminates the disturbance and dispersion issues that come with single point conditioning. These controllers each have an output current capacity of 1.5 A. As a result of their internal current regulating and thermal shutoff mechanisms, these controllers are essentially overload-proof. These components can be used as fixed voltage regulators, changeable output voltage and current generators that work with external components, and power transmission components for precision voltage regulators. A constant output voltage is produced by adjustable voltage regulators, which can be changed to any other number within a specific voltage range. Consequently, a variable voltage regulator is another name for a flexible voltage regulator. The flexible voltage regulator's DC output voltage value ranges from positive to negative. IC for voltage regulator LM317 The intended positive fixed DC voltage value can be produced from the spectrum of accessible voltages using the LM317 voltage regulator IC. Three wires make up the LM317 regulator IC. The output voltage is controlled by the first pin, the output is collected by the second pin, and the input is connected by the third pin. The changeable resistor on the adjustable pin's (terminal) enables the output to change over a wide range.

Circuit Diagram

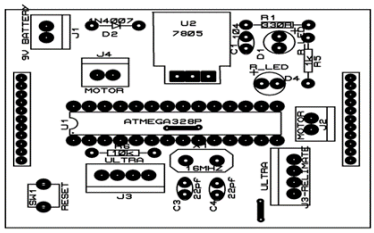


Fig.3

V. APPLICATION

Blind people who don ultrasonic glasses can use this assistive technology to identify nearby obstacles and be warned by vibrations or sounds. Here are a few possible uses for this technology:

1. Independent Mobility: People who are blind or visually impaired may find it easier to travel and move around with the aid of ultrasonic glasses, enabling them to go unaided to new locations. Their general mobility and liberty are enhanced by this.

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2. Safety and Obstacle Avoidance: The glasses can warn the wearer of any walls, poles, or other obstacles in their route. By doing so, user safety is improved and mishaps like collisions are prevented.
3. Accessibility in Public Spaces: The visually disabled can more easily enter sidewalks, parks, and shopping centers with the aid of ultrasonic glasses. This can encourage inclusion and lower obstacles to social involvement.
4. Improvements in mobility and safety can give people with visual impairments more faith in their ability to navigate and interact with others in their environment. As a result, you may socialize more and feel more independent and in charge of your life.
5. Assistance with everyday tasks: The glasses can also be used to assist with daily tasks like cooking, cleaning, and navigating in strange environments.

The glasses can increase the effectiveness and safety of these activities by giving real-time feedback on the location of obstacles. The Ultrasonic Goggles for the Blind project has the potential to greatly enhance the freedom, safety, and mobility of people who are blind and visually impaired.

VI. CONCLUSIONS

In conclusion, developing an ultrasonic eyeglass system for the blind is a promising project that has the potential to significantly improve the lives of the visually impaired. The project involves the use of ultrasonic sensors capable of detecting objects and obstacles in the wearer's environment and transmitting this information to the user through a series of vibrations or sound signals. The device can be made to be pleasant to wear, lightweight, and portable, making it appropriate for daily use. Additionally, it is adaptable to user tastes and specific requirements. Although the initiative is still in the early phases of creation, the possible benefits of such a system are enormous. This improves safety and mishap prevention, increases freedom and movement for those who are blind or partly sighted, and eventually raises their quality of life.

The ultrasound goggle system's architecture needs to be improved, and more testing is required to determine its efficacy and usefulness. However, this initiative has the potential to significantly improve the lives of people with vision impairments and the communities in which they reside with the proper tools and knowledge.

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Professors are primarily responsible for writing the academic papers and the project. Tushar Sawant offered his endorsement. This document would not have been feasible without the suitable and thorough advice he provided, which aided us at every stage of the project. We would like to express our gratitude to our coworkers, who provided valuable insight and assistance throughout the study process.

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Rain Sensing Automatic Car Wiper

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***Abstract*—The automotive industry places a significant emphasis on driver safety, and poor visibility during heavy rainfall can lead to accidents. To mitigate this issue, an automatic rain-sensing wiper system has been proposed that incorporates a rain sensor, Arduino microcontroller board, servo motor. The rain sensor, which is placed on the outside of the windshield, detects the presence and intensity of raindrops, and communicates this information to the Arduino board. The board processes the information and adjusts the speed of the wiper blades accordingly via the servo motor. The system's intelligence lies in its ability to automatically adjust the wiper blade speed based on the intensity of the rainfall. A higher rotation speed of the wiper blades is required for heavier rainfall, while a lower speed is sufficient for light rainfall. The system's implementation involves the use of an LM393 op-amp-based rain sensor, which measures moisture via analog output pins. The Arduino board, which is powered by an onboard power supply and communicates with the PC via a USB port, processes and analyses the information received from the rain sensor. The servo motor, which is connected to the wiper blades, receives instructions from the Arduino board and adjusts the speed of the wiper blades based on the intensity of the rainfall. Overall, the automatic rain-sensing wiper system provides a safer driving experience by reducing the likelihood of accidents caused by poor visibility during heavy rainfall.**

Keywords—Automatic, Sensing, Wiper, Arduino, Rain sensor module.

I. INTRODUCTION

A car wiper is an essential safety device that is installed in all modern vehicles. It consists of a metal arm and a rubber blade, which work together to remove rainwater from the windscreen. In most automobiles, an electric motor powers the metal arm, which moves the blade in a clockwise and anti-clockwise direction, pushing the water from the surface of the glass. The wiper speed is automatically adjusted based on the intensity of the rainfall to provide optimal visibility. To enhance safety and convenience, there is a growing need for automated wipers that can sense rain and start and stop automatically, eliminating the need for human intervention. This can be achieved through the use of a rain sensor that detects the presence of rain and sends a signal to an Arduino microcontroller. The Arduino then controls a servo motor that moves the wiper blade at the appropriate speed. An LCD display module can be used to show the intensity of the rainfall, allowing for further adjustment of the wiper speed. Automated wipers are becoming increasingly common in luxury vehicles, but there is a need for more affordable and reliable solutions for all types of vehicles. The construction of a low-cost, efficient automated wiper system can greatly improve safety during rainy weather and reduce the risk of accidents due to poor visibility. This project is a small but important step towards achieving this goal and improving the comfort and convenience of drivers.

II. EXISTING SYSTEM

According to the World Health Organization (WHO), over 2 million people worldwide die each year due to accidents during the rainy season. Many of these accidents occur as a result of small errors, such as a driver's failure to properly operate their car's wipers during heavy rainfall. In current car models, manual switching is required to start the wipers and adjust their speed. This manual process can be inconvenient for drivers during rainfall, as they must divert their attention from the road to control the wipers. Luxury vehicles are the only car models that typically employ an intelligent rain-sensing windshield wiper system. However, there is a need for a more widely available automatic rain sensing car wiper system that considers various factors, such as sensor type, sensor location, and the controller's programming. To design an effective automatic rain sensing car wiper system, the sensor's location must be chosen carefully to ensure accurate raindrop detection without being affected by environmental factors like dust, dirt, or sunlight. The sensor location should also not interfere with the driver's view. The controller's programming should include adjustments for wiper speed and delay time based on the intensity of the rainfall. It should also be designed to prevent false detections caused by dirt or dust on the windshield. A self-cleaning mechanism should be included in the system to remove any debris that accumulates on the sensor over time. By taking these factors into consideration, an automatic rain sensing car wiper system can be developed that provides drivers with improved visibility during rainfall and reduces the likelihood of accidents. In everyday life, emotion is important. People can communicate and comprehend each other more easily when they express their emotions. Emotion recognition is a technology that allows machines to understand human emotions and has a wide range of applications. It is not necessary that these interpersonal skills are well developed in individuals. Autistic children usually face the issue of interaction and communication. At a very tender age, their development is comparatively slower than others. There are certain red flags that hold them back from engaging with others. They have difficulty comprehending what is going on around them, such as what other people are saying or communicating nonverbally. And due to these developmental delays, they must begin with a steady course of daily therapies. Therapy becomes a daily routine for these kids wherein their minds are developed. To help them practically make decisions in day-to-day life, we wanted to come up with a solution that acts as

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a bridge for them between therapy and practical execution. When autistic children can manage their own challenging behavior, they can learn and get along better with others. We wanted to develop a model which not only can help children but can be used in multiple domains. Emotion, In human-computer interaction (HCI), for example, permits the robot to deliver appropriate feedback based on the user's emotional state, thus boosting the contact quality. In the medical world, having a better emotional understanding of how people with mental illness live their life assists doctors to diagnose and treat the problem more successfully. Because of the rapid advancement of communication technology and the growing popularity of smartphones and social media, Internet users upload a large amount of video data to express their thoughts. Furthermore, different points of view might result in differences in emotional expression. We can gain a more accurate and comprehensive understanding of netizens' attitudes toward network events and products by using emotional recognition of users' multimedia films. Emotion identification has come a long way in recent years. However, most researchers are focused on unimodal emotion identification. Speech and facial expressions, for example, share a lot of the same thematic and temporal properties and are frequently seen in human emotional interactions, therefore they're getting a lot of attention in the emotion computing field. External factors such as occlusion and lighting, on the other hand, may have an impact on the accuracy of face expression recognition. The outcome of speech emotion identification will be influenced by variances in the voices of different participants as well as surrounding noise. By combining more emotional factors and making full use of complimentary emotional information, the recognition result is more accurate, and the recognition performance has evident advantages over single modal recognition. The automatic rain sensing car wiper system design should consider several factors, including the sensor type, sensor location, and the controller's programming. The sensor should be placed in a location where it can detect the raindrops accurately without being affected by other environmental factors such as dust, dirt, or sunlight. The sensor location should also be chosen to avoid any interference with the driver's view. The controller should be programmed to adjust the wiper speed and delay time according to the intensity of the rain. The controller should also be designed to prevent false detections caused by dirt or dust on the windshield. The system should have a self-cleaning mechanism to remove any dirt or debris that may accumulate on the sensor over time.

III. BLOCK DIAGRAM

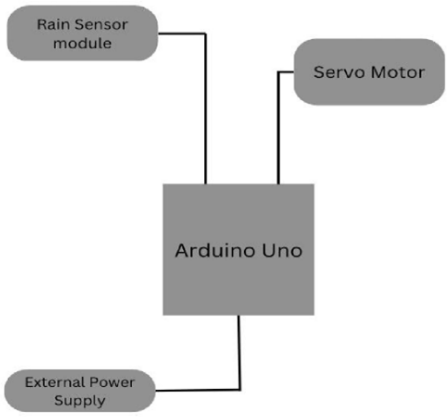


Fig.1 Connecting Arduino to the motor, sensor and power supply

IV. IMPLEMENTATION

This paper proposes an automated car wiper system that activates when rainfall is detected and deactivates when rainfall ceases, without requiring any human intervention. The system employs a servo motor, a rain sensor Arduino. The rain sensor detects the intensity of the rainfall by reading the output of digital analog pins, and sends this information to the Arduino. The Arduino processes this information and sends the appropriate signals to the servo motor to adjust the wiper speed according to the intensity of the rainfall. The proposed system offers a reliable and efficient solution for controlling car wipers during rainy weather conditions.

V. DETAILS OF COMPONENTS

Arduino

Arduino is user-friendly software that allows users to write code for controlling hardware and electronics. With Arduino boards, users can detect various inputs, such as sensing a finger on a sensor, controlling lights in a pattern, or pressing a button. For instance, when a user places a finger on a button, the light turns on and turns off when the finger is removed. The Arduino Uno microcontroller board is programmed by sending code instructions to it. The programming is done using the Arduino software for processing.



Fig.2 Arduino Uno

Rain Sensor

Rain sensors are commonly used to detect rain droplets by setting a threshold limit. When the threshold limit is exceeded, the sensor transmits a signal to perform the desired action. These sensors have digital and analog pins for detecting humidity levels. If the humidity levels surpass the threshold limit, the sensor initiates the desired action. The sensor acts as a variable resistor, changing its resistance from 100,000 to 2 million ohms when it becomes wet. This causes increased conduction of current when the board is wet. The sensor board has A0, D0, GND, and VCC pins for analog output, digital output, ground, and positive voltage, respectively. The sensor is connected to two loop pins, + and -, which correspond to sensor board hooks A and B, respectively.

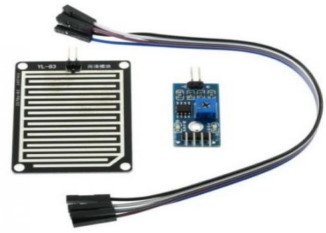


Fig.3 Rain Sensor

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Servo Motor

A servo motor comprises an output shaft that can be positioned to a particular angle using a coded signal sent by the servo. These motors are commonly used in various everyday appliances due to their efficiency and economy. They are compact in size and can be integrated into appliances to perform desired actions more effectively while consuming low amounts of energy. Pulse width modulation is used to control these motors, where an electrical pulse is transmitted through a control wire. There are three types of pulse width modulations: Minimum, Maximum pulse, and repetition rate. A servo motor has a total movement of 180° and can turn 90° in either clockwise or counter clockwise direction.



Fig.4 Servo Motor

VI. RESULT

The automatic car wiper system using Arduino has proven to be an effective solution for controlling car wipers without the need for physical intervention. The system utilizes a rain sensor and an Arduino microcontroller to detect and process the intensity of rainfall, and a servo motor to control the speed of the wiper accordingly. Overall, the automatic car wiper system using Arduino presents a promising solution for enhancing driving safety and convenience in rainy weather conditions. Further research and development could focus on improving the system's accuracy and response time, as well as exploring additional features such as automatic wiper interval adjustments.

VII. CONCLUSIONS

The automated car wiper system was developed to detect rainfall and activate windshield wipers, accordingly, eliminating the need for the driver to manually control them. Studies have shown that the system's response time to rain detection is less than 400 milliseconds. While the system currently relies on rain sensors and Arduino, it could be improved by replacing the sensors with IR sensors for more precise and accurate rainfall detection. Choosing a wiper system that is not only efficient but also costeffective makes a rain sensor a desirable option. Further improvements to the system could include the integration of various sensors to optimize movement and performance.

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Design and Implementation of 32-bit ALU using Xilinx Vivado

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***Abstract*—The proposed paper deals with the designing and implementation of an Arithmetic Logic Unit - ALU of a general Central Processing Unit - CPU. The designed ALU performs base operations like taking binary inputs, executing the operation, and creating, storing, and distributing binary output. The ALU and its pre-requisite digital circuits are designed using Verilog Hardware Description Language (VHDL). ALU of digital computers aims at utilizing logic design algorithms to efficiently utilize the hardware. Various individual aspects of the ALU were designed and tested first and were later linked together to form a single powerful ALU with 32 discrete functions. In order to test the designed ALU, various testbench programs were developed to provide stimulus and verify responses. In this paper, we have simulated, synthesized, and implemented 32-bit ALU using VHDL in Xilinx Vivado.**

Keywords—ALU, VHDL, Xilinx Vivado, FPGA, VLSI.

I. INTRODUCTION

The design and implementation of the FPGA-based Arithmetic Logic Unit is of highest relevance in the design of digital circuits since it is a basic part of the central processing unit. The results of a wide variety of simple arithmetical and logical computations can be computed by ALU. The operands—the data to be acted on—as well as a control unit code indicating the action to perform are inputs to the ALU. The computation's output is what is produced. Depending on the ALU's design specifications, the input can be 4, 8, 16 or 32 bits. We have used a 32-bit setup in the proposed paper. The planned ALU will carry out two key tasks:

- Arithmetic operations
- Logic operations

All the modules described in the design are coded using VHDL as it has high degree of parallelism.

According to Moore's Law, the semiconductor industry has shown a substantial exponential increase in device complexity and performance. The verification and implementation of enormous digital systems require the Very Large-Scale Integration as a key technology. In order to preserve the performance, reliability, and cost-saving advantages of large integrating systems, signal chips may now support designs with tens of thousands to millions of transistors. Computer-aided design tools have reduced the complexity of such designs into a set of clearly defined processes, thereby speeding up design completion and improving the quality of the final output. These improvements are especially in most complex, lengthy and error –prone phases of the project. A functional description using an HDL (Hardware Description Language), such as VHDL, Verilog HDL, etc., always marks the beginning of the design process. Field Programmable Gate Arrays (FPGAs) are the only programmable logic devices (PLDs) that have grown exponentially during the previous two decades, and even at a quicker rate when compared to the rest of the semiconductor industry, particularly Application Specific Integrated Circuits (ASICs) (ASICs). Hence, a major area of interest in the study of algorithms and the development of tools for FPGA-specific design automation difficulties is the field programmable gate array (FPGA) technology. Due to the new challenges that FPGAs bring for logic synthesis and optimization, a number of cutting-edge approaches have been developed recently.

II. DESIGN FLOW

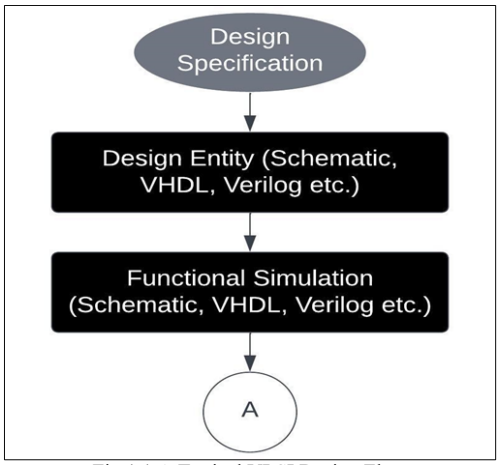


Fig.1.1 A Typical VLSI Design Flow

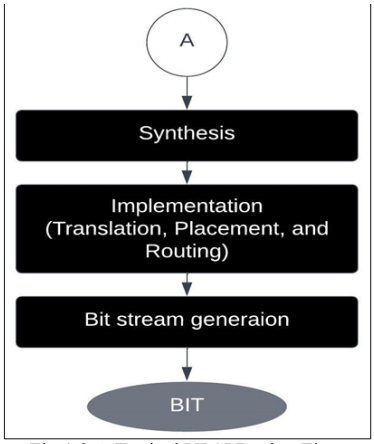


Fig.1.2 A Typical VLSI Design Flow

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The first step in the design process is to create a design specification, which is a functional description of the desired capability in high-level description language. Many languages have been developed for this (VHDL, Verilog HDL, and Hardware C). The CAD Tools were developed for the first design stage of High-Level Synthesis, which entails functional description mapping along with a set of area & performance constraints in terms of registers & combinational functional Units, also known as Primitives, such as ports, adders, comparators, multipliers, and shifters. This stage is extremely dissimilar from the format of data and control signals. The control unit is in charge of activating the specified segments of the data channel according to the set timetable, allowing for the completion of the desired computation. The main issue with high-level synthesis is choosing a scheduling so that only a small portion of a device's resources are drawn to it. High-level synthesis cannot yield an accurate evaluation of a circuit's figures of merit. As a result, it is uncommon for an RTL design to be directly mapped into a logic circuit that satisfies the needs for space, speed, or power. As a result, logical level optimization is always required. When it comes to design, FPGAs are extremely similar to other widely used technologies like standard cells and gate arrays. The logic-level design for FPGAs consists of sequential logic synthesis, which deals with the assignment and/or arrangement of storage components, and combinational logic synthesis, which optimizes logic gate networks.

III. SOFTWARE TOOL-XILINX VIVADO SUITE

Vivado Features

On the most recent Xilinx FPGA, Vivado is the Hardware Development suite used to generate a VHDL, Verilog, or any other HDL design. In order to translate a VHDL design into a configuration file that can be loaded into a Xilinx FPGA, one needs the Vivado framework.

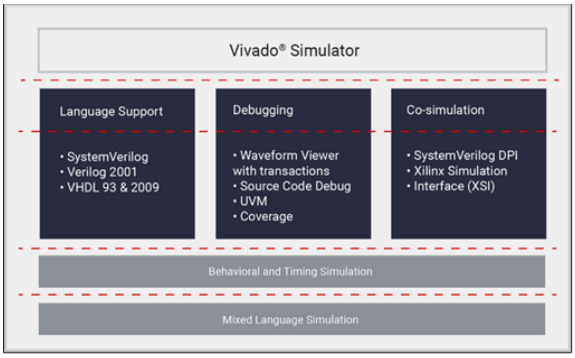


Fig 2 Overall Xilinx Vivado features

With the integrated tool Vivado, one may carry out the entire design flow for a Xilinx FPGA:

- Simulate
- Synthesize
- Map
- Route
- Analyse Timing
- Create a bit-stream FPGA configuration File
- Configure FPGA
- Debug the FPGA using ILA (Integrated Logic Analyzer)

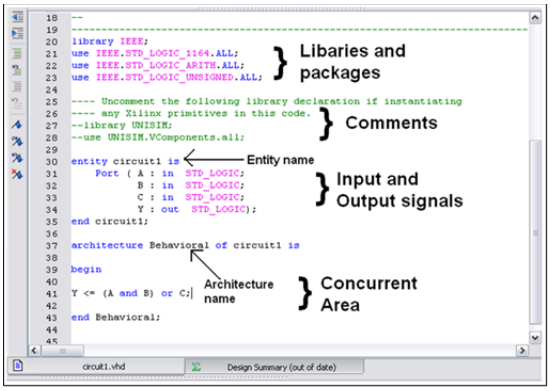


Fig.3 VHDL Program Structure

VHDL program structure in Vivado:

There is at least one entity/architecture pair in every VHDL program. It is customary to write numerous entity/architecture pairings in a large design and connect them all together to create a full circuit. An entity declaration explains the circuit from the standpoint of its input and output interfaces, or from the "outside," in other words. The architectural declaration makes up the second section of a simple VHDL design description.

ENTITY is the list with specifications of all input and output pins of the circuit. Its syntax is shown below:

```
ENTITY name IS
PORT (
port_name : signal_mode signal_type;
port_name : signal_mode signal_type;
...
);
END name;
```

Fig.4

The ARCHITECTURE is the description of how the circuit of design works. Its syntax is as follows:

```
ARCHITECTURE architecture_name OF entity_name
IS
[declarations]
BEGIN
(code)
END architecture_name;
```

Fig.5

With VHDL coding, modelling styles are utilised to express the design's architectural framework. Depending on how sophisticated the digital design is, many modelling philosophies might be chosen. The modelling styles are categorized as :

1. Data flow modelling (Concurrent code)
2. Behavioral modelling (Sequential code)
3. Structural modelling
4. Mixed modelling.

VHDL testbench

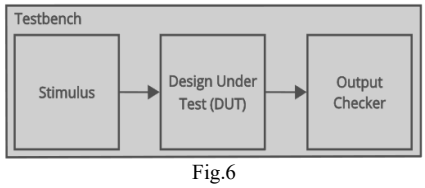


Fig.6

A crucial component of VHDL design is the VHDL Testbench, which uses simulation waveforms to verify the design's operation. For the purposes of checking the output result, test benches offer stimuli for design under test (DUT) or unit under test (UUT). A test bench is a piece of HDL code that enables one to offer a standardised, repeatable set of

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stimuli that may be used with various simulators. The test bench consists of an entity that has no IO ports, a clock input, and different stimuli inputs.

VHDL Testbench syntax consists of:

Header File declaration containing library

```
LIBRARY ieee;
USE ieee.std_logic_1164.ALL;
entity without Ports declaration
ENTITY tb  up  down IS
END tb_up_down;
```

Fig.7

Architecture with component declaration for unit under test

```
COMPONENT up_down_counter
PORT(
clock: IN std_logic;
reset: IN std_logic;
up_down: IN std_logic;
counter: OUT std_logic_vector(3 downto 0)
);
END COMPONENT;
```

Fig.8

Testbench Internal signal declaration

```
--Inputs signal clock: std_logic: = '0';
signal reset: std_logic: = '0';
signal up_down: std_logic: = '0';

--Outputs
signal counter: std_logic_vector (3 downto 0);

For Sequential circuit Clock period representation for
example: 50Mhz equals 20 ns.
constant clock_period: time: = 20 ns;
```

Fig.9

Instantiate Design Under Test using Port Map

```
uut: up_down_counter PORT MAP (
clock => clock,
reset => reset,
up_down => up_down,
counter => counter
);
```

Fig.10

Clock definition process

```
clock_process: process
begin
clock <= '0';
wait for clock_period/2;
clock <= '1';
wait for clock_period/2;
end process;
```

Fig.11

Stimulus definition process

```
wait for 20 ns;
reset <= '1';
wait for 20 ns;
reset <= '0';
up_down <= '0';
wait for 200 ns;
up_down <= '1';
wait;
```

Fig.12

IV. IMPLEMENTATION

A essential component of the central processing unit in a computer system, the ALU, or arithmetic logic unit, performs both arithmetic and logic operations. An integrated circuit found inside a CPU or GPU, also known as an integer unit (IU), is the final component of the processor to carry out computations. It can perform all arithmetic and logical operations, such as addition, subtraction, and shifting operations, as well as Boolean comparisons (XOR, OR, AND, and NOT operations). Bitwise and mathematical operations can also be carried out on binary numbers. In response to input data, the ALU is instructed by its operands and code which operations to do. After the ALU has done processing the input, the data is sent to the computer's memory. Therefore, to design an entire ALU, its singular aspects such as adder, subtractor, multiplier, and multiplexer were firstly designed and implemented in Vivado and later all these circuitries was fused.

Basic Half Adder

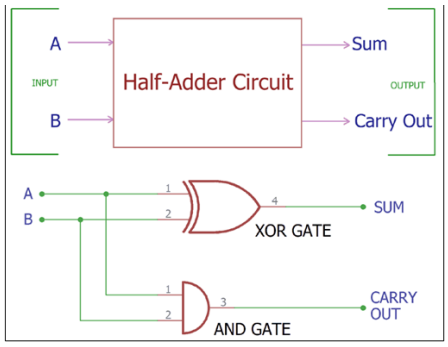


Fig.13 Half Adder Block Diagram and Logic Diagram

A half adder is a digital logic device that adds two binary values with one bit each in binary. A and B are its two inputs, and SUM and CARRY are its two outputs. The CARRY output is the most significant bit (MSB) of the result, indicating if there was a carry-over from the addition of the two inputs, whereas the SUM output is the least significant bit (LSB) of the result. XOR and AND gates, for example, can be used to build the half adder.

- VHDL Code for Half Adder

```
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;
use IEEE.STD_LOGIC_ARITH.ALL;
use IEEE.STD_LOGIC_UNSIGNED.ALL;

entity project_2_HA is
    Port ( A : in STD_LOGIC;
           B : in STD_LOGIC;
           S : out STD_LOGIC;
           C : out STD_LOGIC);
end project_2_HA;

architecture Dataflow of project_2_HA is

begin
S<= A xor B;
C<= A and B;

end Dataflow;
```

Fig.14

- RTL Schematic of designed Half Adder

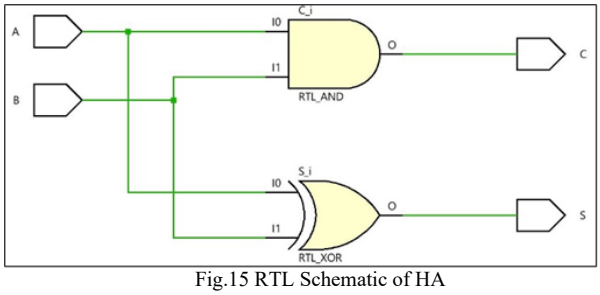


Fig.15 RTL Schematic of HA

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- Post Synthesis Schematic of Half Adder

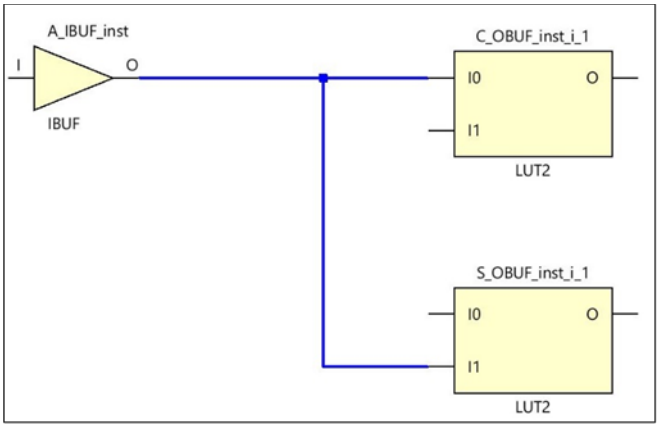


Fig.16 Post Synthesis Schematic of HA

- Output Timing Diagram



Fig.17 Output Timing Diagram of HA

Verifying the timing diagram with the truth table of Half-Adder, it is concluded that the implementation is successful. In a similar way, digital circuits such as Full Subtractor, Multiplier, Multiplexer which are fundamental aspects of an ALU were designed and verified with their intended operation. VHDL code, timing diagram, RTL schematic of these circuits is as below:

Basic Full Subtractor

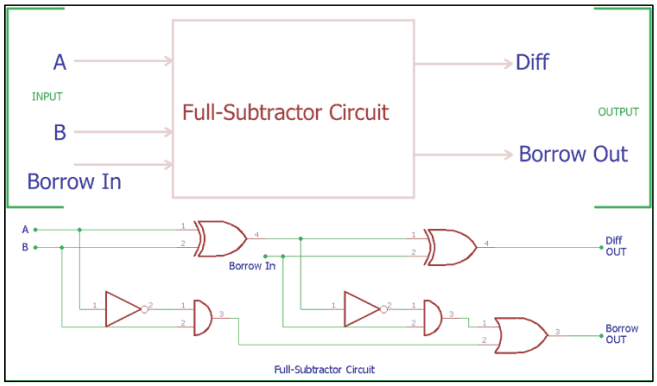


Fig.18 Full Subtractor Block Diagram and Logic Diagram

- VHDL Code for Full Subtractor

```
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;

entity project_4_FS_Behavioral is
    Port ( A : in STD_LOGIC_VECTOR (2 downto 0);
           Y : out STD_LOGIC_VECTOR (1 downto 0));
end project_4_FS_Behavioral;

architecture Behavioral of project_4_FS_Behavioral is
begin
process(A)
begin
if(A = "001" or A = "010" or A = "111")then
Y <="11";
elsif (A = "011")then
Y <= "01";
elsif (A = "100")then
Y <= "10";
else
Y <= "00";
end if;
end process;
end Behavioral;
```

Fig.19 Full Subtractor VHDL Code

- RTL Schematic of designed Full Subtractor:

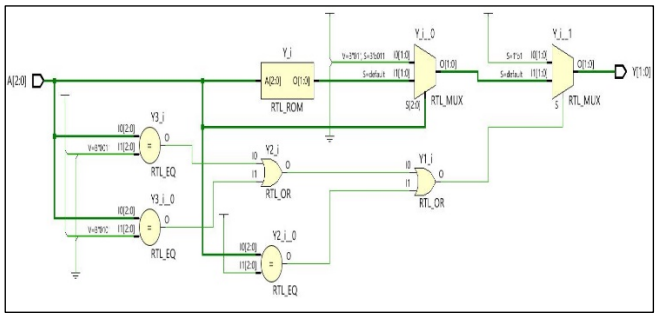


Fig.20 RTL Schematic of FS

- Post Synthesis Schematic of Full Subtractor:

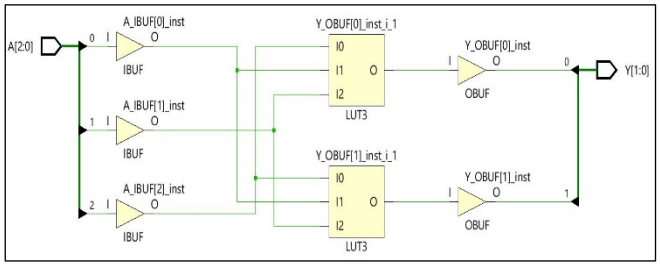


Fig.21 Post Synthesis Schematic of FS

- Output Timing Diagram:



Fig.22 Output Timing Diagram of FS

16:1 Multiplexer

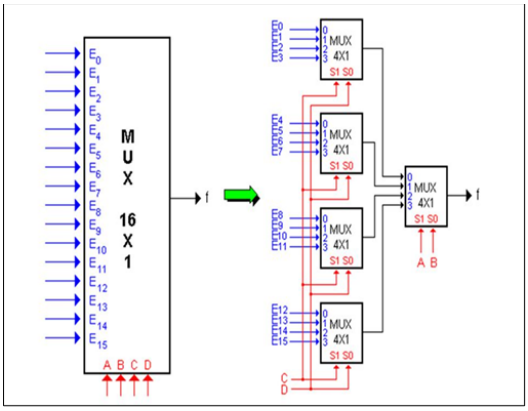


Fig.23 16x1 Multiplexer Block Diagram and Logic Diagram

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- VHDL Code for 16x1 Multiplexer:

```
use IEEE.STD_LOGIC_1164.ALL;

entity project_6_161MX_Behavioral is
    Port ( Din : in STD_LOGIC_VECTOR (15 downto 0);
           Sel : in STD_LOGIC_VECTOR (3 downto 0);
           Y : out STD_LOGIC);
end project_6_161MX_Behavioral;

architecture Behavioral
of project_6_161MX_Behavioral is

begin
process(Sel,Din)
begin
case Sel is
when"0000"=>Y<=Din(0);
when"0001"=>Y<=Din(1);
when"0010"=>Y<=Din(2);
when"0011"=>Y<=Din(3);
when"0100"=>Y<=Din(4);
when"0101"=>Y<=Din(5);
when"0110"=>Y<=Din(6);
when"0111"=>Y<=Din(7);
when"1000"=>Y<=Din(8);
when"1001"=>Y<=Din(9);
when"1010"=>Y<=Din(10);
when"1011"=>Y<=Din(11);
when"1100"=>Y<=Din(12);
when"1101"=>Y<=Din(13);
when"1110"=>Y<=Din(14);
when"1111"=>Y<=Din(15);
when others=>Y<='X';
end case;
```

Fig.24 16x1 Multiplexer VHDL Code

- RTL Schematic of designed 16x1 Multiplexer:

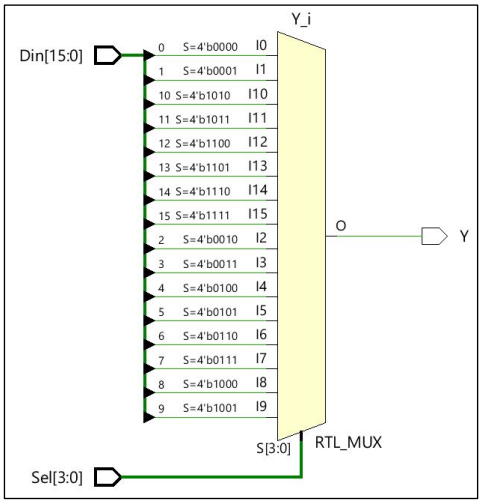


Fig.25 RTL Schematic of 16x1 Multiplexer

- Post Synthesis Schematic of 16x1 Multiplexer:

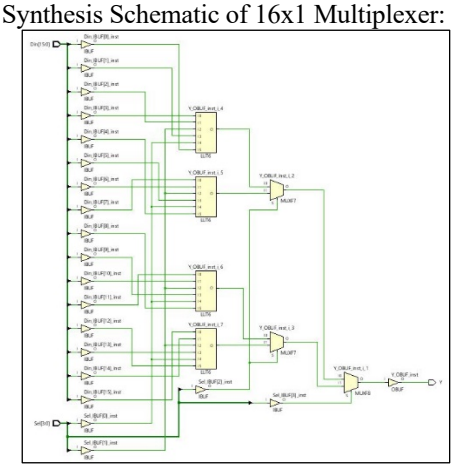


Fig.26 Post Synthesis Schematic of 16x1 Multiplexer

- Output Timing Diagram:



Fig.27 Output Timing Diagram of 16x1 Multiplexer

Signed Multiplier VHDL Code.

```
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;
--use IEEE.STD_LOGIC_ARITH.ALL;
--use IEEE.STD_LOGIC_UNSIGNED.ALL;

use IEEE.NUMERIC_STD.ALL;

entity project_9_signedmultiplier is
generic (N : integer := 8);
 port( a : in STD_LOGIC_VECTOR (N-1 downto 0);
   b : in STD_LOGIC_VECTOR (N-1 downto 0);
   p : out STD_LOGIC_VECTOR (2*N-1 downto 0));

end project_9_signedmultiplier;
architecture Behavioral of project_9_signedmultiplier is

SIGNAL a_int: SIGNED(N-1 downto 0) := (others => '0');
SIGNAL b_int: SIGNED(N-1 downto 0) := (others => '0');
SIGNAL pdt_int: SIGNED(2*N-1 downto 0):= (others => '0');

begin
 a_int <= SIGNED (a);
 b_int <= SIGNED (b);
 pdt_int <= a_int * b_int;
 p <= STD_LOGIC_VECTOR(pdt_int);

end Behavioral;
```

Fig.28 Signed Multiplier VHDL Code

- RTL Schematic of designed Signed Multiplier:

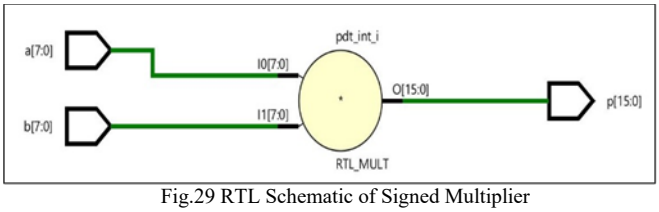


Fig.29 RTL Schematic of Signed Multiplier

- Post Synthesis Schematic of Signed Multiplier:

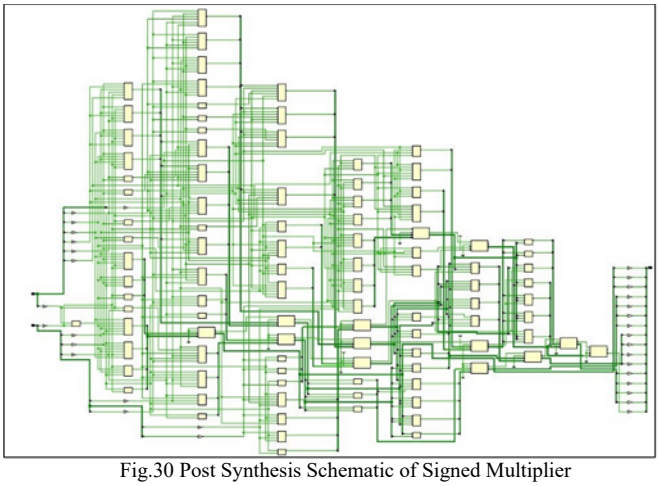


Fig.30 Post Synthesis Schematic of Signed Multiplier

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- Output Timing Diagram:

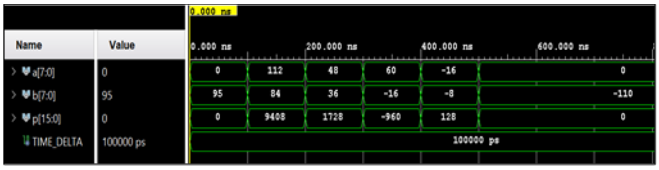


Fig0.31 Output Timing Diagram of Signed Multiplier

V. COMPILATION

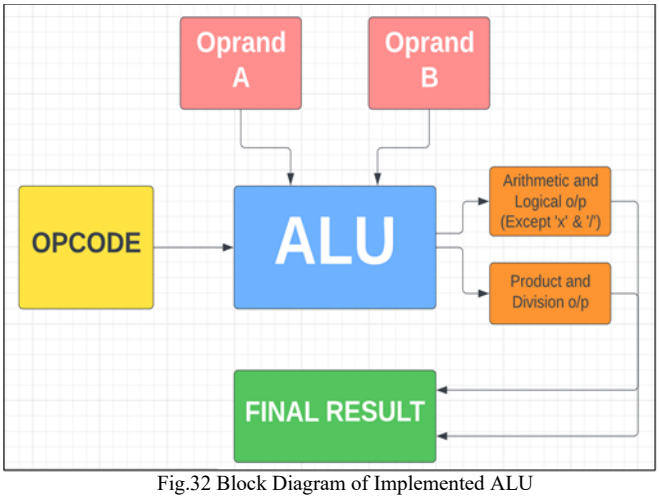


Fig.32 Block Diagram of Implemented ALU

The designed ALU has 3 inputs, namely, 2 operands and 1 opcode. The input operands are 32 bit each. The opcode is designed such that it performs 32 different operations. These operations include 4 arithmetic operations i.e., addition, subtraction, multiplication and division. The rest are logical operations with include AND, OR, etc. basic gates, shifting operations, and rotating bits operation. The output has 2 separate terminals, all arithmetic and logical operations except multiplication and division are received at one node, while the remaining are received at other.

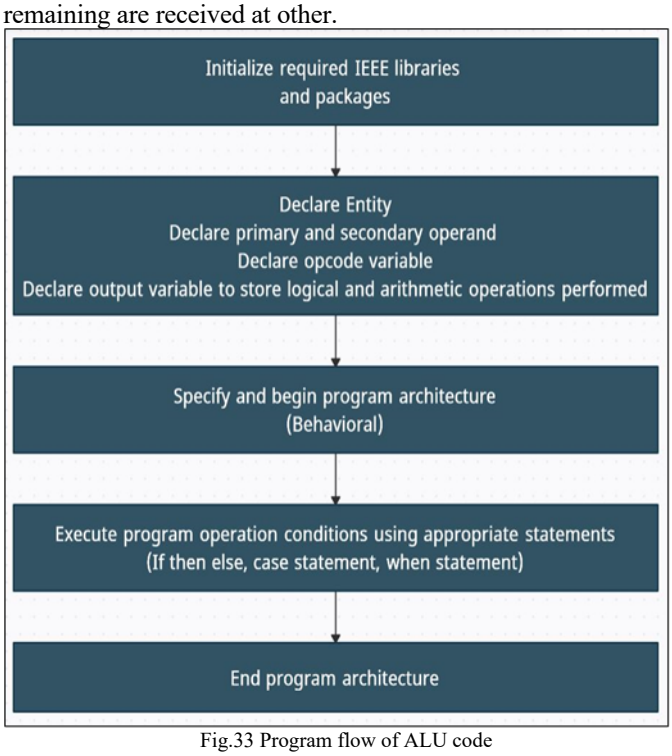


Fig.33 Program flow of ALU code

The basic program flow of ALU is as shown in Fig 20. Firstly, all required IEEE libraries such as 'std logic 1164', 'std logic unsigned' and 'numeric std' are initialized. After initialization, entity named ALU is declared, variables 'A' and 'B' are declared as primary and secondary operands. And 'ALU_Opcode' is declared as the opcode variable. Variables 'ALU_Out' and 'ALU_PQ' are declared as output variables. The program output for every input opcode is specified in the architecture using 'When" statement in VHDL. All the parenthesis are closed and the program architecture is ended. The opcode table of an ALU shows the user\what operations the ALU is capable of performing. It also facilitates the programmer to reprogram, rearrange all the functionalities according to the user specific requirements.

TABLE 1 ALU OPCODE TABLE

Sr. No	*Opcode*	*Operation*
1	00000	Add A with B
2	00001	Subtract B from A
3	00010	Multiply A with B
4	00011	Divide A with B
5	00100	Logical AND between A and B
6	00101	Logical OR between A and B
7	00110	Logical NAND between A and B
8	00111	Logical NOR between A and B
9	01000	Logical XOR between A and B
10	01001	Logical XNOR between A and B
11	01010	Logical complement of A
12	01011	Logical complement of B
13	01100	Shift left logical A by 1 bit position
14	01101	Shift left logical A by 4 bit position
15	01110	Shift right logical A by 2 bit position
16	01111	Shift right logical A by 3 bit position
17	10000	Shift left arithmetic A by 1 bit position
18	10001	Shift right arithmetic A by 4 bit position
19	10010	Rotate left A by 1 bit position
20	10011	Rotate right A by 2 bit position
21	10100	Shift left logical B by 1 bit position
22	10101	Shift left logical B by 4 bit position
23	10110	Shift right logical B by 1 bit position
24	10111	Shift right logical B by 4 bit position
25	11000	Shift left arithmetic B by 1 bit position
26	11001	Shift right arithmetic B by 4 bit position
27	11010	Rotate left B by 1 bit position
28	11011	Rotate right B by 2 bit position
29	11100	Rotate left A by 1 bit position
30	11101	Rotate right A by 2 bit position
31	11110	Rotate left B by 4 bit position
32	11111	Rotate right A by 4 bit position

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The block diagram, program flowchart and opcode table of ALU being designed and verified the final VHDL code is made.

```
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;
use IEEE.STD_LOGIC_UNSIGNED.ALL;
use ieee.NUMERIC_STD.all;

entity ALU is

    Port (
    A, B     : in  STD_LOGIC_VECTOR(31 downto 0);  -- 2 inputs 16-bit
    ALU_opcode  : in  STD_LOGIC_VECTOR(4 downto 0);  -- 1 input 5-bit for selecting function
    ALU_Out   : out  STD_LOGIC_VECTOR(31 downto 0); -- 1 output 16-bit
    ALU_PQ   : out  STD_LOGIC_VECTOR(63 downto 0) -- 1 output for product and division 64-bit
    );
end ALU;
architecture Behavioral of ALU is

signal ALU_Result : std_logic_vector (31 downto 0);
signal ALU_Prodiv : std_logic_vector (63 downto 0);
```

Fig.34 Entity and I/O declaration

```
begin
   process(A,B,ALU_opcode)
 begin
  case(ALU_opcode) is
  when "00000" => -- Addition
   ALU_Result <= A + B ;
   ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

  when "00001" => -- Subtraction
   ALU_Result <= A - B ;
   ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

  when "00010" => -- Multiplication
   ALU_Result <= "00000000000000000000000000000000" ;
   ALU_Prodiv <= std_logic_vector(to_signed((to_integer(signed(A)) * to_integer(signed(B))),64)) ;

  when "00011" => -- Division
   ALU_Result <= "00000000000000000000000000000000" ;
   ALU_Prodiv <= std_logic_vector(to_signed(to_integer(signed(A)) / to_integer(signed(B)),64)) ;

  when "00100" => -- Logical AND
   ALU_Result <= A and B;
   ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";
```

```
when "00101" => -- Logical OR
 ALU_Result <= A or B;
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "00110" => --  Logical NAND
 ALU_Result <= A nand B;
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "00111" => -- Logical NOR
 ALU_Result <= A nor B;
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "01000" => -- Logical EX-OR
 ALU_Result <= A xor B;
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "01001" => -- Logical EX-NOR
 ALU_Result <= A xnor B;
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "01010" => -- Logical NOT
 ALU_Result <= not A;
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";
```

```
when "01011" => -- Logical NOT
 ALU_Result <= not B;
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "01100" => -- Logical Shift Left A by 1
 ALU_Result <= to_stdlogicvector(to_bitvector(A) sll 1);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "01101" => -- Logical Shift Left A by 4
 ALU_Result <= to_stdlogicvector(to_bitvector(A) sll 4);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "01110" => -- Logical Shift Right A by 2
 ALU_Result <= to_stdlogicvector(to_bitvector(A) srl 2);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "01111" => -- Logical Shift Right A by 3
 ALU_Result <= to_stdlogicvector(to_bitvector(A) srl 3);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "10000" => -- Logical Shift Left Arithmetic of A by 1
 ALU_Result <= to_stdlogicvector(to_bitvector(A) sla 1);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";
```

Fig 35.1 Opcode Assignment

```
when "10001" => -- Logical Shift Right Arithmetic of A by 4
 ALU_Result <= to_stdlogicvector(to_bitvector(A) sra 4);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "10010" => -- Rotate Shift Left A by 1
 ALU_Result <= to_stdlogicvector(to_bitvector(A) rol 1);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "10011" => -- Rotate Shift Right A by 2
 ALU_Result <= to_stdlogicvector(to_bitvector(A) ror 2);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "10100" => -- Logical Shift Left B by 1
 ALU_Result <= to_stdlogicvector(to_bitvector(B) sll 1);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "10101" => -- Logical Shift Left B by 4
 ALU_Result <= to_stdlogicvector(to_bitvector(B) sll 4);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "10110" => -- Logical Shift Right B by 1
 ALU_Result <= to_stdlogicvector(to_bitvector(B) srl 2);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";
```

```
when "10111" => -- Logical Shift Right B by 4
 ALU_Result <= to_stdlogicvector(to_bitvector(B) srl 3);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "11000" => -- Logical Shift Left Arithmetic of B by 1
 ALU_Result <= to_stdlogicvector(to_bitvector(B) sla 1);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "11001" => -- Logical Shift Right Arithmetic of B by 4
 ALU_Result <= to_stdlogicvector(to_bitvector(B) sra 4);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "11010" => -- Rotate Shift Left B by 1
 ALU_Result <= to_stdlogicvector(to_bitvector(B) rol 1);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "11011" => -- Rotate Shift Right B by 2
 ALU_Result <= to_stdlogicvector(to_bitvector(B) ror 2);
 ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

when "11100" => -- Equal comparison
  ALU_Result <= "00000000000000000000000000000000" ;
  ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";
```

```
  when "11101" => -- Greater comparison
    ALU_Result <= "00000000000000000000000000000000" ;
    ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

  when "11110" => -- Lesser comparison
    ALU_Result <= "00000000000000000000000000000000" ;
    ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

  when "11111" => -- Lesser comparison
    ALU_Result <= "00000000000000000000000000000000" ;
    ALU_Prodiv <= "00000000000000000000000000000000000000000000000000000000000000000";

  when others => ALU_Result <= "00000000000000000000000000000000" ;
  end case;
 end process;

 ALU_Out <= ALU_Result; -- ALU out
 ALU_PQ <= ALU_Prodiv; -- ALU product / quotient out
end Behavioral;
```

Fig.35.2 Opcode Assignment ad program termination

To test the designed algorithm, a VHDL testbench is required. The testbench provides stimulus to the designed VHDL program and outputs timing diagrams. These timing diagrams are then verified with the original truth tables.

```
LIBRARY ieee;
USE ieee.std_logic_1164.ALL;
use IEEE.std_logic_unsigned.all;

--USE ieee.numeric_std.ALL;

ENTITY tb_ALU IS
END tb_ALU;

ARCHITECTURE behavior OF tb_ALU IS

    -- Component Declaration for the Unit Under Test (UUT)
    constant ain : std_logic_vector := "00000000000010100000000000001010";
    constant bin : std_logic_vector := "11111111000000011111111100000000";

    COMPONENT ALU
    PORT(
         A : IN  std_logic_vector(31 downto 0);
         B : IN  std_logic_vector(31 downto 0);
         ALU_opcode : IN  std_logic_vector(4 downto 0);
         ALU_Out : OUT  std_logic_vector(31 downto 0);
         ALU_PQ : OUT  std_logic_vector(63 downto 0)
        );
    END COMPONENT;
```

Fig.36 Library and component declaration of Test Bench

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```
    constant TIME_DELTA : time := 30ns;

        --Inputs
    signal A : std_logic_vector(31 downto 0) := (others => '0');
    signal B : std_logic_vector(31 downto 0) := (others => '0');
    signal ALU_opcode : std_logic_vector(4 downto 0) := (others => '0');

       --Outputs
    signal ALU_Out : std_logic_vector(31 downto 0);
    signal ALU_PQ : std_logic_vector(63 downto 0);

BEGIN

 -- Instantiate the Unit Under Test (UUT)
   uut: ALU PORT MAP (
          A => A,
          B => B,
          ALU_opcode => ALU_opcode,
          ALU_Out => ALU_Out,
          ALU_PQ => ALU_PQ
        );
```

```
    -- Stimulus process
    simulation: process
    begin
     a <= ain;
     b <= bin;
     ALU_opcode <="00000";
     wait for TIME_DELTA;

     a <= ain;
     b <= bin;
     ALU_opcode <="00001";
     wait for TIME_DELTA;

     a <= ain;
     b <= bin;
     ALU_opcode <="00010";
     wait for TIME_DELTA;

     a <= ain;
     b <=bin;
     ALU_opcode <="00011";
     wait for TIME_DELTA;
```

Fig.37 Test Bench Stimulus

Similar statements are repeated for opcode 00100 till 11111.

```
     a <=ain;
     b <=bin;
     ALU_opcode <="11111";

     wait;
     end process simulation;
end behavior;
```

Fig.38 Test Bench Stimulus

The designed VHDL core source code and simulation test bench code were run in Vivado and the output timing diagrams were verified.

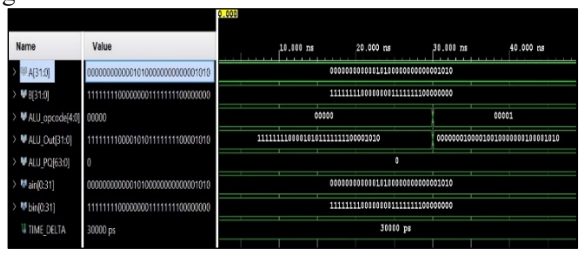


Fig.39 Timing Diagram 1

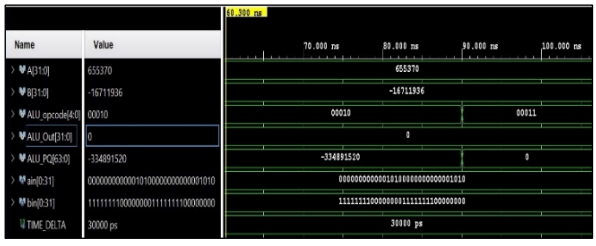


Fig.40 Timing Diagram 2

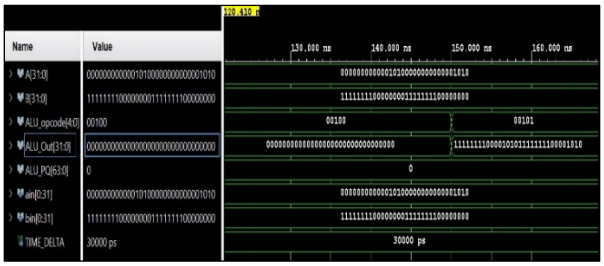


Fig.41 Timing Diagram 3

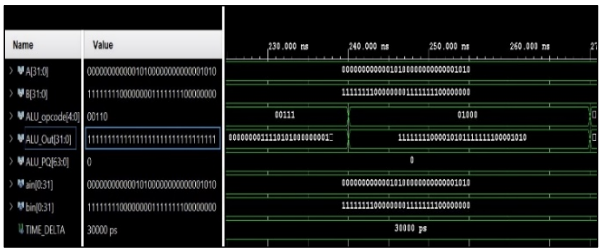


Fig.42 Timing Diagram 4

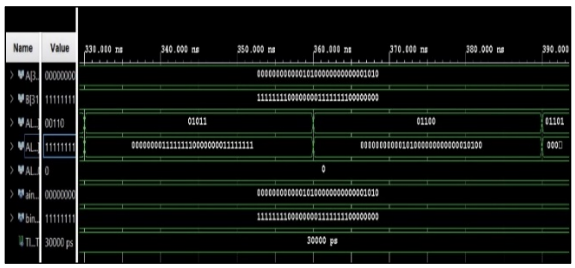


Fig.43 Timing Diagram 5

Timing Diagrams 1, 2, 3, 4 and 5 demonstrate efficient functioning of ADD-SUB, MUL-DIV, AND-OR, NAND-NOR, and shifting operations on 32-bit data stream effectively.

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- RTL Schematic of Arithmetic Logic Unit

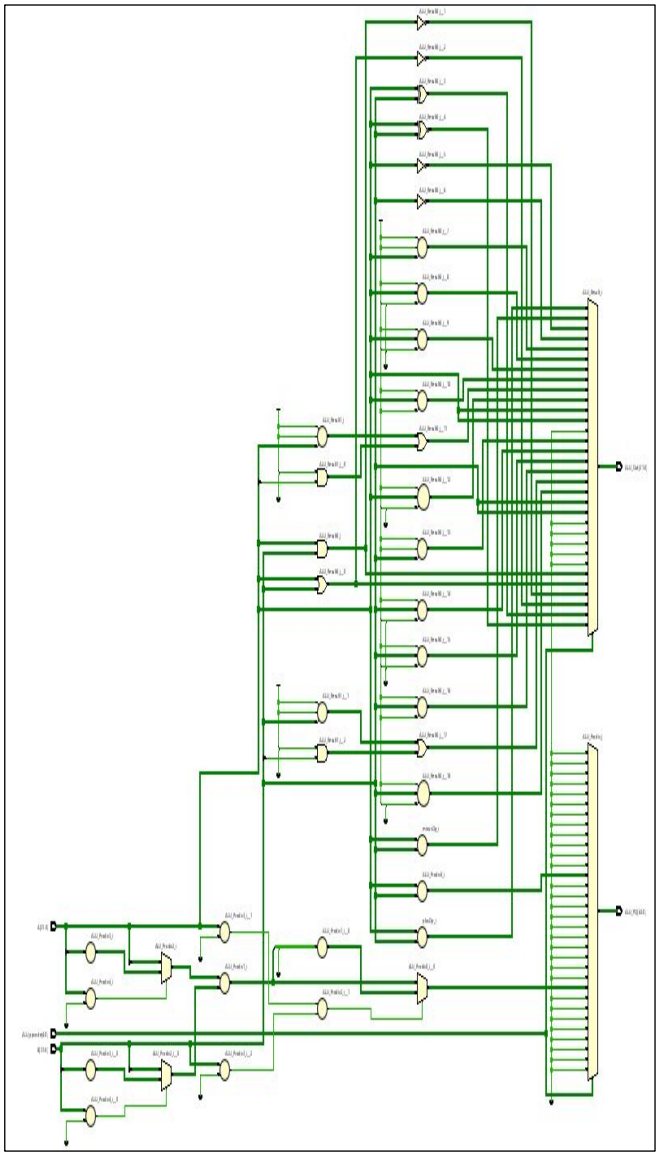


Fig.44 RTL Schematic of Arithmetic Logic Unit

- Post Synthesis Schematic of Arithmetic Logic Unit

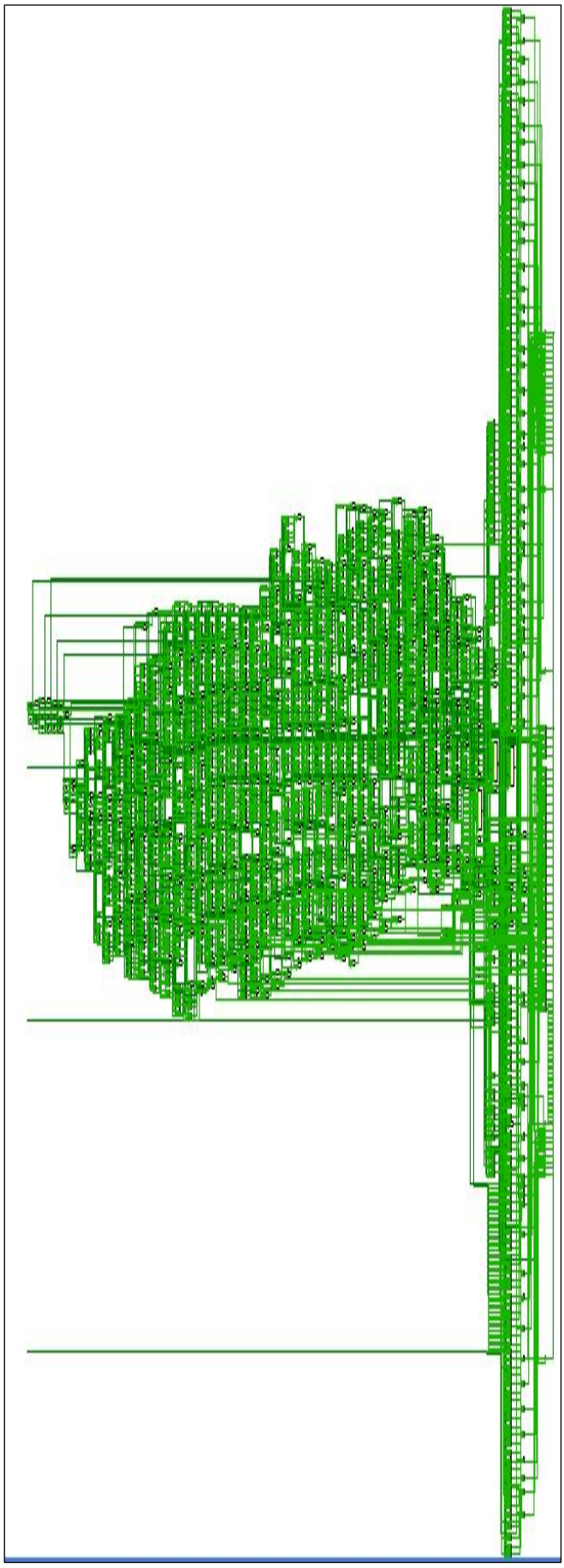


Fig.45 Post Synthesis Schematic of ALU

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VI. CONCLUSIONS

In this project, we designed and implemented a 32-bit Arithmetic Logic Unit (ALU) using Verilog Hardware Description Language (HDL) in Xilinx Vivado. The ALU performs arithmetic operations such as addition, subtraction, multiplication, division, and logical operations such as AND, OR, NOT, and XOR. We started by understanding the requirements and specifications of the ALU and then created the design using Verilog HDL. We simulated the design using ModelSim simulator and verified its functionality. We then synthesized the design using Vivado, and implemented it on the Xilinx FPGA board. After testing, the ALU showed correct results for all the implemented operations. Overall, this project demonstrated the process of designing and implementing a complex logic circuit using Verilog HDL and Vivado. It also provided an opportunity to explore the capabilities of FPGA boards and the power of hardware description languages in digital circuit design.

VII. FUTURE IMPROVEMENTS

There are several improvements that can be made to the existing 32-bit Arithmetic Logic Unit (ALU) design using Verilog Hardware Description Language in Xilinx Vivado. Some of these improvements include:

1. Optimizing the design for speed: The current ALU design may have some areas where the combinatorial logic can be optimized to reduce delay and improve performance. This can be done by analyzing the timing reports and using Xilinx Vivado's optimization tools to identify and eliminate timing violations.
2. Implementing pipelining: Pipelining the ALU can improve its throughput by breaking the processing of an instruction into several stages. This can help to reduce the overall execution time of the ALU and improve its performance.
3. Adding more functions: The existing ALU design may have limited functionality in terms of the operations it can perform. Adding more functions such as bitwise logic, shift, rotate, and conditional operations can make it more versatile and useful for a wider range of applications.
4. Implementing parallelism: Another way to improve the performance of the ALU is to implement parallelism. This can be done by adding more processing units or replicating the existing units to work in parallel. Parallelism can increase the throughput of the ALU and enable it to handle more complex computations.
5. Adding support for Double Precision Arithmetic: Currently, the ALU design only supports single precision arithmetic operations. Adding support for double-precision arithmetic can make the ALU more powerful and suitable for applications that require high precision computations.
6. Adding Support for Floating-Point Arithmetic: If the application requires floating-point arithmetic operations, the ALU design can be modified to support them. This can be done by adding a floating-point unit (FPU) to the existing design or implementing floating-point arithmetic in the existing ALU design.
7. Increasing Bit Width: As the existing ALU design is 32-bit, Increasing Bit Width of operands and output can enable the ALU to work on more significant numbers.

Overall, these improvements can make the 32-bit ALU design more powerful, efficient, and versatile, making it suitable for a wide range of applications.

VIII. ACKNOWLEDGEMENT

I would sincerely thank my guide Prof. (Dr.) Poonam Kadam and Head of Department Prof. (Dr.) Amit A Deshmukh for their valuable time guidance and efforts for this work done by us. They have been our guiding lamp and comprehensive direction at each and every step, which supported us at every level. We would like to express our gratitude towards them.

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Finger Track: A Real-Time Fingerprint Attendance Monitoring System

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***Abstract*—In all the educational institutions, taking attendance of all scholars daily has come an important factor. A typical approach is used to track students' daily attendance. The lecturers often take attendance by hand using an attendance register book and method. This data is also completely filled on the garçon on daily or yearly base to find the attendance report of each pupil. It wastes the time from the lecture period and it's veritably time consuming process. And in this process, it's frequently seen that scholars cheat and do attendance of other scholars also. To address this, we suggested and implemented an IoT-based student attendance system for the smart council lot. The goal of this project is to create a biometric attendance system that will provide academic advisors and speakers tools for regulating student attendance. So, to fete the attendance of scholars, we created a mobile gadget with a fingerprint feature point scanner. We'll capture attendance of scholars of the class with the device and also, it'll be transferred to the remote garçon using Wi - Fi. We have also enforced the browser operation so that the scholars and the faculty can view the attendance report. This approach will allow the instructor to lecture for less time and it'll also ameliorate the delicacy of the attendance recording due to biometric features.**

Keywords--IoT, Biometric, Attendance.

I. INTRODUCTION

A very crucial factor is how many students show up for class. Several educational institutions still manually record students' attendance in class using an attendance register. By calling the class's roll number at the conclusion of class or the beginning of lecture, preceptors record students' attendance as "P" or "A" in the register. This procedure takes a lot of time, and students may fake their attendance on other people's attendance rolls. Everyone is aware that every living thing has distinct biometric characteristics, such as point patterns. While we do expand, our fritters' point pattern stays the same. So, comparable characteristics are employed to create a person's own identity and set them apart from others. These distinctive characteristics of a person are employed for recognition in many identification and verification activities, adding to the delicateness and trustworthiness of the process. One of the precise and safe technologies is the biometric authentication system. Biometrics is a useful tool in the world of technology for connecting human beings. By employing this concept, you may create a special system that uses fingerprints to identify students for attendance purposes. In this project, we'll use Arduino to create a point-based biometric attendance system. To create the requested design, we will simply combine a point detector with an Arduino, a TV display, and an RTC module. In this design, attendance data and records were collected and maintained using the Arduino and Point Module. Systems for recording attendance using biometrics are often employed in churches and seminaries. This concept is widely used in schools, councils, corporations, and other settings where time-based attendance tracking is necessary.

II. OBJECTIVE

In the World of Technology, Attendance is one of the important criteria that are rigorously covered, piecemeal from giving detailed attention to a pupil's academic and co-curricular conditioning. The major reason for developing this design is to overcome the colorful downsides which are present in the current homemade system of marking the attendance. therefore, there exists a need for developing a better volition similar as the "point grounded attendance system " which eliminates all the downsides of the homemade system.

The following are the objectives of the suggested work:

- To create the database schema for recording the credentials of students, teachers, class topics, and attendance data for individual subject days.
- To register student fingerprints.
- To create a mobile attendance system that can move around the classroom.
- Send the fingerprints of students and the information about the ones who are currently enrolled to the remote attendance boy for processing.
- To provide a dashboard for staff and students to see attendance reports on the front end of the windows.

III. METHODOLOGY

1. Speech Phase of Strategic Planning: Website creators must analyse the needs of a website at this phase, claims the research of Web- Grounded Learning System Development Situation- Grounded Learning Approach for Visual Design. Inventors must do research into the selection of website development items, assignment content, and target audience.
2. Phase of Recipient Authentication: Repliers will be connected before creating a system that is web-based. All Kuala Terengganu Polytechnic speakers are the major druggies in this system. Also, the academic advisor assigned to each student is a member of the system. The students are beginning to be druggies who can get around this system.

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3. Designing Phase: This stage defines the general perspective on the look, structure, media kinds, and technology used.
4. Networking Design: At this stage, a network design is drawn to ensure that the system can link to the Kuala Terengganu Polytechnic's Original Area Network and be directly connected to the internet for remote access.

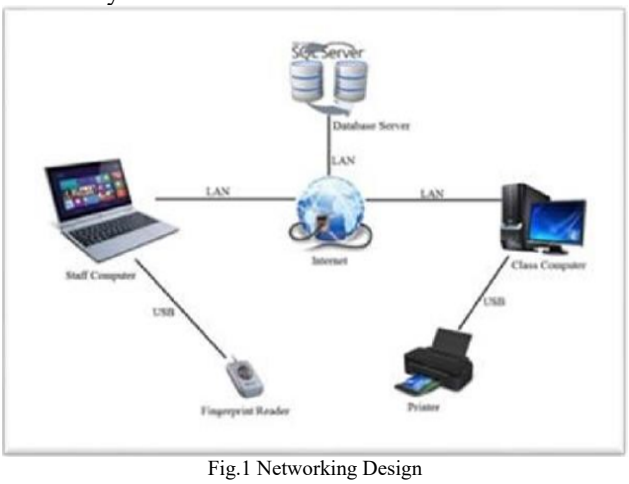


Fig.1 Networking Design

IV. INTERFACE MODEL

At this stage, the logical interface is created to combine all of the database tables and create a system that can show the requested information. Every information is entered into a database that will be accessible when the report is released under stoner circumstances.

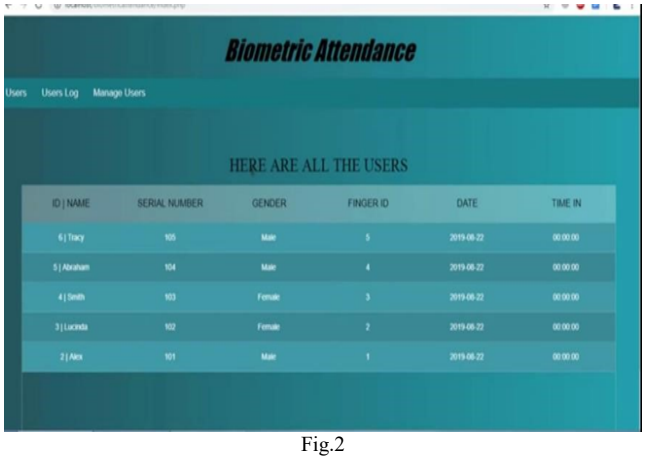


Fig.2

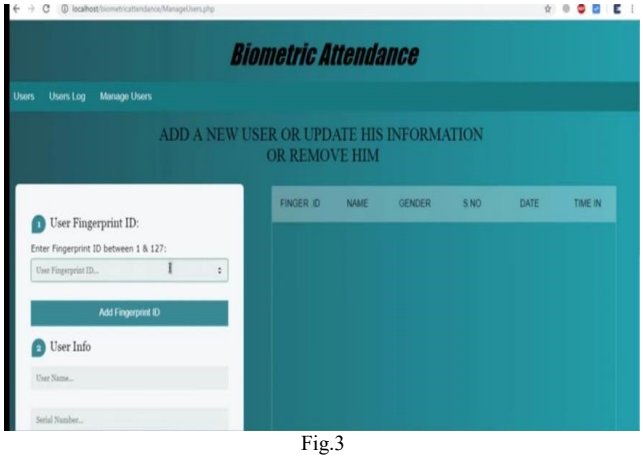


Fig.3

V. FLOWCHART

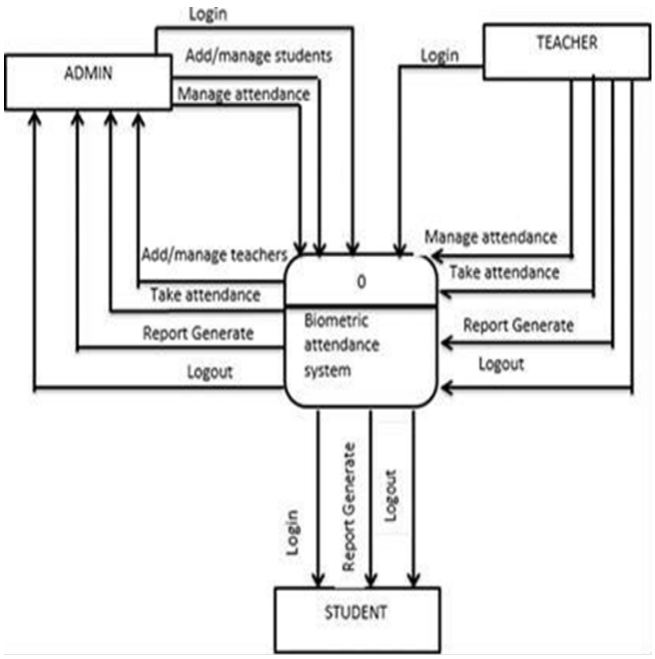


Fig.4 Content Diagram Interface

VI. CIRCUIT DIAGRAM

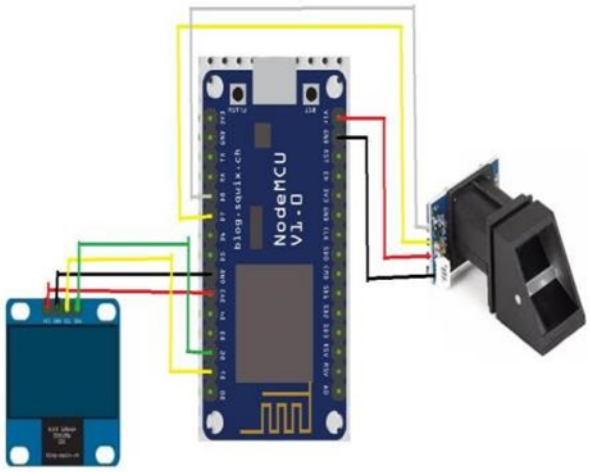


Fig.5

The desired findings were obtained after creating the experimental model in accordance with the circuit illustration. The detector detects the information and saves it in the pall each time a cutlet is placed on it. When it's time to inspect the point, someone puts the cutlet on the detector. The detector searches and compares the data with fingerprints that have been saved after reading the data. Date and time, however, only show the username if either of them match. Furthermore states that the point doesn't match if not. That is how the whole system works.

VII. FUTURE SCOPE

If a student routinely misses a few days of school, his parents will also get a message explaining the situation using gsm technology. The system might be changed to a web-based system, allowing reports to be created from any location. If a staff member fails to show up or arrives late, the association

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cannot accept his false attendance. Maintaining a felonious attendance and record in prison, as well as using it for private and public duties, may be done in this way. A biometric attendance system powered by an Arduino Uno is unquestionably helpful for a variety of tasks and services. It's simple, economical, and really effective. As a result, this technology's unborn compass is widely used and comparatively crucial in both home and artificial operations.

VIII. RESULT AND CONCLUSIONS

The procedure is made simpler and more reliable thanks to the Biometric Attendance System's ability to save each student's biometric information. The biometric attendance system will make the system more secure and delicate. The IOT grounded smart attendance system point scanner fixes the issue with the classroom's primary attendance system. We created the mobile attendance system to go around the classroom and take attendance. Also, we have mandated frontal end windows operating as the attendance system dashboard from which teachers may monitor and record students' attendance. So, using the enforced system will save time over manually recording attendance on garçon and taking attendance in class. The operating system has undergone development that is swiftly spreading across all fields, and is no longer a purely new commodity. It is inevitable that computerised operating systems will be employed in all fields since they are designed to facilitate and improve the handling of information and data. The operating system not only creates new venues and gests for researchers and speakers, but it also implicitly encourages a revolution in the usage of databases by guaranteeing the accuracy and error-free nature of the data obtained. It takes a lot of time, effort, and sensitivity to monitor and sustain student attendance in primers. The IoT-based biometric attendance system has biometric identification features that allow it to automate the whole process. A number of organisations might greatly benefit from an attendance system that combines three important components, including the Internet of Things (IoT), cloud computing, and virtualization. These elements show that it is really safe and secure, as they suggest. This technique is suitable for users because of its simplicity.

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Automatic Solar Panel

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***Abstract*—A solar panel or solar collector is automatically moved to follow the path of the sun throughout the day by a device known as an automatic solar tracker. The solar panel's energy output is increased by this system since it collects more sunlight throughout the day. A microcontroller, sensors, motors, and a power source are all components of the solar tracker system. In order to move the solar panel, the microcontroller collects data from sensors regarding the sun's location and transmits commands to the motors. The sensors, which determine the sun's position in relation to the solar panel using GPS or light sensors, are also options. To follow the path of the sun, the motors move the solar panel along the azimuth and elevation axes. Automated solar trackers have a number of advantages, such as higher energy output, cheaper installation, and more dependable systems. A smaller system can provide the same amount of energy as a bigger stationary system due to the solar panel's enhanced energy output. Because the required solar panel size is smaller and the system may be mounted on a single pole rather than several poles, the installation cost is lower.**

Keywords*— *Solar, Renewable Energy, Sustainable, Arduino Uno, Light Sensors, Servo Motor, Sun position, Sun Movement, Efficiency.

I. INTRODUCTION

A device known as an automatic solar tracker moves a solar panel or solar collector automatically to follow the path of the sun throughout the day. By doing this, the system maximises the solar panel's energy output, improving the solar power system's performance and efficiency. A popular microcontroller board in the realm of automation and control systems is the Arduino Uno. It is a well-liked option for many applications, including automatic solar trackers, because it is an open-source hardware and software platform that is incredibly flexible and adaptable. A system called an automatic solar tracker utilising an Arduino Uno microcontroller board combines the capabilities of a solar tracker and a microcontroller board to provide a smart and effective solar power system. The Arduino Uno microcontroller board collects data from a variety of sensors, including light sensor, and uses this data to determine the sun's location in real-time. Based on this knowledge, the system uses motors to alter the solar panel's position along its two axes of azimuth and elevation in order to monitor the sun's motion. Many advantages of this system include increased energy output, lower installation costs, and enhanced system dependability. A cost-effective and sustainable option for energy generation is provided by the use of an open-source platform like Arduino Uno, which also makes it simple for people and organisations to design and personalise their solar tracker system.

II. OBJECTIVE

A device known as an autonomous solar tracker follows the path of the sun and modifies the location of solar panels or collectors to produce as much electricity as possible. An innovative and effective method of generating solar electricity is to employ an Arduino Uno microcontroller board in an autonomous solar tracker system. The Arduino Uno board gathers information from multiple sensors, including light and GPS sensors, to determine the sun's location in real-time. The solar panel is then moved using motors along azimuth and elevation axes to guarantee that it is always perpendicular to the sun's beams. Many advantages of this technology include greater energy output, enhanced system dependability, and cheaper installation. By ensuring that the solar panel receives the most sunshine possible throughout the day, the automated solar tracker maximises the utilisation of solar energy. The Arduino Uno board is an excellent option for people and organisations to create their own solar tracking systems since it offers versatility and customizability. Overall, an efficient and sustainable method for producing solar electricity that is affordable, dependable, and environmentally beneficial is the combination of an automated sun tracker with an Arduino Uno microcontroller board.

III. LITERATURE REVIEW

As per the present scenario, the vehicle utilization rate continues to increase. As a result, the number of accidents has grown. The majority of accidents are thought to be caused by careless driving. Car accidents are responsible for 1.24 million deaths per year. Drunk driving, tiredness, and poorly designed speed bumps are the root causes of these incidents in India. A viable n006F system exists that guards against these primary drivers. Our suggested framework presents an imaginative, practical, and logical solution to automobile accident prevention. This article provides a completely distraction-free and consistent atmosphere. [6] To detect driver tiredness, our proposed approach employs eye closure rate as an informative indicator. If the eye closure ratio is less than the where standard ratio, A chime warns the driver of the usual ratio. A Pi camera was utilised to photograph the driver's eyes for our frame, and a Raspberry-Pi was used to incorporate the complete frame. Lastly, an SMS reminder is sent to the owner's phone. According to police data, there were at least 218,253 accidents in Indonesia between 2007 and 2010. Human error is responsible for around 65% of all accidents. During the Hari Raya holiday, which lasted from August 23 to September 7, 2011, sleepy driving was the leading cause of accidents (1,018), followed by roadworthy cars (449), driving on the road (387), and speeding (387). (up 155). The sleepiness detection system is intended to lessen the

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likelihood of car accidents. The system takes a picture of the driver detects the face and eyes next. The findings of eye detection will be examined if the eyes are closed for 4 seconds. If the driver's eyes are closed for 4 seconds, the system detects drowsiness and sounds a warning. Experiments show that the average detection time is 954ms, and the ideal camera position is above the driver on the dashboard and in good light.

IV. CIRCUIT DIAGRAM

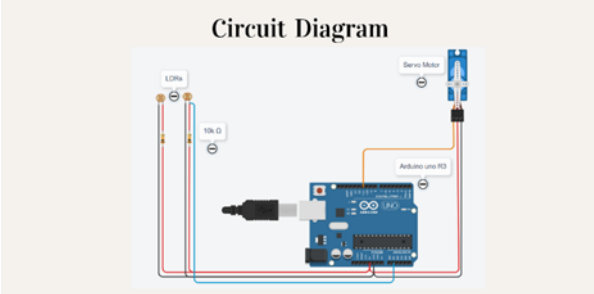


Fig.1 Circuit Diagram

As shown in this circuit diagram, we have used the proximity sensor i.e the LDR sensor as the input to the uno controller. As the input is received by the arduino, it gives the output accordingly. The output component i.e the servo motor driver react as per the input they receive from the arduino controller. And on the basis of input to the motor driver, the motor rotates accordingly.

V. FLOWCHART

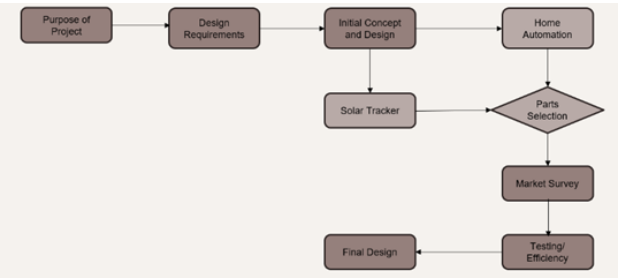


Fig.2 Flowchart

VI. METHODOLOGY

1. Specify the goals. Evaluate the solar tracker's performance parameters, such as tracking precision, power output, and cost-effectiveness.
2. Decide on the type of solar tracker: Single-axis and dual-axis trackers are two examples of the various types of solar trackers. Choose the approach that best fits your goals and price range.
3. Build the hardware: Design the frame, gears, and motors for the solar tracker's mechanical construction. The layout ought to work with the Arduino Uno.
4. Create the control system: Create a system that can track the path of the sun and manage the motors that move the solar panel. To operate the motors and read sensor readings, use the Arduino Uno board, sensors, and software.
5. Put the system into action: Put the hardware and software components together, test the system, and make sure it satisfies the performance criteria established in step 1.
6. Improve the setup: To boost performance, fine-tune the system by enhancing the software algorithms and modifying the hardware elements.
7. System evaluation: Assess the system's performance in various weather scenarios and contrast it with the performance indicators established in step 1.
8. Maintain the system: Regularly check the hardware parts, clean the solar panels, and update the software as required to maintain the solar tracker.

Overall, mechanical design, control system development, and software optimization are needed to create an autonomous solar tracker utilising an Arduino Uno. To guarantee that a system achieves its goals, it is crucial to identify specific objectives and put it through a rigorous testing process. An easy way to programme the control system and interface with the hardware components is by using an Arduino Uno board.

- Arduino Uno

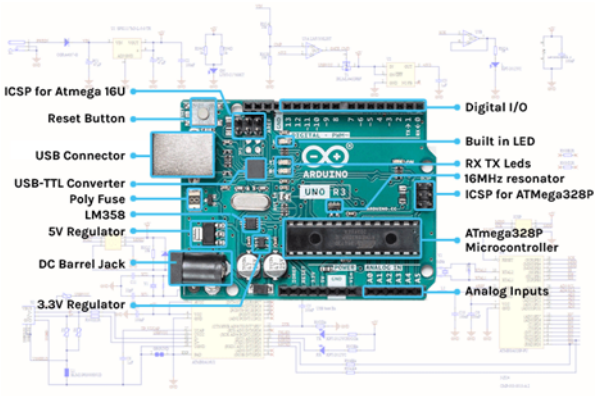


Fig.3 Arduino Uno

A microcontroller board called Arduino Uno is based on the ATmega328P microprocessor. One of the most well-liked boards in the Arduino line-up, it makes it simple for newcomers and hobbyists to begin working with electronics and programming. The board contains a 16 MHz quartz crystal, 6 analogue inputs, 14 digital input/output pins, a USB connector for power and programming, and a power jack for external power. The Arduino Integrated Development Environment (IDE), an open-source software tool for writing code for the board, may be used to programme the Arduino Uno.

- Servo Motor



Fig.4 Servo Motor

A prominent type of motor used in robotics and automation systems is the servo motor. It is a rotary actuator that employs feedback control to accurately regulate the output shaft's position, speed, and acceleration. A DC motor, some gears, a potentiometer for position feedback, and a control circuit that

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modifies the motor's position in response to the feedback signal make up a servo motor. They stand out for their strong torque, precision, and capacity to hold their place without drifting. Applications requiring precise positioning frequently employ servo motors, including robotic arms, drones, CNC machines, and camera gimbals. They may be operated in a variety of ways, such as via PWM signals, serial transmission, or analogue voltage signals, and come in a range of sizes, torque ratings, and control interfaces.

- Jumper Wire

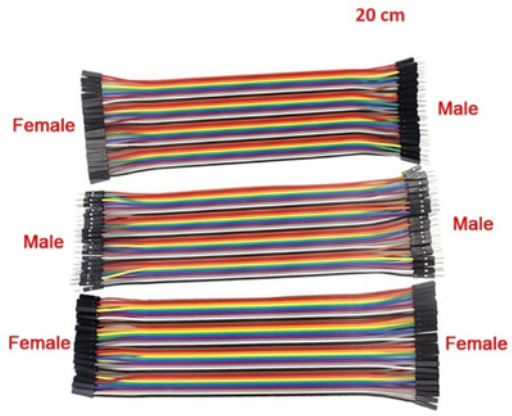


Fig.5 L293D Motor Driver

VII. DESCRIPTION OF THE PROJECT

An Arduino Uno-based automated solar tracker is a device that uses a solar panel to detect the sun's location and changes the panel's orientation to absorb as much solar energy as possible. The system makes use of a solar panel, a servo motor, an Arduino Uno microcontroller board, and a light sensor. The Arduino Uno determines the location of the sun by using data from the light sensor, which measures the brightness of the sun's light. The solar panel's position is then changed by the servo motor to optimise the quantity of solar energy it can absorb. The solar panel is continually adjusted throughout the day as a result of the system's constant observation of the sun's location.

You would need to attach the light sensor and servo motor to the Arduino Uno board in order to make an automated solar tracker. You would then need to develop a software in the Arduino IDE that reads sensor data and moves the servo motor to change the position of the solar panel. Based on the sensor data, the computer would need to do trigonometric calculations to establish the location of the sun, and then utilise that knowledge to drive the servo motor.An automated solar tracker powered by an Arduino Uno may be an efficient method to boost solar panel efficiency and optimise the amount of solar energy they can harvest, making it the perfect option for off-the-grid or isolated regions with restricted access to electricity.

Software

The software platform known as Arduino IDE (Integrated Development Environment) is used to programme and create applications for Arduino boards. Users may develop, build, and upload code to an Arduino board using the software's user-friendly platform. This is how it goes:

1. Coding: Writing code is the first step in utilising the Arduino IDE. The IDE allows users to make new sketches or access old ones. A streamlined version of C++ called Arduino is used to create the code.
2. Coding compilation: The "Verify" button in the IDE must be clicked by the user after writing the code. The code is then reviewed for syntax mistakes and transformed into commands that the Arduino board can comprehend.
3. Uploading code: When the code has been built, the user may click the "Upload" button in the IDE to upload it to the Arduino board. The board's microcontroller receives the code and executes it there.
4. Data may be sent to and received from the Arduino board using the Serial Monitor function of the IDE. Testing and debugging may be done with this capability.

The Arduino IDE, in general, makes it easier to programme and create applications for Arduino boards. It offers an intuitive user interface, simple-to-use tools, and a sizable user community that shares expertise and source code.

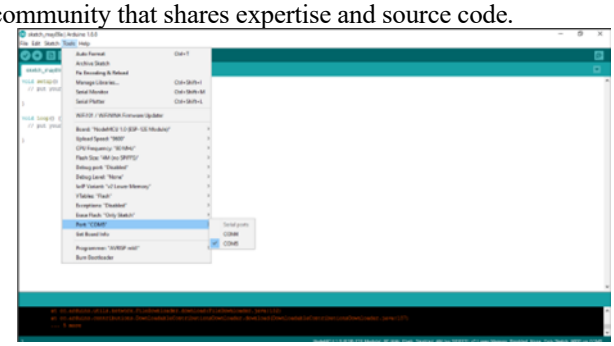


Fig.6 Setting up NodeMcu-Port connection

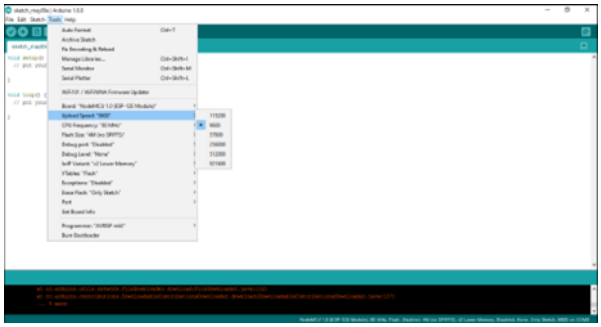


Fig.7 Setting up NodeMcu-Upload Speed

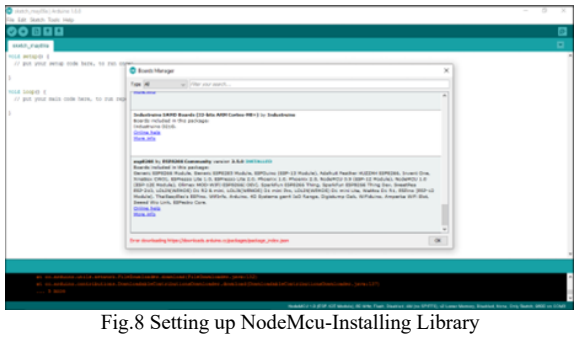


Fig.8 Setting up NodeMcu-Installing Library

Working of Hardware

An autonomous solar tracker utilising an Arduino Uno monitors the position of the sun throughout the day and moves a solar panel or array to get the most sunshine exposure. This is how it goes:

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The tracker measures the intensity of sunshine using a light sensor. The Arduino's analogue input is linked to the light sensor.

1. Arduino: The Arduino utilises the data it gathers from the light sensor to determine where the sun is in the sky. The motor is then instructed to move the solar panel by means of signals sent from the device.
2. Motor: A motor drives the solar panel, rotating it to follow the path of the sun. The Arduino manages the motor, sending commands to modify its position.
3. Power source: A solar panel or a battery powers the entire system.
4. Programming: Using data from the light sensor, the Arduino is programmed with code that determines the sun's location. The motor is then instructed to move the solar panel by means of signals sent from the device.

You may get the code for an automated solar tracker using an Arduino Uno online and modify it to suit your project's needs. The accuracy of the light sensor and the Arduino's code determine how accurate the tracker is.

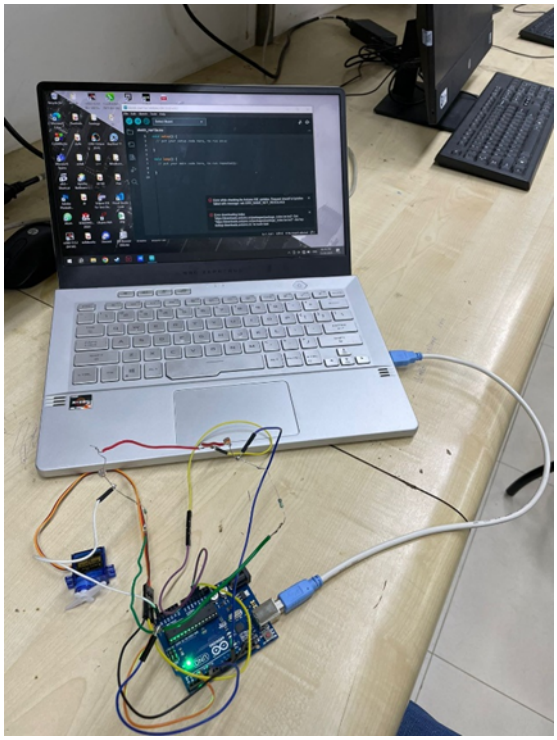


Fig.9 Hardware Circuit

VIII. CONCLUSIONS

Energy is the primary foundation upon which the entire society is founded in today's world of unbridled output. Given that energy cannot be generated or destroyed, it may be inferred from this statement that it can somehow be stored. Our project has tried to uncover the road of such objectivity in an effort to make this aim more concrete. Constant energy use inevitably leads to scarcity insofar as terrestrial resources are concerned, which is only normal. The fundamental and mother source of all energy is the sun, which is the tallest source and has been spiking over for aeons from the beginning of the cosmos and through which life has been conceived. The project has been dismantled after considering the most basic from the perspective of storing such energy. The technique by which such energies are created by the burning of various materials, which involves the release of a significant quantity of pollutants and makes the environment and atmosphere worse every day, is not from the Sun. Every day is a new challenge of hatching something new and unique, which makes an energy to be the ultimate source behind all the hard work exists. The speed and intelligence of the world's current behavioural visibility, where easy access of every sphere of life is in need of the acute comfortability, makes an energy to be the ultimatum source behind all the hard work exists. In that light, it would be more important to acknowledge how commercialization has spread its wings in the quest for money and power to the point where we somehow find ourselves in the pool of acute ignorance of the world's resource shortage, causing harm to the entire planet. The base of cultivation with which the hour clock is calling is global healing, and this project offers the opportunity to open the corridors of lowering pollution while storing energy drawn from the Sun as well as to accelerate the rate of progress.

IX. FUTURE SCOPE

The project known as the "Automatic Sun Tracking System" is the perfect example of how the futuristic problem may be put to rest. This system, which is a pioneer by virtue of its spirit, operates with the greatest possible efficiency, both in terms of its ability to pay for itself and in terms of accessibility. This gadget, amid the smoke of the darkness where pollution is engulfing all sectors of improvement as a result of producibility, work towards just progress and growth by removing the pollution generally in its very effectiveness.

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SmartShield: A Helmet that Protects You Inside and Out

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***Abstract*— Increase in population number of vehicles are being used. It has undoubtedly changed the number of accidents taking place all around. A careful analysis of the patterns of these accidents that have emerged so far make it clear that a lot of lives can be saved if they get the right equipment and hospitality on time. A helmet can help prevent head injuries by providing added protection to the head in case of an accident. The intention of the project is to build an end-to-end system that is within the BIS (Bureau of Indian Standards) approved ISI (Indian Standard Institute) ratings, but also alert the concerned authorities in case of any such incidents. The need for a robust, cost effective and easy to implement system became clear to us. Considering all these factors, the fundamental intention behind the creation of this project was to urge people to ride with the right gear and follow the guidelines even at public places.**

Keywords*— *facial recognition, emotion recognition, python, JavaScript, visual studio, CSS3, HTML, Tensor flow, OpenCV, Machine Learning, Autism.

I. INTRODUCTION

According to statistics, bike accidents are a significant cause of injuries and fatalities worldwide. In many cases, the failure to wear a helmet while riding a bike is a major contributing factor to the severity of the injury.According to studies, helmets can lower the risk of brain injury by up to 88% and the risk of head injury by up to 85%. This is because helmets are designed to absorb the impact of a collision and protect the head and brain from injury. However, despite the proven benefits of wearing a helmet, many bike riders still choose not to wear one. This can lead to serious injuries or even death in the event of an accident.

Helmets can also include health monitoring features that can detect a variety of health metrics, such as heart rate, blood pressure, and oxygen levels. These features can help detect potential health issues early, allowing for timely intervention and prevention.

II. OBJECTIVE

The objective of helmets is to enhance safety and reduce the risk of injury for individuals who engage in activities such as cycling, motorcycling, and extreme sports.Our Helmet is equipped with advanced technologies such as sensors, cameras, and communication systems that allow for real-time data collection and analysis to improve the safety of the wearer. Some specific objectives of helmet are:

Injury prevention: Helmet aims to prevent head injuries by providing advanced warning systems and features such as impact detection and emergency response. By detecting sudden impacts or changes in speed and motion, helmets can trigger an alert to notify emergency responders or even activate voice assistants to protect the rider.

Improved communication: The Helmet can facilitate communication between riders and other parties, such as emergency responders or fellow riders. Built-in communication systems allow for hands-free phone calls and messaging.

Enhanced situational awareness: Helmets can improve situational awareness by providing riders with real-time data such as speed, location, and weather conditions.

Data collection and analysis: Helmet collects and analyzes data on a rider's behavior, such as speed, acceleration, and braking patterns, which can be used to improve safety and develop new safety features. Along with rider health data such as temperature and oxygen level.

Overall, the objective of our helmet is to improve safety and reduce the risk of injury for individuals who engage in high-risk activities. Through advanced technologies and real-time data collection and analysis, helmets have the potential to save lives and prevent serious injuries.

III. LITERATURE REVIEW

A study published in the 1]Journal of Trauma and Acute Care Surgery evaluated the effectiveness of smart helmets equipped with sensors for detecting impacts. The study found that helmets with sensor technology provide better protection against head injuries compared to traditional helmets.

Research published in the 2]International Journal of Human-Computer Studies explored the use of smart helmets for communication among cyclists. The study found that communication systems embedded in smart helmets can enhance communication and improve safety among riders.

Several companies, including Bell Helmets and Sena, have developed smart helmets with advanced features such as Bluetooth connectivity, built-in cameras, and intercom systems. These products have received positive feedback from users and have been successful in the market.

IV. PROPOSED DESIGN

The smart helmet will be equipped with various sensors and features that will allow it to monitor the environment, communicate with other devices, and provide real-time data and feedback to the wearer.

Collision detection: The MPU6050 sensor can detect sudden changes in acceleration or rotation, which can indicate a collision or fall. When such an event is detected, the helmet can light up LED lights and emit a loud beep to alert the user

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and any nearby people. The helmet can also send an alert to the user's smartphone via WiFi.
Navigation: The GPS can provide location data, which can be used for navigation. The helmet can indicate the direction and distance to a desired location using audio cues. The user can enter the destination using the mobile app.
Vital sign monitoring: The heart rate sensor MAX30100 can measure the user's heart rate and send it to the mobile app. The app can display the heart rate in real-time and notify the user if the heart rate is outside of a safe range.`
Data logging: The helmet can log sensor data (such as acceleration, rotation, and heart rate) to a file or a database for later analysis. This can help identify patterns or trends in the user's activity and health.
FOMO: It is a new machine learning approach that enables object recognition on devices with severe limitations. Compared to MobileNet SSD or YOLOv5, it can count items, locate things in an image, and monitor numerous objects in real time while using up to 30 times less computing power and memory. Our design using this algorithm will precisely detect the oncoming traffic as well as the vehicles present in front of the rider. It will categorize the location of the same based on the portion of the frame in which they are present, this is determined by calculating their centroids. This will help in lane change and indications while taking a turn as well as avoid blind spots.
FIREBASE: It is a cloud-based mobile and web application development platform that provides a range of tools and services to help developers build and deploy high-quality applications quickly and easily.Firebase offers a range of features and tools that can be used for developing, testing, and deploying applications. Some of the key features of Firebase include:
Realtime Database: Firebase provides a cloud-hosted NoSQL database.
Authentication: Firebase provides a simple and secure authentication system.
Hosting: Firebase provides fast and reliable web hosting for static and dynamic content, with SSL support and automatic scaling.
Cloud Functions: Firebase provides serverless functions that can be triggered by events in your application.
Our device updates the acquired data to the realtime database where we analyze and fetch it for display on our mobile application as well as our website. The data entries are constantly monitored for discrepancies and sorted based on parameters such as location, traffic and utility.

V. IMPLEMENTATION

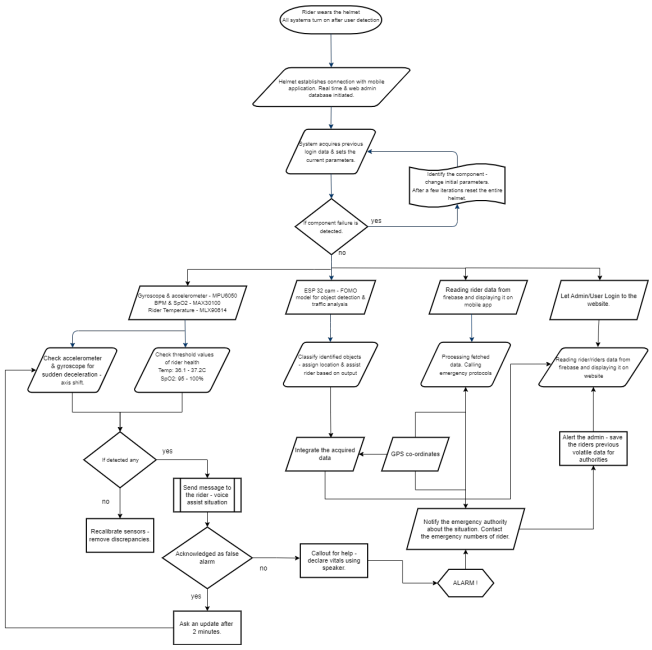


Fig.4 Accuracy and Loss in Training over 30 Epochs



a)MAX30100
b)MLX9061 c)MLX90614
Fig.5.1 Accuracy and Loss in Training over 30 Epochs

MAX30100 - Calibration and I2C BUS interfacing

The operating voltage range for the MAX30100 is between 1.8 and 3.3V. After initializing the LED current is changed to 6mA using the software registers. The I2C address of MAX30100 is 0x57 used to implement master slave I2C bus as we are using single channel I2C present on ESP32. The placement of this sensor is important as 16-bit sigma delta ADC, ambient light cancellation (ALC), and custom discrete a temporal filter makes up the pulse oximetry subsystem efficiently to be placed beside the rider's cranial region.

MPU6050 - Calibration and Placement

The data utilized in this accident detection network was collected from an MPU 6050 sensor, which features a 3-axis accelerometer and a 3-axis gyroscope. The accelerometer in the MPU 6050 has a range of 2g, 4g, 8g, and 16g, while the gyroscope has a range of 250, 500, 1000, and 2000. For this accelerometer is set at 16g scale and gyroscope is set at a scale of 250. The I2C operating frequency is set to 10Hz. Using the existing values roll, pitch and yawn are derived to provide better inputs. For detection we used BPNN to provide accurate output at any state or situation of the rider. Data is normalized and stored until the first few seconds to calibrate the MPU6050 every time the device is presented in a new environment. The preexisting factors taken from the EEPROM of ESP32 are used for the present calculations which become the input for BPNN. A large number of neurons make up each layer. Assume that 1], 2], and 3] represent the input, hidden, and output neurons, respectively. In general, node 1] is the number of inputs, which in this

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instance refers to the accelerometer and gyroscope axis, and node 3] is the predicted output pattern, which in this case refers to whether or not the object is falling. The overall BPNN work process is situated at node 2]. if 3] has an inadequate value. On the network, some train data is made available as input data. If there is a discrepancy between the output value calculated by the network and the value actually obtained, the weight in the network will be modified.

$$e_k(p) = y_{dk}(p) - y_k(p)$$

$$\delta_k(p) = y_k(p) \text{ x } [1 - y_k(p)] \text{ x } e_k(p)$$

Weights can be corrected by the formula:

$$\Delta w_{jk}(p) = n \text{ x } y_j(p) \text{ x } \delta_k(p)$$

Both input and output data must be converted in the range 0-1, in order to begin the motion recognition process utilizing backpropagation. Hence the values of the output are directly compared with threshold to provide a boolean for determining the state of the rider. MPU6050 is placed at the crown.

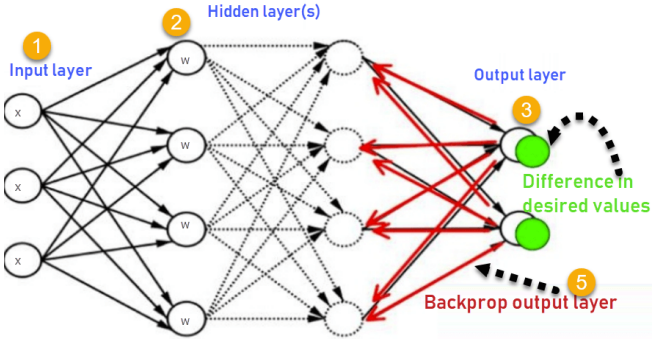


Fig.5.2 Neural network of back propagation algorithm

MLX90614 - Calibration and Output

To calibrate the MLX90614 sensor, we subtract the zero level temperature reading from the temperature measurement reading to obtain the calibrated temperature value. The placement is adjacent to the temporal lobe of the rider, since a temperature of 100.4 K or higher indicates emergency and it can be precisely detected at this location. For an I2C bus the address is 0x5A connected with MAX30100. The temperature values are read using the registers and can be calibrated as well as differentiated with respect to the ambient readings. In case of a spike an alert is sent along with a query for analysis of other vital signatures.

SmartShield App

Flutter offers a rich set of features and functionalities, including animations, graphics, and multimedia support, making it an ideal platform for creating engaging and visually appealing applications. Additionally, Flutter's architecture is designed to be flexible and scalable, allowing developers to build complex applications that can handle large amounts of data and traffic. Hence we used flutter to make an application which makes our app more scalable. Data which is being uploaded by esp32 using an on chip WiFi module on Firebase. Firebase is a NoSQL database which stores data in the form of collection, documents and field format. This data which is being uploaded by ESP32 is then fetched in the App to make the user know about his/her real time health conditions. Instructions can be given to the user on the basis of analyzed data of the user.

If an accident happens then with help of sensors present on helmet detection of crash takes place and emergency messages and calls are made.

Google Maps API:

Google Maps API is a web service that provides developers with a set of tools to integrate maps, geocoding, and other location-based functionalities into their applications.

The Google Maps API uses various technologies and data sources to provide accurate and up-to-date information, such as satellite imagery, street view images, and traffic data.

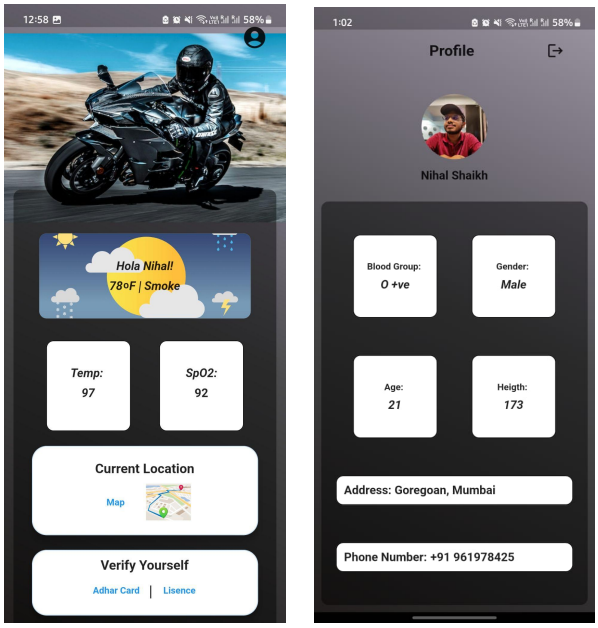
General overview of how the Google Maps API works:

Request: When a user interacts with an application that uses Google Maps API, the application sends a request to the API, specifying the type of data or functionality needed, such as a map or directions.

Authentication: The API checks if the request comes from an authorized application by verifying the API key. If the key is valid, the API processes the request.

Processing: The Google Maps API processes the request and retrieves the relevant data from its servers. For example, if the request is for a map, the API retrieves the map image and related data.

Response: The API sends the requested data back to the application in the form of a response, which the application can then use to display the map or other data to the user.



a) Home Page b)Profile Page

Fig 5.3 Mobile app interface

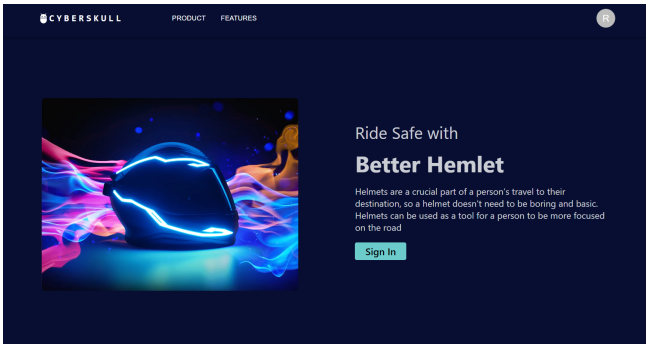
Cam Usecase

By using machine learning, we can expand upon the scope of improving driver assistance using helmet cam. It can be optimized to look for signals and convey a corresponding message to the rider. If the signal shows a “Red” sign and if the rider's speed is more than the ideal then the system would assist the rider. It can be extended by reading the road side signals and assisting the rider. In case of a crash or collision the overhead camera can also be used as a webcam, and the video stream of the last 2 mins will be saved to the cloud.It promotes building an ecosystem of emergency services, since the webcam footage can be directly used as a proof to claim insurance.

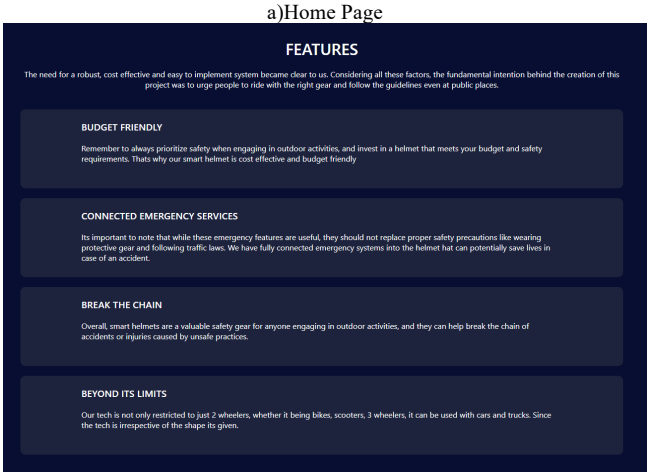
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Website:

Website is made using React.js for its front-end and uses firebase as its backend.Website displays all the data received through the users sensors in a structured way.Website has an option to login as an admin or as an individual user. If the logger is the user, upon correct authentication, the website displays its latest updated data like location, riders temperature, and Google Maps API is used to display the current location of the user.If the logger is an admin, then all the riders data is displayed on the webpage. Depending upon the riders receiving data, the website generates flags, if a particular person is at some kind of risk if their body temperature or oxygen is higher or lesser than usual, and whether emergency services has been called.Data analytics and data science can also be implemented into the website, having the data of accident prone areas, and knowing areas where people are continuously at risks, data can be analyzed and can be provided to the concerned authorities, so that improving steps could be taken on time.



a)Home Page



b)Features Page

Fig 5.4 Website interface

VI. SOCIAL IMPACT

Smart helmets with advanced safety features such as impact detection, fall detection, and emergency notification systems can help reduce the risk of head injuries and fatalities in accidents.

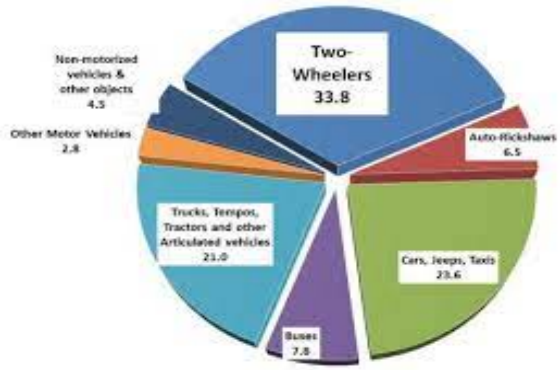


Fig 6.1 Distribution of Vehicles on Road

This can have a significant positive impact on society by improving road safety and reducing the burden on healthcare systems.Smart helmets can also have a positive impact on the environment by reducing the need for disposable helmets and promoting the use of sustainable materials and production methods.

VII. FUTURE SCOPE

Augmented reality: Smart helmets with augmented reality (AR) technology can provide riders with real-time information on their surroundings, including traffic, weather conditions, and points of interest. This can enhance the riding experience and improve safety.Artificial intelligence: Smart helmets with artificial intelligence (AI) can learn from the rider's behavior and adjust settings accordingly, providing a personalized experience. AI-powered helmets can also analyze data from sensors and cameras to detect patterns and provide insights for improving safety and performance.

ACKNOWLEDGMENT

Without Dr. Sanjay Deshmukh, this project and related technical paper would have not been possible. This work would not have achieved the heights it did without his significant participation, which included his effective coaching, comprehensive direction, and unwavering support at every level of the project. We offered knowledge and experience that substantially aided the study process and kept us engaged throughout.

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Crop Health Monitoring System

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***Abstract*—Agriculture is the fundamental source of national prosperity. Many conventional agricultural practices have become obsolete as a result of technological advancements in monitoring, supervision, management, and control systems. Their replacement with new technologies falls under the category of "advanced farming," which entails employing current methods to make the process easier, increase the efficiency compared to the previous yields, expand the production rate by advanced inspections and aiding farmers to overcome unnecessary losses. Plant disease and health automation in agriculture science is a major worry for many countries, as food demand is rapidly increasing due to population growth.**

Keywords— disease diagnosis, control system, python, advance farming, linear regression, pooling, google net architecture, epoch, training model, pickle-maxin..

I. INTRODUCTION

Food security is seriously threatened by crop diseases, (Strange and Scott, 2005), and other factors continue absence thereof). On a held-out test set, the trained addition to posing a threat to global food security, and publicly available image datasets. The potential to billion people has been provided by modern climate change, pollinator decline, and other threats. In deep learning. We train a deep convolutional neural detection is now achievable thanks to growing developments in computer vision made possible by generate enough food to suit the needs of more than 7 gigantic worldwide scale is presented by the method of healthy plant leaves taken under controlled settings (or identify them quickly. Smartphone-assisted disease model achieves an accuracy of 99.35%, proving the network to recognize 14 crop species and 26 diseases places throughout the world, it is still difficult to plant diseases can have catastrophic effects on Platform on Biodiversity Ecosystem and Services on Plenary of the Intergovernmental Science-Policy smallholder farmers whose livelihoods depend on smartphone adoption worldwide and recent smartphone-assisted crop disease diagnosis on a technology. The decline of pollinators (Report of the work of its fourth session, 2016), plant diseases threats are not new (Tai et al., 2014), and they include to pose a threat to food security. However, these training deep learning models on progressively larger using a public dataset of 54,306 photos of sick and viability of this method. Overall, a clear road for yet due to a lack of the essential infrastructure in many robust crops. More than 80% of agricultural production in the developing countries is produced by smallholder farmers (UNEP, 2013), and reports of yield losses of more than 50% due to pests and illnesses are frequent (Harvey et al., 2014). Furthermore, according to Sanchez and Swaminathan (2005), smallholder farming households account for 50% of all hungry people, making them particularly vulnerable to disruptions in the food supply caused by pathogens. Many initiatives have been created to stop crop loss from diseases. Integrated pest management (IPM) tactics have replaced traditional methods of applying insecticides widely over the past ten years (Ehler, 2006). Whatever the method, the first step in effective illness management is accurate disease identification when it first manifests. Historically, institutions like local plant clinics or agricultural extension agencies have assisted disease identification. More recently, these initiatives have also been helped by the availability of online resources for disease detection, taking advantage of the global increase in Internet usage. Even more recently, mobile phone-based tools have emerged, capitalising on the historically unprecedented global adoption of mobile phone technology (ITU, 2015). Because of their computer power, high-resolution displays, and comprehensive built-in accessory sets, such as powerful HD cameras, smartphones in particular offer very unique techniques to aid in the identification of diseases. By 2020, it is predicted that there will be between 5 and 6 billion smartphones worldwide. Mobile broadband coverage was available to 69% of the world's population by the end of 2015, while mobile broadband penetration reached 47% in 2015, a 12-fold increase since 2007. (ITU, 2015). If automated picture identification for disease diagnosis is technically possible, it may be made widely available thanks to factors such as high-definition cameras, high performance processors, and broad smartphone adoption. Here, we use 54,306 photos of 14 crop species with 26 illnesses (or healthy) that were made publicly available through the project PlantVillage (Hughes and Salathé, 2015) to show the technical viability of a deep learning technique. Figure 1 shows a sample of each crop-disease relationship. In recent years, object identification and computer vision in general have made significant strides. The PASCAL VOC Challenge (Everingham et al., 2010) and, more recently, the Large-Scale Visual Recognition Challenge (ILSVRC) based on the ImageNet dataset (Deng et al., 2009) have been extensively used as benchmarks for a variety of visualization-related issues in computer vision, including object classification. In 2012, a sizable, deep convolutional neural network classified photos into 1000 different categories with a top-5 error of 16.4%. (Krizhevsky et al., 2012). The error rate was reduced to 3.57% during the course of the next three years by a number of deep convolutional neural network advancements (Krizhevsky et al., 2012; Simonyan and Zisserman, 2014; Zeiler and Fergus, 2014; He et al., 2015; Szegedy et al., 2015). Large neural networks can take a long time to train,

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but once trained, the models can swiftly classify photos, making them suited for consumer applications on smartphones. In many different fields, deep neural networks have lately been successfully used as examples of end-to end learning. A mapping between an input such as a picture of a sick plant and an output such as a crop disease pair is provided by neural networks. The mathematical nodes in a neural network receive numerical inputs from the incoming edges and output numerical results as the outgoing edges. A sequence of stacked layers of nodes in deep neural networks simply map the input layer to the output layer. The difficult part of building a deep network is making sure that the network's structure, functions (nodes), and edge weights accurately map the input to the output. By adjusting the network parameters in such a way, deep neural networks are trained method that the mapping improves during the training procedure. This method is computationally complex and has in recent times been improved considerably by a number of both conceptual and practical advancements.We required a sizable, validated dataset of photos of damaged and healthy plants in order to create accurate image classifiers for plant disease diagnosis. Such a dataset did not exist, and even smaller datasets were not openly accessible, until quite recently. To solve this issue, our project has started gathering tens of thousands of photographs of both healthy and damaged crop plants and has made them openly and freely accessible. Here, we report on the classification of 26 illnesses in 14 crop species utilizing 54,306 photos with a convolutional neural network technique. By predicting the right crop-disease match out of 38 different classes, our models' performance is evaluated. The top model demonstrates the technical viability of our method with a mean F1 score of 0.9934 (overall accuracy of 99.35%). Our findings mark the beginning of a system for plant disease diagnosis supported by smartphones.

II. MOTIVATION

One of the most important challenges for enhancing agricultural food production is disease diagnostics. In India, husbandry employs relatively 60% of the population. It's the backbone of Indian frugality. Thus, it absolutely was important to boost agrarian affairs and effectiveness by icing the planter's safety, feasibility while husbandry and to pave the long run for Agriculture and Farming with a vision of Digital India in mind. Governments often want to understand where soil is degrading and inventory which crops are present (crop identification) in which areas. NGOs and hedge funds often want to predict future yields, the former to predict food scarcity, the latter to modify purchases in wheat, corn and other futures. Farmers want to know exactly which crops to spray with fertilizer or pesticide, thus reducing cost and impact to the environment. One of the most important challenges for enhancing agricultural food production is disease diagnostics. Data analysis is characterized by the training and validation of datasets. The structure of the production area is analysed using high resolution photographs, the type of plant is inventoried, seedling height parameters and the degree to which the soil is covered with leaves are determined, and the normalized difference vegetation index is calculated. The wireless technique of the plant health monitoring system presents a model based on the calculation of vegetation index values of healthy and unhealthy plants. The widespread use of Artificial Intelligence allied with climate change, population growth, shortage of agricultural workers, and food security concerns, propelled the agro field into seeking even more innovative approaches to increase their yields

III. PROPOSED DESIGN

Collection Description: We examine 54,306 pictures of plant leaves with a total of 38 different class designations. We attempt to forecast the crop-disease pair for each class label based solely on the image of the plant leaf. In all of the methods outlined in this research, we downscale the images to 256 256 pixels before performing the model optimization and making predictions on them. We employ three distinct iterations of the entire PlantVillage dataset in all of our trials. We run all the experiments on a version of the PlantVillage dataset where the leaves were segmented, thereby removing all the extra background information that might have the potential to introduce some inherent bias in the dataset due to the regularized process of data collection in case of the PlantVillage dataset. We start with the PlantVillage dataset as it is, in colour; then we experiment with a gray-scaled version of the PlantVillage dataset; and finally, we run all the experiments on a version of the PlantVillage dataset The segmentation process was automated using a script that was optimized for our specific dataset. We selected a method based on a set of masks created by analyzing the colour, brightness, and saturation elements of various image components in several colour spaces (Lab and HSB). We were able to readily correct colour casts, which were particularly prominent in several of the dataset's subsets, during one of the processing phases, eliminating yet another potential bias. This series of tests was created to determine whether the neural network genuinely picks up on the "notion" of plant illnesses, or if it is simply picking up on the biases built into the dataset. Figure 2 displays the several iterations of the same leaf for a set of leaves chosen at random.

Performance Measurement: We run all of our experiments across a variety of train test set splits, including 80-20 (80% of the entire dataset used for training, and 20% for testing), 60-40 (60% of the entire dataset used for training, and 40% for testing), and 50-50 (50% of the entire dataset used for training, and 20% for testing), to get a sense of how our approaches will perform on new, unseen data, as well as to keep track of whether any of our approaches are overfitting. 50 percent of the entire dataset was used for testing and 50 percent for training; 40-60 (40 percent of the entire dataset was used for training and 60 percent for testing); and 20-80 (20 percent of the entire dataset was used for training and 80 percent for testing). It should be noted that the PlantVillage dataset frequently contains numerous photographs of the same leaf (shot from various orientations), and we have the mappings for such scenarios for 41,112 images out of the total of 54,306 images. We ensure that every image of the same leaf is included in either the training set or the testing set for these test-train splits. Additionally, we compute the mean precision, mean recall, mean F1 score, and overall accuracy across the whole training period for each trial at regular intervals (at the end of every epoch). For the purpose of comparing the outcomes of all of the various experimental settings, we utilize the final mean F1 score.

Data Analysis: We will first collect the data and then clean it for further steps. By using basic functions of data types we will discard the information which is not required and make

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our data more structured for use. We will be importing libraries such as pandas, scikit-learn and pickle-maxin.

Linear regression: Linear Regression attempts to model the relationship between two variables by fitting a linear equation to observed data. The system is provided with the inputs and is tested for its working. The accuracy is checked. And therefore, the data that is used to train the model or test it, has to be appropriate.

Model deployment: Model Deployment is one of the last stages of any machine learning project. Here, we will design a user interface. This will take the input photo for each crop and match it with existing data in the database.

Training Mechanism: To refer to specific trials, use the Dataset Type: Train Test-Set-Distribution. For illustration, consider the experiment utilizing the transfer learning-trained Google Net architecture. We will use the notation for the train—test set distribution of 60–40 on the grayscale dataset. Google Net: Transfer Learning: GrayScale:60–40. Every one of these 60 experiments lasts for a total of 30 epochs, where an epoch is the number of training iterations during which the specific neural network has successfully completed a full pass of the whole training set. The decision to use 30 epochs was based on the empirical finding that, across all of these studies, learning always converged within this time frame (as is seen from the combined plots in Figure 3). We also attempted to standardize the hyper-parameters throughout all of the experiments, and we used the following hyper-parameters in all of the experiments to enable a fair comparison between the outcomes of all the experimental configurations: Stochastic Gradient Descent is a sort of solver.

Learner base rate: 0.005.

Step (decreases by a factor of 10 per 30/3 epochs) is the learning rate policy.

Motion: 0.9,

Decline in weight: 0.0005

Gamma: 0.1,

Batch sizes: 24 (for Google Net) and 100 (in case of Alex Net).

A quick, open-source deep learning framework called Caffe (Jia et al., 2014) was used for all the aforementioned tests.

The fundamental outcomes, such as overall accuracy, can also be reproduced using a regular instance of Caffe.

IV. IMPLEMENTATION

The Convolutional Neural Network (CNN) is a type of artificial neural network that is commonly used for image processing, segmentation, and classification tasks. Convolution involves sliding a filter over an image to extract important features from the input image, which is represented as a matrix of numerical values. These filters are applied at multiple stages to learn essential content or features. The CNN's hidden layer is made up of convolutional layers, pooling layers, fully connected layers, and normalization layers. The output of the hidden layers is fed into an activation function, which enables the network to learn complex and complicated forms of data and represent nonlinear mappings between inputs and outputs. To generate nonlinear mappings, a non-linear activation function such as ReLU is used in the hidden layers, and SoftMax is used in the output layers. Pooling is used to reduce the dimensionality of the input representation, with various types such as min, max, and average pooling. Fully connected layers indicate that the weights from the previous layer will act as input to all neurons in the next layer. The normalization layer is used to maintain the mean activation close to 0 by normalizing the activations of the previous layer.

V. RESULTS AND CONCLUSIONS

Various CNN algorithms were utilized in this project to anticipate a leaf's health. The model can make predictions using only a few parameters and has a 49 percent accuracy rate. However, research is being done to integrate subjective characteristics in the model, in order to improve the model's accuracy. The goal of this study is to use external parameters to understand a potato leaf's health condition.

ACKNOWLEDGEMENT

This project and technical paper were greatly supported by Professor Ranjushree Pal. Her expert coaching and comprehensive assistance were invaluable to us at every level of this project, and this paper would not have been possible without his contributions. We are grateful to our colleagues who contributed their knowledge and experience to the research and assisted us throughout the process.

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Design of Centre Slotted Square Microstrip Antenna For Circular Polarized Response

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***Abstract*—This paper presents a micro strip square patch antenna at 900 MHz with a rectangular slot at the center of the square patch. The proposed micro strip square patch antenna with central slot has been designed using an fr4 substrate having dielectric constant 4.33 and loss tangent 0.02, having an air gap of 1.6mm. To fulfill the circular polarization, a rectangular slot at the center of the square patch has been cut to design the antenna for TM10 fundamental mode and having a diagonal feed. To feed the antenna coaxial feed has been used. The proposed antenna offers approx-11 dB reflection loss, 2.23dB axial ratio and 25% antenna efficiency.**

Keywords— Circular-polarization, Square microstrip antenna, Rectangular-slot

I. INTRODUCTION

Because of the diverse advantages like low profile conformal design, microstrip antenna (MSA) finds greater utilization in the field of wireless communications. In these applications, antenna used must receive signals from all the possible directions as well as different orientations of the incident wave. Here the different orientation refers to the different polarization. The polarization of the antenna is an essential factor that determines the performance of the antenna. In the case of a square patch antenna with an FR4 substrate and a rectangular slot in the middle, circular polarization is preferred over elliptical polarization due to several reasons.

II. TYPE OF POLARIZATION

Firstly, circular polarization is more robust to polarization mismatch than elliptical polarization. In the case of an antenna with a rectangular slot in the middle, the polarization of the electromagnetic wave can become distorted due to the slot's geometry. Circular polarization is more tolerant to such mismatches because it is identical in both clockwise and counter clockwise directions, while elliptical polarization is not. Thus, circular polarization can provide better performance in the presence of polarization mismatch, making it a preferred choice for antennas with a rectangular slot. Secondly, circular polarization can reduce the effects of multipath fading. In wireless communication systems, multipath fading can occur when the transmitted signal arrives at the receiver through multiple paths, resulting in phase cancellation and amplitude attenuation. Circular polarization can reduce the effects of multipath fading because it has a uniform wavefront that does not change as the wave propagates. Finally, circular polarization is more efficient than elliptical polarization in terms of antenna design. Keeping all these design feature in consideration, this paper presents the design of centre slotted square MSA (SMSA) offering CP response. Initially the design of the SMSA is explored on thinner FR4 ($\sum_r = 4.3$, h = 0.16 cm. tan ™ = 0.02) and then on the rectangular slot in centre. In both these designs, parametric study for the changes in length of the slot dimension is conducted. The SMSA TM10 mode degenerates into two diagonally directed resonant modes when the slot length creates an uneven length along the patch diagonal axis. CP response is produced by an ideal separation between these resonant frequencies. In the designs with FR4 substrate, SMSAs yields impedance and axial ratio (AR) BW in the range of 4 – 5% and 0.7 – 1%, respectively. Using IE3D software, the configurations shown in the current article are first analysed before being experimentally verified. An SMA connector was used to activate all of the antennas. Inside the antenna facility, high gain Horn antennas and reference wideband were chosen for the radiation pattern, input impedance, and gain measurements. The three-antenna method is used to determine the antenna's gain.

III. SELECTION OF SUBSTRATE

We used a FR4 base with a loss tangent of 0.02 and a dielectric constant of 4.3 for our antenna design at a frequency of 900 MHz. After contrasting it with the other substrates on the market based on a number of different criteria, we decided to use this form of substrate for our design. FR4 substrate is a widely accessible, reasonably priced substrate substance that is an economical option for antenna fabrication. It has excellent dielectric properties that allow for effective energy transfer between the antenna and free space, such as a low loss tangent of 0.02 and a high permittivity.

Good Mechanical Strength: The FR4 substrate has good mechanical strength and stiffness, which prevents it from bending or deforming both during antenna manufacturing and operation. Because FR4 substrate is widely used in the electronic industry for a variety of applications, there is a wealth of information accessible about its characteristics, making it simpler to forecast and model the behaviour of the antenna. Overall, FR4 substrate is a desirable option for fabricating antennas, especially for uses that call for low-cost and low-to-medium performance due to its cheap cost, good dielectric properties, ease of fabrication, good mechanical strength, and widespread use.

IV. CENTRE SLOT RMSA FOR CP RESPONSE

Various techniques can be used to realize the CP response in MSA like, cutting slot in the patch, loading the patch with open circuit stub, using modified shape of the radiating patch

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in MSA, loading shorting post on the patch, using resonant slots in the patch and by employing the modified ground plane designs [1, 2, 4 – 15]. In the initial study, design is presented on FR4 substrate. The SMSA dimensions are selected so that its TM_{10} mode frequency is around 900 MHz. Thus, SMSA dimenision are $L_p = W_p = 7.9$cm. The modal current distributions and resonance frequency plots at the observed resonant peaks, displayed in Fig. 1(b – d) are obtained by carrying out the parametric study for the truncated corners of dimension 'd'. In the resonance curve plot for SMSA, as patch length and width are equal, resonant peak due to TM_{10} mode is observed for frequency of 900 MHz. With the coaxial feed at $x_f = 20$ cm and $y_f = 20$ cm from the patch center, the unequal diagonal lengths de-generates patch TM_{10} into diagonally directed resonant modes as given in Fig. 1(c, d). At the first peak surface currents show half wavelength variation along the $\angle = 135^0$, whereas at the second mode it shows half wavelength variation along $\angle = 45^0$. Due to these diagonal changes, these modes are referred to as TM_{10}^{135} and TM_{01}^{45}. This yields Circular Polarized response for less than 3 dB AR.

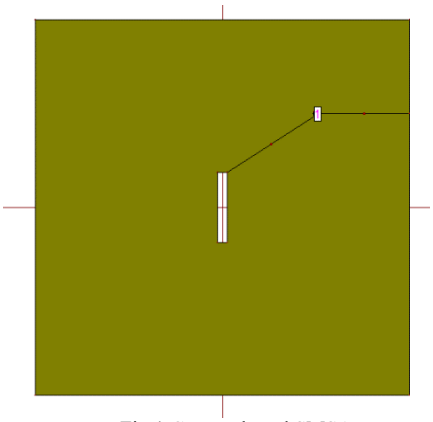


Fig.1 Centre slotted SMSA

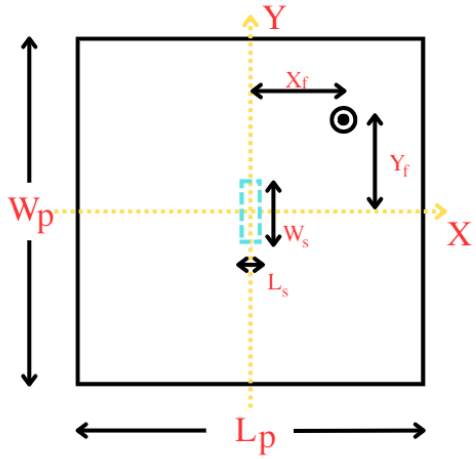


Fig.2

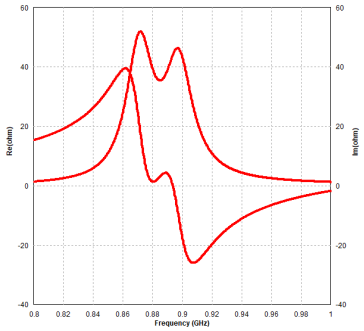


Fig.3 Centre slotted SMSA and its resonance frequency plot

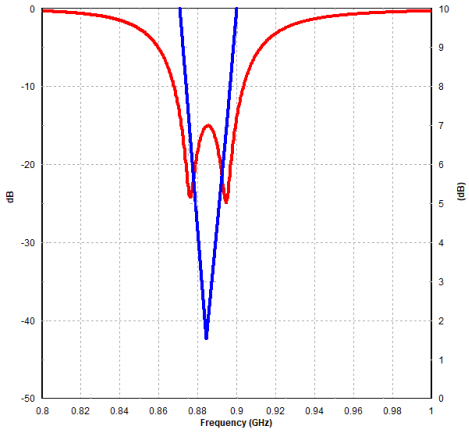


Fig.4 Optimum results showing S_{11} & AR BW

The measured BW is 35 MHz. The experimental values of the AR BW is 7 MHz.

V. FORMULATION

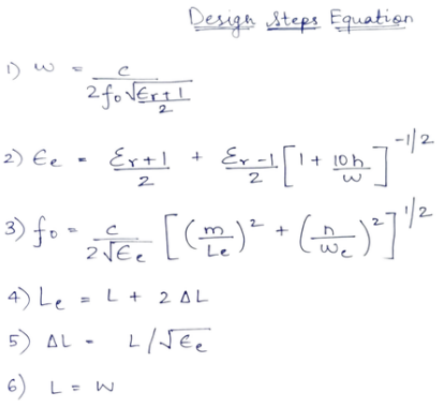


Fig.5

We calculated the physical dimension of the SMSA using the above formulae. The SMSA dimensions are found to be $L_p = W_p = 7.9$cm and its TM_{10} mode frequency is around 900 MHz.

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VI. DESIGN METHODOLOGY FOR CENTRE SLOTTED RMSA FOR CIRCULAR POLARIZED RESPONSE

In this paper, we present a study on the design of a Single-Feed Microstrip Antenna (SMSA) operating at 900 MHz that can achieve circular polarization. The initial design was a conventional SMSA without any slot, and its feed was along the X-axis. However, the design did not result in circular polarization. Therefore, we decided to offset the feed from the axis, which resulted in circular polarization. However, we observed that the impedance curve did not split into two modes, TM01 and TM10. To further improve the antenna's performance, we decided to add a rectangular slot in the ground plane of the antenna. We carried out a parametric study to determine the optimal slot width that would achieve an axial ratio of less than 3dB. The addition of a rectangular slot in the ground plane of the antenna helped to split the impedance curve into two modes, tm01 and tm10, resulting in better impedance matching. In this patch fundamental TM_{10} mode frequency (f_{10}) is not present, but the degenerated orthogonal mode frequencies, TM_{10}^{135} and TM_{01}^{45}.

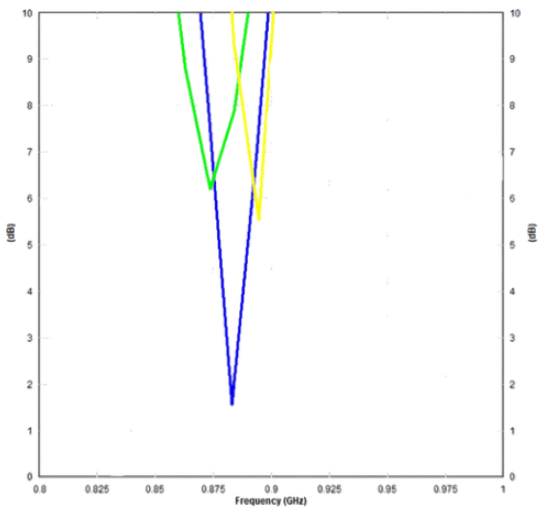


Fig.6 AR BW for the various configuration for parametric study

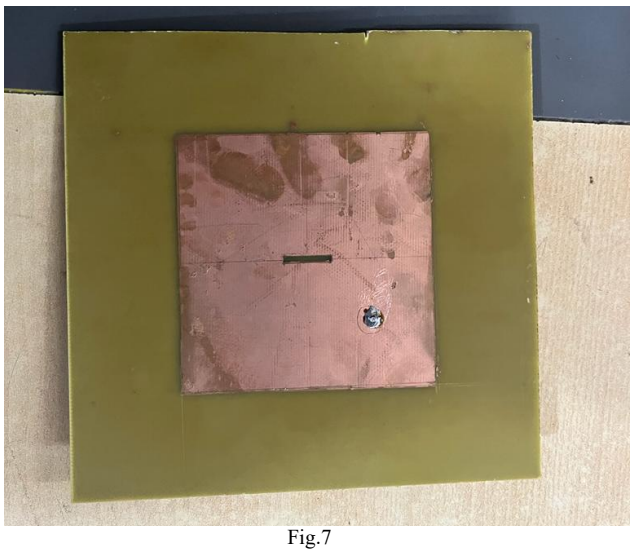


Fig.7

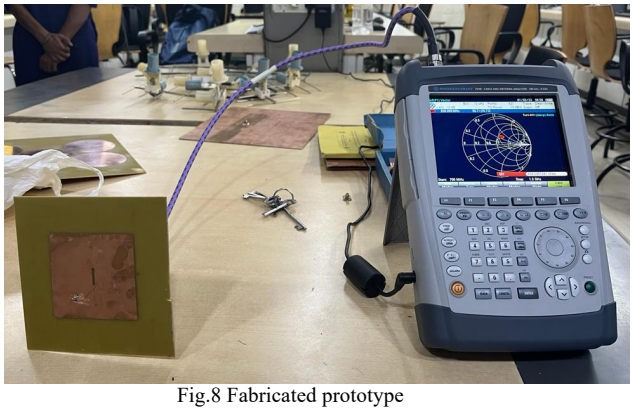


Fig.8 Fabricated prototype

VII. LITERATURE SURVEY

The design of microstrip antennas (MSAs) for circular polarization has been an active area of research due to their wide range of applications, such as satellite communication, navigation, and remote sensing. Various techniques have been proposed to achieve circular polarization, including the use of slots, perturbations, and feeding methods. In this section, we review some of the relevant literature on designing circularly polarized MSAs. In the paper "Circularly Polarized Microstrip Antenna with Cross Slot" by Y. T. Lo and S. W. Lee, a cross slot was etched in the center of a square patch to achieve circular polarization. The antenna was fed using a coaxial probe, and the slot was designed to create a phase difference between the orthogonal modes. The results showed a 3 dB axial ratio bandwidth of 8.6% and a gain of 5.7 dBic. The authors also investigated the effect of slot dimensions on the performance of the antenna and showed that increasing the slot size improved the axial ratio bandwidth but reduced the gain. In another study by A. A. Kishk and K. F. Lee, a U-shaped slot was etched in the patch of a square MSA to improve the axial ratio bandwidth of the antenna. The authors used a probe feed and optimized the dimensions of the slot and the patch for circular polarization. The proposed antenna achieved a 3 dB axial ratio bandwidth of 11.4% and a gain of 5.4 dBic. The authors also compared their design with a circular patch antenna with a U-shaped slot and showed that the square patch MSA had a wider axial ratio bandwidth.

VIII. CONCLUSIONS

This paper presents the design and optimization of a square patch microstrip antenna (MSA) with a rectangular slot in the middle for circular polarization. To achieve circular polarization, we incorporated a rectangular slot in the square patch's center, creating a phase difference between the orthogonal modes. We performed a thorough parametric study to optimize the dimensions of the patch and the slot for circular polarization. The study involved evaluating the effects of changing the dimensions of the patch and the slot, as well as the position of the slot on the performance of the antenna. The results showed that the optimal dimensions for the proposed antenna were 2mm by 15mm. The final design achieved a low 1.8 dB axial ratio with a bandwidth of 7MHz, meeting the current requirements. The proposed antenna offers a compact and low-profile solution, making it suitable for space-constrained applications. The rectangular slot in the patch provides additional degrees of freedom to tune the antenna's performance. The study also highlights the

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importance of selecting an appropriate feeding technique for MSAs, which can significantly affect the antenna's performance. In conclusion, the results of this study demonstrate that incorporating a rectangular slot in the patch of a square MSA can enhance circular polarization performance. The proposed design can be considered as a viable option for circular polarization applications. The parametric study provides valuable insights into the design and optimization of MSAs for circular polarization, and the proposed antenna offers a promising solution for various wireless communication systems and other related applications. Future work may include further optimization of the antenna's dimensions for wider bandwidth or investigating the antenna's performance under different environmental conditions.

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Dr. Amit Deshmukh and Dr. Aarti Ambekar generously contributed to this research and technical paper. This project was made possible by their invaluable mentorship and comprehensive guidance, which help ed us at every step. Without them, this paper would not have been possible. We would like to express our gratitude to our colleagues for their knowledge and assistance throughout the study process.

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Smart Safety Device

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***Abstract*—Every day, individuals from all walks of life are struggling for their personal safety. As we know, India is a developing country, yet the increasing crime rate is still an area of concern. The streets, standard public transport, and many other public places have become unsafe and vulnerable for every human. A personal safety device backed with intelligent and advanced technology will help individuals, especially women escape unwanted situations. In this paper, a smart security device is proposed. It uses Arduino as the primary microcontroller to integrate some hardware components that aim to enhance the device's safety and security features, and helps to ensure the user's well-being**

Keywords— Personal Safety, Internet of Things(IOT), Smart Security, GPS Tracking, Arduino Nano, Buzzer

I. INTRODUCTION

Our proposed system has a motive for robust, low-cost, and user-friendly solutions. It aims to eliminate safety issues that prevail in society. It will help women, children, and even senior citizens wander freely without being concerned about their safety.The increasing concern for personal safety has led to the development of various wearable devices that can track the location and provide emergency alerts. Our smart safety device with Arduino GPS module is one such device that is designed to enhance personal safety by tracking the user's location and providing other features like the ringing of a buzzer in case of an emergency situation.In this device, the GPS module tracks the user's location in real-time. The push button can be pressed to send an emergency message to a designated contact with the user's location information.As of 2021, India has been grappling with high crime rates against women and senior citizens. Here are some statistics on crime rates against women and senior citizens in India:Crime rate against women: According to the National Crime Records Bureau (NCRB) report of 2020, crimes against women in India have increased by 7.3% from 2019 to 2020. The NCRB report shows that there were a total of 3,71,503 cases of crime against women reported in India in 2020, with the majority of cases involving rape, assault, and harassment.Crimes against senior citizens: According to the NCRB report of 2020, there were 44,917 cases of crime against senior citizens reported in India in 2020. This represents a 19.3% increase from the previous year. The majority of cases involved theft, robbery, and cheating.This paper aims to provide a detailed overview of the smart safety device with the Arduino GPS module, its features, methodology, and ease of use. The paper also presents a literature review of related wearable safety devices and GPS technology and discusses the implications of the device for personal safety and related fields. Overall, the smart safety device with Arduino GPS module has the potential to enhance personal safety and provide peace of mind to the user and their loved ones. Arduino is a popular microcontroller platform that offers a wide range of capabilities for designing and implementing custom electronic systems, making it an ideal choice for creating a smart safety device. It provides a reliable and flexible platform for controlling and interfacing with the various hardware components of the device, such as the GPS module, GSM module, and buzzer. The GPS (Global Positioning System) module is used to determine the user's precise location and track their movements in real-time. GPS modules typically consist of a small antenna, a receiver, and a microcontroller that processes the incoming satellite signals and calculates the user's location. The module communicates with the Arduino microcontroller or a smartphone, using a serial interface or other communication protocol. The GSM (Global System for Mobile Communications) module is a key component of the smart safety device project, as it provides wireless communication capabilities that enable the device to send alerts and notifications to designated contacts or emergency services. With the help of the GSM module, the smart safety device can quickly send alerts to designated contacts or emergency services in case the user is in danger or needs assistance. For example, if the device's GPS module detects that the user is in a potentially dangerous area, it can automatically send an alert to the user's designated contacts, notifying them of the user's location and the potential danger. The buzzer serves as an audible alarm that alerts the user and nearby individuals to potential dangers or emergencies. The purpose of the buzzer is to provide a loud and distinctive sound so that the user can receive help from people near him. The buzzer is triggered when the user presses the push button. Overall, this feature provides an effective and attention-grabbing method that serves as an additional layer of security apart from sending the live location alert of the user. Our device is particularly useful for individuals who may be at risk of accidents, such as elderly people or those with medical conditions. It can also be used by outdoor enthusiasts, travelers, and people working in high-risk occupations.

II. OBJECTIVE

The objective of this device is to provide a portable and effective solution for personal safety. It aims to detect potential threats and alert the user in real-time, providing a sense of security and peace of mind. The device is designed and features such as a panic button, GPS tracking, and sound alarms are integrated with the help of Arduino which can help women feel safer when traveling alone or in potentially dangerous situations. As such, this paper provides a comprehensive overview of the device, highlighting its potential benefits and implications for personal safety and related fields. Giving a woman access to a safety system that enhances and guarantees their safety gives them confidence as

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they navigate societal challenges. Asia Pacific University of Innovation and Technology (APUengineering)'s department is working on a project to create a smart wearable device for women's safety. This device includes a variety of parts, including GPS, GSM, a camera, a buzzer, and a shock mechanism.The NodeMCU V3 ESP8266 microcontroller is used in the circuit for this research. The entire system depends on the digital touch sensor being activated; once the touch sensor is triggered with sufficient power supply, Node MCU reactivates. After the microcontroller is activated, all of the sensors connected to it are also activated; the GPS sensor begins tracking the live location and sending SMS with the help of the GSM sensor; text messages are sent to the emergency personnel. Gyroscope module MP uses 050 measures a user's stability and orientation in relation to the object. All the information from the sensor is then sent through visual terminal and updated in the BLYNK app All the data is saved in real time with the help of RTC module. Electronic jacket for women safety - Women's safety is the focus of this project, which is based on an electronic jacket that includes GPS, GSM, a camera, a shock circuit, and a buzzer memory card that are connected to a Raspberry Pi-3 board, which allows Arduino to control the circuit. Using a microcontroller, the system can track every time interval and display the precise location to family members, parents, and friends. Use the panic button to protect yourself while an emergency is happening. Wearable jackets and mobile technology are combined in the AVR microcontroller-based variable jacket for women's safety to ensure the safety of women in public. Using a buzzer GPS, GSM model, this system aids in warning the victim's family and close friends. The GPS module tracks the longitude and the latitude to address an exact location of user and then prestored emergency message including location to the registered contact numbers the audio recording module starts the recording of the conversation for five minutes and store in as evidence the message goes in the queue if the network problem occurs and send it when a network gets available.

III. PROPOSED DESIGN

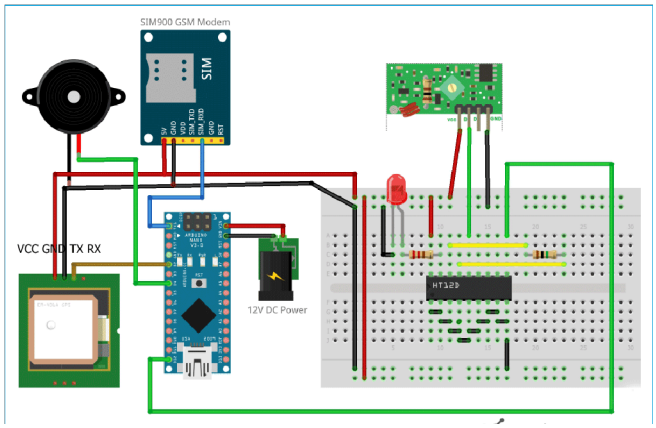


Fig.1 Schematic Block Diagram

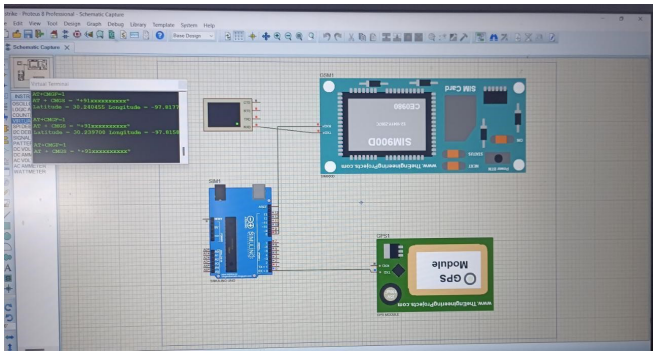


Fig.2 Arduino simulation

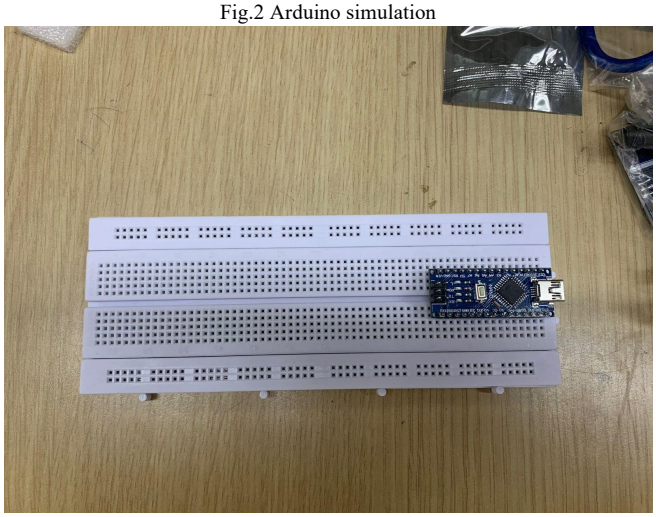


Fig.3 Arduino Nano microcontroller

The Arduino platform is highly flexible and can be easily customized and extended with additional hardware components or sensors as needed. This allows us to tailor the device's capabilities to the specific needs of the user or environment, making it a powerful tool for ensuring their safety and security.

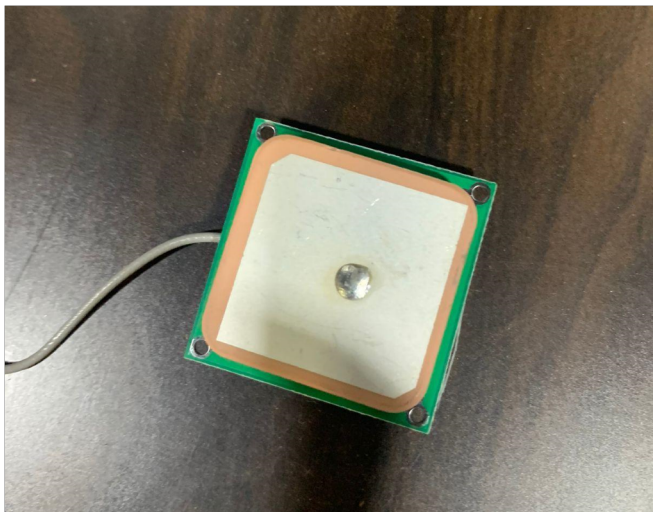


Fig.4 GPS module

The GPS module communicates with the Arduino microcontroller or a smartphone, using a serial interface or other communication protocol.

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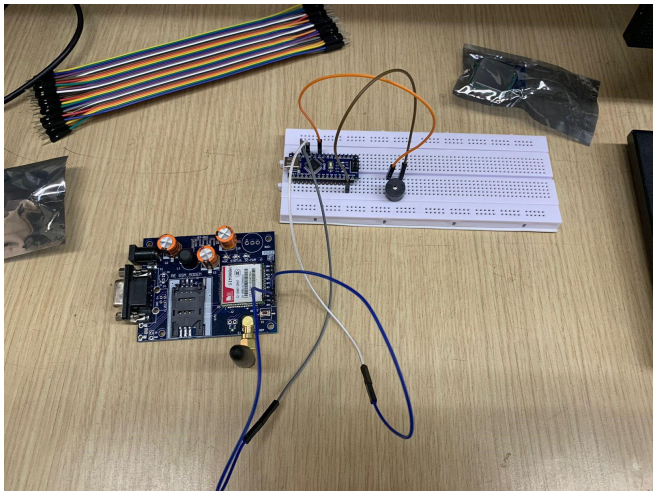


Fig.5 GSM module connected to the Arduino microcontroller

IV. ADVANTAGES OF PROPOSED SYSTEM

It is an all-in-one system. Hence, there is no need to carry multiple devices together. GPS tracking feature tracks the live moments of the user whenever the emergency button is pressed. Second distinct feature is the buzzer makes a loud sound in order to let other people around know that someone is in danger. This device provides safety with an enhanced mechanism

V. FUTURE SCOPE AND CONCLUSION

We can use a variety of sensors to accurately identify the current situation in urgent abusive situations. A shock generator can be added so that the subject can take immediate action before help comes from elsewhere.The device can be linked with smart glasses to get a better camera angle which can help in identification of the suspect. Moreover, the device has the potential to revolutionize safety practices in industries such as construction, manufacturing, and transportation. It can also enhance safety measures in households, schools, and public places, thereby creating a safer and healthier environment for all. While there are still some limitations and challenges associated with the development and adoption of smart safety devices, the potential benefits far outweigh the costs. Therefore, it is crucial to continue investing in research and development to improve the effectiveness and efficiency of this product.

VI. SOCIAL IMPACT

The main objective of technology in our world is to improve peoples' quality of life by making it more flexible, secure, and sophisticated. Many ideas, services, and ways of interacting with and using them have changed significantly in this century as a result of the Internet of Things (IoT) and its technologies. The device has the potential to revolutionize safety practices in industries such as construction, manufacturing, and transportation. It can also enhance safety measures in households, schools, and public places, thereby creating a safer and healthier environment for all. While there are still some limitations and challenges associated with the development and adoption of smart safety devices, the potential benefits far outweigh the costs. Therefore, it is crucial to continue investing in research and development to improve the effectiveness and efficiency of this product.

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Security Lock for Bike Ignition using Fingerprint Sensor

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***Abstract*—All effective security system for a bike is built using a R-307 fingerprint sensor interfaced with an Arduino UNO, with a 5V two channel Relay acting as a link between the hardware and the software. The R-307 Fingerprint sensor is employed to increase the security. Instead of the ignition key to turn on the bike, it uses a tool which compares the Person's Fingerprint pattern with the fingerprint pattern stored in the module's memory. To make the project working, both the Fingerprints should match. Since a single bike is used by multiple people, a system is devised in which more than 100 fingerprints could be enrolled.**

Keywords—Bike Security, Arduino Uno, R-307 fingerprint system

I. INTRODUCTION

In Today's World with the increasing cases of Bike theft, it has never been more important to have an additional layer of security to protect valuable assets. In the year 2022 alone more than 7800 bikes were stolen across our Country and more than 77% was not able to be recovered with a net loss of more than 10 crores. We here in this project will discuss the biometric system as the first layer of security for a vehicle. Biometric systems are proven to be a boon for industries in all segments. It helps in Increasing the security by recognising the unique biometric code of every individual. It has been applied to the Automobile sector as well and is utilized as the additional layer of security for safeguarding the vehicle. The Biometric method involves processing data through algorithms in order to arrive at a final outcome ie. whether it's successful or unsuccessful. Arduino UNO generates the signals and sends them to the proper module circuits. Using fingerprint sensors has the benefit of lowering the crime of motorbike theft, which happens often in the neighborhood. This is due to the fact that turning on the motorcycle requires using the fingerprint recognition system that has been installed. They also aid in reducing community members' fears about driving in shopping malls. One of the characteristics of the fingerprint is its eternal nature. Immutability, uniqueness, and originality are qualities of a fingerprint. With the exception of unusual events, such as a severe injury that changes the patterns of their existing prints, a person's fingerprints are immutable, which means they won't ever change. There are no two fingerprints exactly the same because each one is unique and different. This study created a security system for motorcycles that swaps out the stop contact function with fingerprint identification saved on a fingerprint sensor. The microcontroller then issues a voice command to the motorcycle's built-in speakers telling them to activate the motor indication.

II. COMPONENTS USED

In The Arduino microcontroller UNO, R 307 fingerprint sensor, 5V two-channel relay module, 8 ohms speaker,Tip 120 transistor, DC motor and some common circuits are used in this project to implement the hardware modules.

R307 Fingerprint sensor module

An electronic gadget, a fingerprint sensor is used to take digital pictures of fingerprint patterns. A saved biometric template that is utilized for matching was created from the image, which was referred to as a live scan of digital processing. Below is a list of some of the fingerprints that are frequently used in technological sensors. The R307 Optical Fingerprint Reader Sensor Module having a TTL UART interface, can be directly linked to a microcontroller UART or to a Computer with a MAX232 / USB-Serial adapter. The user can set up the module to save the fingerprint information and identify the subject in 1:1 or 1: N mode.



Fig.1

Features

- Chip that integrates an algorithm and image gathering all in one.
- The fingerprint reader can be fitted into a variety of final products and has secondary development capabilities.
- Inexpensive cost, tiny size, and high performance.
- Low power consumption.
- Professional optical technology, exact manufacturing processes for modules.
- An image with a resolution of 500 dpi can be effectively captured with good image processing capabilities.

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Arduino Uno

An open-source microcontroller board, the Arduino Uno is built around the Microchip ATmega328P processor. Six of the 14 digital I/O pins on the board can be utilized for PWM output, and there are six analogue I/O pins. It also consists of a USB connection, a reset button, a 16 MHz ceramic resonator, an ICSP header and a power jack. I t may be programmed using the Arduino IDE and a type B USB connector (Integrated Development Environment).



Fig.2

Hardware Section

The circuit connections are made as shown in the circuit diagram using the breadboard, R307 fingerprint sensor. The Vcc, Ground, Transmit (Tx), and Receive (Rx) pins are the only ones on the R307 fingerprint sensor module. The Tx pin is attached to pin 3 of the Arduino, and the Rx pin is attached to pin 2 of the Arduino module. The Gnd pin is grounded and 3.3V of power is delivered to Vcc. Two channel relay has been employed in this design. However you could also use a single channel relay in place of this. Attach the Arduino UNO's input pin, pin 8, and provide it with 5V electricity. Attach the Arduino Uno to Tip-120 Transistor . Currently, the circuit connection is complete. The coding must be completed in order to enroll the fingerprint after the hardware connections of the module have been made.

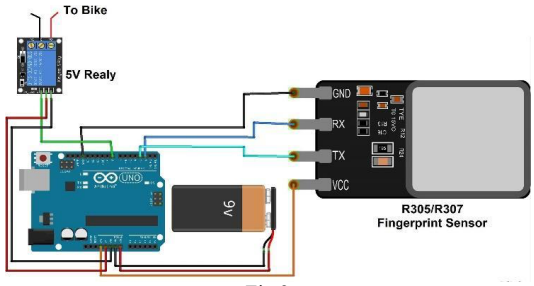


Fig.3

Programming Section

The fingerprint module stores fingerprints using the enrolling code. The fingerprint is really kept on the fingerprint module rather than the Arduino. As a result, this program aids with fingerprint enrollment in the fingerprint module. Presently, the software is in the process of compiling. The fingerprint must then be registered after this. We must now input an ID between 1 and 127 in the new window that will open when we click the serial monitor on the monitor's upper right side. The fingerprint will be saved in the opened ID and any of them may be used. We will now be prompted to enter our fingerprint. After placing the finger on the fingerprint module, the image will be taken and it will be stored in the Arduino. Multiple fingerprints can be registered.Relay module programming is now required in order to start the bike. The relay output has been linked to the bike and pin 8 has been designated as the output in this program. Hence, when the recorded fingerprint is applied to the fingerprint sensor, a valve opens, allowing fuel to flow and starting the bike. The valve remains closed, the petrol won't ever flow, and the bike won't start if the fingerprints don't match. Once the hardware module has been installed on the bike by swapping out the self-start button with this anti-theft fingerprint security system, upload this code directly to the Arduino UNO board.

Block diagram

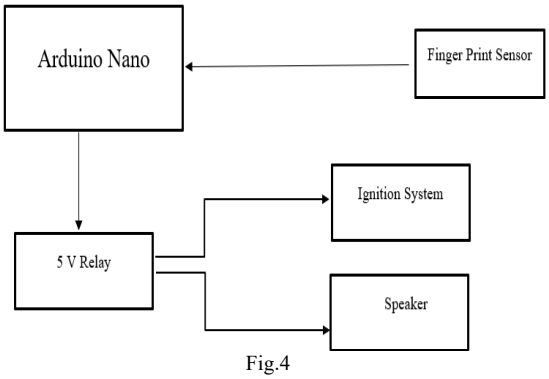


Fig.4

III. CIRCUIT DIAGRAM

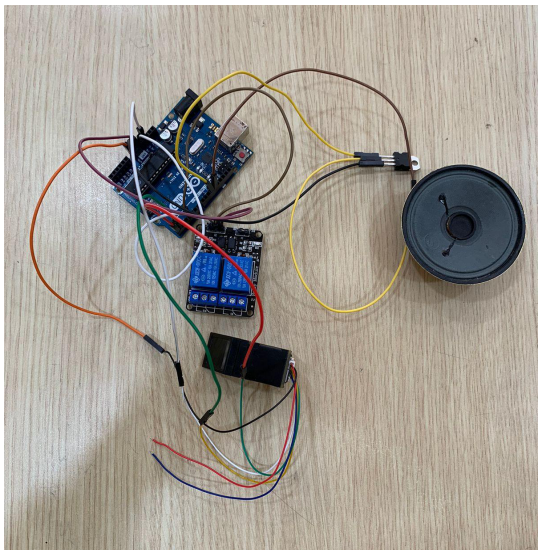


Fig.5

IV. RESULTS AND DISCUSSION

As a result of this project, only the authorized person will be able to start the bike after scanning his or her finger on the fingerprint module. The input fingerprint data will be compared with stored data, and if the data matches, the microcontroller will ignite and the bike will start; otherwise, the bike will not start.

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V. CONCLUSIONS

For bike security and starting, we installed a fingerprint sensor. The fingerprint is detected by our algorithm, and access is granted to the authorized user. We tested our algorithm on a large number of images and discovered that it detects fingerprints successfully. The fingerprint-based vehicle security system proposed here is a modern and dependable security mechanism. This project's system protects against theft in a convenient manner. By adding an extra layer of security to the vehicle, the fingerprint sensor effectively eliminates the need for a key to start the bike's ignition and eliminates the threat of theft. The proposed model is both economical and user-friendly. Thus, by implementing this relatively inexpensive and simple model, one can ensure far greater security and exclusivity than a traditional lock and key. A thief will have to do a lot of research to steal a bike, and they are unlikely to have advanced technology to fake your fingerprint.

The advantages of designing this system are:

- The system can efficiently differentiate between authentic and fake user.
- Features such as locating the bike, noise alert, immobilizing unit were added which enhances the security of the bike.
- Proposed a good system for user authentication using a fingerprint sensor.
- This system can be made adaptive to all kinds of vehicles.

ACKNOWLEDGEMENT

We would like to thank our mentors Prof. Tanaji Biradar and Prof. Tushar Sawant for guiding us through the course of this project. In addition to this we would also like to thank our college in supporting us to complete this project successfully.

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Compact Broadband Microstrip Antenna

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***Abstract*—In this paper, we present the design and analysis of a rectangular microstrip antenna operating at 900 MHz frequency using the Zealand software. The proposed antenna consists of a rectangular patch of dimensions L × W and a ground plane, both made of copper, separated by a dielectric substrate of thickness 1.6 mm. The design process involves determining the dimensions of the patch and the substrate to obtain the desired resonant frequency and impedance matching. The antenna's performance is evaluated in terms of radiation pattern and antenna gain.**

***Keywords*—Radiation Pattern, Microstrip Antenna (MSA), Gain, Zeland software, Frequency, Resonance, Substrate**

I. INTRODUCTION

Microstrip antennas have gained significant popularity in recent years due to their advantages such as low profile, lightweight, ease of fabrication, and integration with microwave integrated circuits. A microstrip antenna is a type of antenna that consists of a metallic patch placed on a dielectric substrate and backed by a metallic ground plane. The patch and the ground plane are separated by a dielectric material that supports the propagation of electromagnetic waves. Microstrip antennas are widely used in modern wireless communication systems due to their low profile, ease of integration, and compatibility with microwave integrated circuits. However, microstrip antennas suffer from poor impedance matching, narrow bandwidth, and low gain. The rectangular microstrip antenna is one of the most common types of microstrip antennas, known for its simple structure and ease of design. However, it suffers from poor impedance matching, narrow bandwidth, and low gain. One way to overcome these issues is by shorting the rectangular patch to the ground plane. A shorted microstrip antenna is a variation of the microstrip antenna that includes a shorting pin that connects the metallic patch to the ground plane. The shorting pin acts as a capacitive load and increases the effective area of the patch, which broadens the bandwidth and enhances the antenna gain. Shorting the patch to the ground plane also changes the resonant frequency and improves the impedance matching. Shorted microstrip antennas are commonly used to overcome the limitations of microstrip antennas and improve their performance in terms of bandwidth, gain, and impedance matching.

II. SELECTION OF SUBSTRATE

For our design of the antenna at a frequency of 900 MHz we have used a FR4 substrate which has a dielectric constant of 4.3 and a loss tangent of 0.02. We chose to use this type of substrate for our design after comparing it with the other substrates available in the market on the basis of various factors. FR4 substrate is a low-cost substrate material that is widely available in the market, making it a cost-effective choice for antenna fabrication. It has good dielectric properties, such as low loss tangent of value 0.02 and high permittivity, which enables efficient energy transfer between the antenna and the free space. As a substrate it is easy to handle and fabricate, making it a popular choice for prototyping and low-volume production runs. FR4 substrate has good mechanical strength and stiffness, which makes it resistant to bending and deformation during the fabrication process and during the antenna's operation. It is widely used in the electronic industry for a range of applications, which means that there is a lot of data available on its properties, making it easier to predict and simulate the antenna's behaviour. Overall, the combination of low cost, good dielectric properties, ease of fabrication, good mechanical strength, and widespread use makes FR4 substrate an attractive choice for fabricating antennas, particularly for applications that require low-cost and low-to-medium performance.

III. DESIGNING OF A MICROSTRIP ANTENNA

The designing process of a microstrip antenna involves several steps, which can be summarised as follows:

Specification of requirements

The first step in designing a microstrip antenna is to specify the system requirements, such as operating frequency, bandwidth, gain, radiation pattern, polarisation, and size constraints. This information is essential for selecting the appropriate substrate material and determining the patch dimensions and feed location. In our project, we decided our operating frequency to be 900 MHz as stated previously in the paper.

Substrate selection

The substrate material is a critical parameter that affects the antenna's efficiency and performance. The choice of substrate depends on various factors such as dielectric constant, dielectric loss, thickness, cost, and availability. Commonly used substrate materials include FR4, Rogers, Duroid, and Teflon. In our project we have used FR4 as our substrate as stated previously, on the basis of its relatively good performance.

Patch shape and dimensions

The patch shape and dimensions are determined based on the operating frequency and polarisation. The patch can be rectangular, circular, triangular, or any other shape, depending on the application. The length and width of the

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patch are selected to resonate at the desired frequency and achieve the desired impedance matching.

Feed mechanism

The feed mechanism is used to excite the patch and launch the electromagnetic wave into free space. The feed can be a coaxial probe, microstrip line, or aperture-coupled mechanism, depending on the design requirements. In our project we have used a coaxial probe feed.

Ground plane design

The ground plane serves as a reflector and counterpoise for the microstrip antenna. It is essential to ensure that the ground plane is large enough to prevent surface wave losses and provide a low-loss return path for the antenna current. Since our project was only simulated on Zeland, we went ahead with using an infinite ground plane since it typically has a higher gain and a more directional radiation pattern than a finite ground plane antenna.

Simulation and optimization

Once the design parameters are determined, the antenna's performance can be simulated using software such as Zeland. The simulation results are used to optimise the design parameters and ensure that the antenna meets the system requirements. Overall, designing a microstrip antenna requires careful consideration of various design parameters and simulation tools to achieve the desired performance and efficiency.

IV. CONFIGURATIONS OF THE MICROSTRIP ANTENNA

The dielectric constants of the various substrate materials that can be employed for the design of microstrip antennas range from 2.2 to 12 r. The substantial substrates whose dielectric constant is at the lower end of the spectrum are typically favoured because they offer superior efficiency, a wider bandwidth, and loosely constrained fields for radiation at the expense of bigger element size. The substrate's height should be between 0.003 and 0.05 inches, on average. Typically, the feed lines and radiating elements are photo etched onto the dielectric substrate.

X-Configuration

The X configuration is created by placing three patches side-by-side horizontally on an infinite ground plane. The three patches have a gap between them of 1 mm. To obtain the optimised result of the configuration, the dimensions of the parasitic patches are altered.

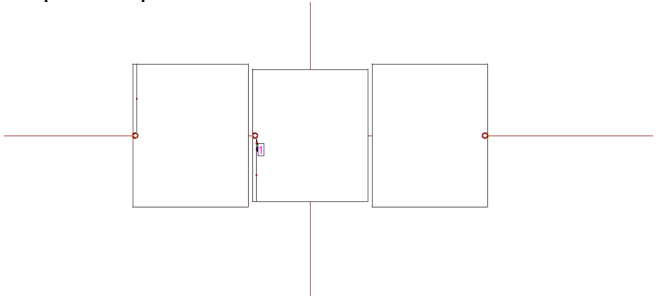


Fig.1 X-configuration

1.

2. Y-Configuration

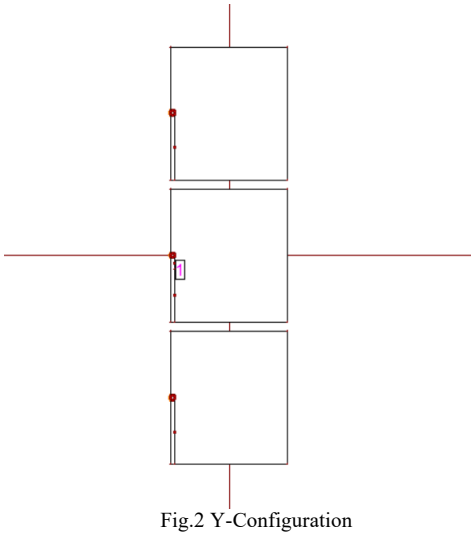


Fig.2 Y-Configuration

The Y-configuration is created by the X-configuration in its vertical form. Three patches are arranged vertically on an infinite ground plane, just as we did for the X-configuration. This configuration too has a gap of 1 mm between each patch.

X+Y Configuration

The ultimate desired configuration is created by combining the optimised X and Y configurations. Five patches are placed in the final configuration on an infinite ground plane. The arrangement resembles a plus symbol, and proved to be a sufficiently efficient design. This plus symbol-like configuration is a type of microstrip antenna design that is highly efficient due to its symmetrical structure and broadside radiation pattern. The configuration

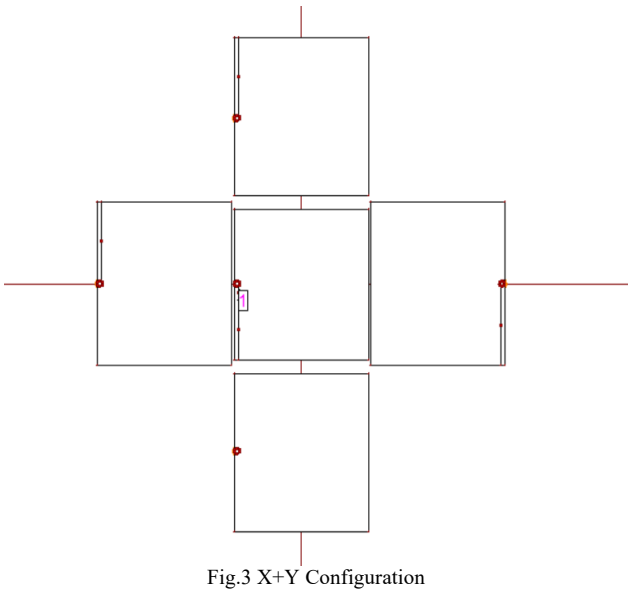


Fig.3 X+Y Configuration

consists of four rectangular patches arranged in a plus shape, with a coaxial feed connected to the central-most patch. The symmetrical structure of the antenna provides a balanced distribution of the electric field, which helps to minimise losses and maximise radiation efficiency.

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Additionally, the broadside radiation pattern of the plus symbol configuration makes it well-suited for applications that require omnidirectional coverage, such as wireless communication and navigation systems. Another advantage of the plus symbol configuration is its wide bandwidth. By adjusting the dimensions of the patches and the coaxial feed, it is possible to achieve a broad frequency range with good impedance matching, making it suitable for a variety of applications. Overall, this configuration is an efficient microstrip antenna design that offers high gain, radiation efficiency, omnidirectional coverage, and wide bandwidth. Its compact size and symmetrical structure makes it an optimum choice for various wireless communication and navigation systems, where space is often limited.

V. OPTIMIZATION OF MICROSTRIP ANTENNA

The desired optimised output is produced by the final X+Y configuration, as shown in the following Smith chart and resonance frequency graph. The optimised output was produced as a result of varying the dimensions of the parasitic feed patches that are placed above and below the feed (central) patch. In the case of our configuration, the optimised impedance matching Smith chart shows a point that lies on the 50-ohm resistance circle, which represents the desired input impedance of the antenna. The point on the Smith chart could be obtained by adjusting the dimensions of the patches and the coaxial feed, however we chose to only manipulate the dimensions of the parasitic patches to achieve the desired resonance frequency and impedance matching.

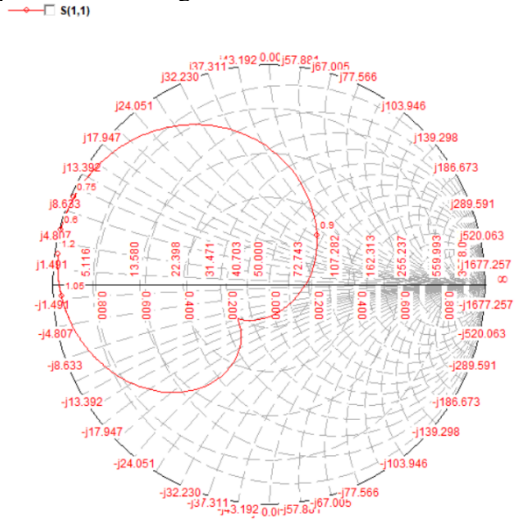


Fig.4 Optimised Smith Chart

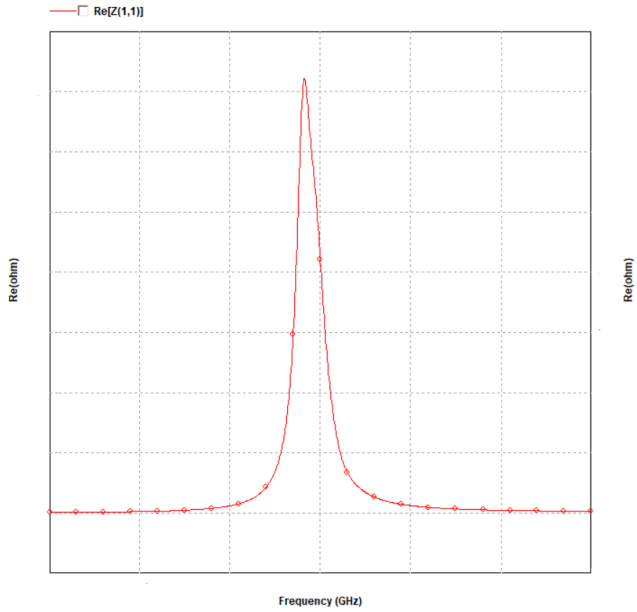


Fig.5 Optimised resonance frequency graph

VI. LITERATURE SURVEY

Compact broadband microstrip antennas have gained significant attention in recent years due to their compact size, wide bandwidth, low profile, and ease of fabrication. These antennas have found applications in various wireless communication systems, such as Wi-Fi, Bluetooth, RFID, and mobile communication systems. In this literature survey, we briefly discuss some recent advancements in compact broadband microstrip antennas. One approach for designing compact broadband microstrip antennas is the use of various feeding techniques, such as aperture-coupled, proximity-coupled, and coplanar-waveguide (CPW) feeding. For example, a broadband circularly polarised microstrip antenna with a CPW-fed configuration has been proposed, which achieves a bandwidth of 52% and a low axial ratio of less than 3 dB over the entire bandwidth. Another approach is to use different geometries and structures, such as meander-line, fractal, and metamaterial-based structures. For instance, a compact meander-line antenna has been proposed, which achieves a bandwidth of 65% and a peak gain of 7.6 dB at 6.8 GHz. Similarly, a fractal-based antenna has been proposed, which achieves a bandwidth of 80% and a peak gain of 4.6 dB at 6.1 GHz. Moreover, hybrid structures, such as the combination of a patch antenna with a slot or a stub, have also been investigated for broadband performance. For example, a broadband patch antenna with a slot and a stub has been proposed, which achieves a bandwidth of 40% and a peak gain of 6.4 dB at 3.4 GHz. In conclusion, compact broadband microstrip antennas have become a popular area of research due to their potential for use in a wide range of wireless communication applications. Various techniques, such as feeding techniques, geometries, and hybrid structures, have been explored to achieve wide bandwidth and high performance in these antennas.

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GAIT Analysis Using Pose Estimation For Medical Applications

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***Abstract*—This paper proposes a method for analyzing human gait using computer vision.We present a novel method for gait analysis using computer vision, which combines 2D and 3D pose estimation to accurately track the movement of key body parts during walking. The proposed method uses live video data captured by a camera to extract relevant gait features.These features are then used to identify abnormalities in a person's gait that may be indicative of underlying musculoskeletal or neurological disorders.We validated our results using IMU sensors. The results show that the proposed method is able to accurately extract gait features from the video data, and can effectively identify abnormal gait patterns.The proposed method also has the advantage of being non-invasive, low-cost, and easily scalable to large-scale studies.Our findings demonstrate the potential of computer vision for gait analysis and suggest that it may be a valuable tool for improving human movement patterns and reducing the risk of injury.**

Keywords—Open CV, Mediapipe, pose estimation, GAIT, pose landmarks, MPU6050,Arduino UNO.

I. INTRODUCTION

Facial Human gait refers to the way that a person walks or runs, including the manner in which they move their legs, feet, and other parts of their body. Gait analysis is the study of the movement patterns involved in walking and running, and it is used in various fields, including medicine, sports science, and biomechanics. Human gait can be divided into different phases, including the stance phase (when the foot is in contact with the ground) which makes up 60% of the cycle and the swing phase (when the foot is off the ground) which makes up 40% of the cycle. During the stance phase, the foot absorbs shock and supports the weight of the body, while during the swing phase, the leg is propelled forward in preparation for the next step.

The Gait cycle can be further divided into 8 subparts

- Initial Contact (Fig 1.1)
- Loading response (Fig 1.2)
- Midstance (Fig 1.3)
- Terminal Stance (Fig 1.4)
- Preswing (Fig 1.5)
- Initial Swing (Fig 1.6)
- Midswing(Fig 1.6)
- Terminal Swing (Fig 1.7)

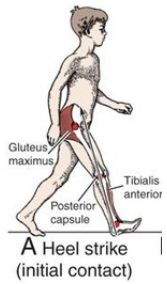


Fig.1.1 Initial contact

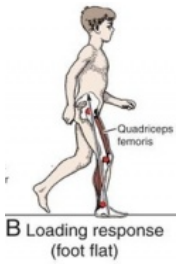


Fig.1.2 Loading response



Fig.1.3 Midstance



Fig.1.4 Terminal stance

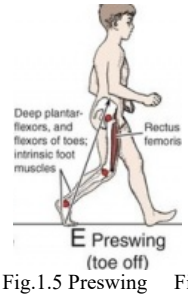


Fig.1.5 Preswing

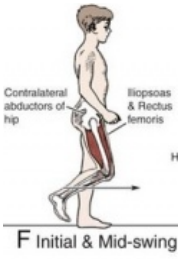


Fig.1.6 Initial & Mid-swing

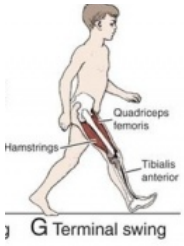


Fig 1.7 Terminal swing

Gait analysis can provide information about a person's movement patterns and can be used to identify abnormalities or inefficiencies that may lead to pain, injury, or poor performance. This information can be used to develop interventions such as exercise programs, orthotics, or gait retraining to improve a person's gait and reduce their risk of injury. Gait dysfunction is prevalent in subjects with a cognitive decline with respect to cognitively healthy subjects. So, gait analysis can provide a concrete additional aid for dementia diagnosis and then for distinguishing among different dementia subtypes.

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II. LITERATURE REVIEW

Gait Analysis has been a well researched area and numerous technologies have been utilized to analyze relevant gait parameters. In 2008 Katia Turcot et al [2] used a novel technique in comprehending and monitoring gait strategy in patients with osteoarthritic knee. The technique incorporates the use of functional postural calibration, 3-D accelerometers, 3-D gyroscopes, and reflective markers rigidly fixed on an exoskeleton. A six-camera optoelectronic system was used to monitor the locations of the markers. A 120 Hz external trigger mechanism was used to synchronize the collection of all data. A 10 window length automated singular spectrum analysis (SSA) was used to filter the positions of the markers. Ground reaction forces were measured using two Kistler force plates built into the treadmill to identify gait cycle occurrences. A fourth order zero-lag Butterworth filter with a cutoff frequency of 30 Hz was used to screen the kinetic data. Between two consecutive foot contacts, which correspond to moments when the vertical ground reaction forces were greater than 2% of the participant's body weight, the gait cycles were normalized (0%–100%). In 2012 Moshe Gabel et al[3] implemented "Full Body Gait Analysis with kinect".They introduced a reliable, cost-effective, and non-intrusive gait analysis system. Since their system is built on the Kinect sensor, it can gather complete gait data from every part of the body. They measured arm kinematics in addition to standard stride information, illustrating the broad variety of parameters that can be extracted. The "virtual skeleton" created by the Kinect camera and software is used in their method. The skeleton information is converted into a large set of features which are fed to a model that predicts the values of interest. To learn the regression model, they used the Multiple Additive Regression Trees (MART) algorithm. In 2019 Abdullah S. Alharthi et al[4] used deep learning to track human gait. With the help of Convolutional Neural Network the extracted spatiotemporal gait features were utilized. Two "Long-Short Term Memory(LSTMs) models" were accustomed: the first model processed the CNN output while the second extracted features from gait using the Wearable sensor. Then a "Grey Wolf Optimizer" was accustomed to merge the outputs by LSTMs. Human pose estimation from depth sensors has recently seen large advances, notably with the release of the Microsoft Kinect.The advantages of gait analysis with a depth sensor include long-term monitoring in a home setting and tracking the full body in 3D at a low cost with natural clothing and without wearable sensors or markers. In 2021 Andrew Hynes et al [5] proposed "Spatiotemporal gait measurement with a side-view depth sensor using human joint proposals." From depth images, a stochastic predictor built on the Kinect algorithm produced numerous joint proposals. The proposals were shown as vertices in a graph with weights, the weights were determined by the anticipated and measured distances between the body parts.A shortest path through the graph is a set of joints from head to foot.Comparing pairs of the shortest paths allows for the selection of precise foot positions. By tracking the movement of the feet over time, stance phases of the feet can be identified. Four gait parameters—stride length, step length, stride width, and stance percentage—are determined by the stance phases. Over the past few decades, there has been a significant transition in the way that gait measurements are taken, with technology playing a crucial role in this shift. Initially, inertial measurement units (IMUs) were the primary method for capturing gait data. These devices measure acceleration and angular velocity and can provide information about a person's movement patterns. However, IMUs are limited in their ability to capture fine-grained movement details, and they can be cumbersome to wear. More recently, there has been a move towards using Microsoft Kinect-based approaches for gait analysis. The Kinect is a motion sensing device that uses depth sensing cameras to capture 3D images of a person's movements. This approach allows for more precise tracking of body movements, and it has been shown to be effective in capturing gait data. In recent years, there has been a further shift towards using deep learning techniques to analyze gait, particularly through the use of silhouette images. Silhouette-based approaches involve capturing the outline of a person's body as they walk or run, which can then be used to extract information about their movement patterns. Deep learning techniques can be applied to these images to identify subtle differences in gait that may not be visible to the naked eye, and this approach has shown promising results in the detection of gait abnormalities. Overall, the transition from IMUs to Kinect-based approaches to deep learning reflects a growing interest in using technology to improve the accuracy and precision of gait analysis. These advances have the potential to improve our understanding of human movement patterns and to develop more effective interventions for individuals with gait abnormalities.

III. PROPOSED DESIGN

There are a couple of challenges with pose estimation, a few of them are listed below:

1. Limited pose landmark accuracy

Pose landmarks are derived from computer vision algorithms that estimate the location of specific points on the human body from an image or video. However, the accuracy of these pose landmarks can be limited due to factors such as camera angle, lighting, and occlusions.

2. Complex movements: Some activities involve complex movements that can be challenging to capture accurately using pose landmarks. For example, rapid or overlapping movements and unpredictable movements that can be difficult to track.

3. Variability across individuals

There can be significant variability in body shapes and movements across individuals, which can make it challenging to develop a generalizable model for motion detection using pose landmarks.

4. Sensor drift: IMU sensors can suffer from drift, which can cause measurement errors over time. This can lead to inaccurate estimates of gait parameters.

5. Sensor calibration: IMU sensors need to be calibrated properly to ensure accurate measurements. This can be a time-consuming process and requires specialized equipment and expertise.

6. Interference

IMU sensors can be affected by electromagnetic interference, which can introduce errors and variability in the measurements. After carefully examining the performance of various tools available for pose estimation like OpenPose, Posenet and mediapipe in different settings we came to an

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inference that mediapipe offers a much better accuracy in low light intensity and overlapping landmark locations. To promote our objective on building a remote,scalable and easily implementable solution we went ahead with a computer vision based approach yet we also validated our results with IMU sensors. The objective of this project is accomplished by the support of a few machine learning libraries and some sensors and microcontrollers. A brief description about them has been mentioned below:

OpenCV

This open source computer vision library helps to solve CV(Computer Vision) problems by enhancing the machine's understanding of perception. It also provides a wide range of functionalities for image and video processing, such as image filtering, segmentation, feature detection, object recognition, and tracking. It also includes tools for camera calibration, stereo vision, and optical flow analysis.

MediaPipe

MediaPipe is a cross-platform open-source library for creating real-time computer vision and machine learning pipelines. Google created the library, which is available in several programming languages, including Python, C++, and Java. The Python version of MediaPipe comes with a number of pre-built computer vision and machine learning models that can be used for a variety of tasks, including object detection, face detection, pose estimation, and hand tracking. These deep learning-based models are designed for real-time performance on mobile devices and other resource-constrained platforms.

Arduino UNO R3

The Arduino Uno R3 is a versatile and flexible board that can be used in a wide range of applications, from simple LED blinking and sensor reading projects to more complex robotics and automation projects.It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, and a power jack and is based on the ATmega328-based microcontroller. The board is simple to use and can be programmed using the Arduino programming language, which is based on C/C++. It also includes a number of libraries and examples for interacting with various sensors, actuators, and other electronic components.

MPU 6050

The MPU-6050 sensor is a small, low-cost, and versatile MEMS device that combines a 3-axis gyroscope and a 3-axis accelerometer on a single chip. The gyroscope measures angular velocity or rotational rate in degrees per second, whereas the accelerometer measures linear acceleration in metres per second squared. The MPU-6050 sensor combines these two sensors to provide accurate rotational and linear motion measurements. The sensor communicates with a microcontroller or other computing device via a standard I2C interface, making it simple to integrate into a variety of electronics projects. It also includes a Digital Motion Processor (DMP), which can perform a variety of motion processing tasks such as quaternion calculations, gesture recognition, and sensor fusion, making it easier to develop motion sensing and control applications.

MySQL

MySQL is a relational database management system based on the Structured Query Language, which is the popular language for accessing and managing the records in the database.Some of the features of MySQL include support for transactions, multi-user access, replication, and security mechanisms such as access control and encryption. MySQL is known for its reliability, scalability, and ease of use.

IV. IMPLEMENTATION

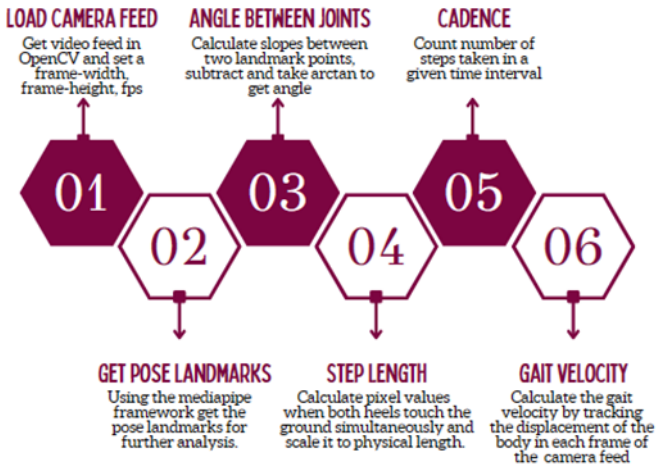


Fig.2 Implementation steps

One of the questions when measuring GAIT was which parameters should be considered. As highlighted by Ridao-Fernández C et al in [6] there are different observational gait assessment scales. Some of them assess falls and balance, which may be useful to the evaluation of individuals with Parkinson's disease or vestibular disorders. Some scales emphasize the investigation of kinematics or the gait cycle. There are various evaluation forms that measure gait metrics such as arm swing and fluency and account for the frequent use of assistive devices during gait recovery. Observed gait assessment scales have become an effective clinical alternative as a result of their speed and use. To show the robustness of our technique we did not resort to a particular assessment scale rather we chose parameters that were common to a lot of scales so that our measurement technique could be easily generalizable. In particular we chose Angle at the hip, cadence, step length and gait velocity as the measurement parameters using mediapipe. The pose landmarks measured by mediapipe are shown in fig 3.

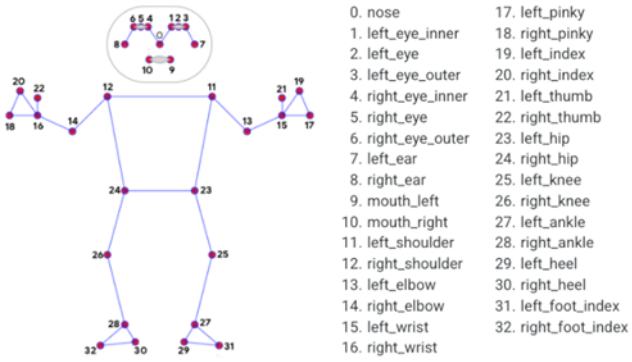


Fig.3 Pose Landmarks

The angle was measured at pose landmark 24 during the terminal stance phase of gait cycle, since our camera feed was

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taken in a sagittal plane parallel to the ground. The step length was measured between pose landmarks 31 and 32. By timing the measurements of step length measurements we calculated cadence. Since 2x the step length makes one stride thus we calculated the gait velocity as stride-length/time of one cycle.While gait acceleration can provide valuable information about the mechanics and dynamics of gait, it is less clinically relevant than gait velocity. By positioning the camera in the coronal plane different measurements could be made, like width between heels, equidistant arm swings etc. Thus by placing cameras in different planes and exploiting all the available pose landmarks a variety of different parameters can be calculated and evaluated. Figure 4 shows how these landmarks are measured.



Fig.4.1 Pose Landmarks in mediapipe

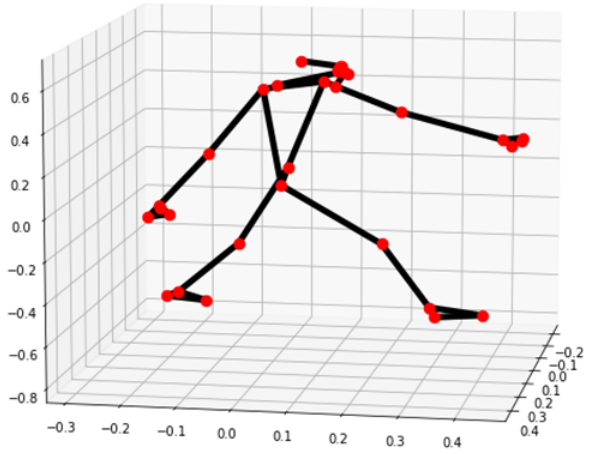


Fig.4.2 3d Coordinate mapping where axis are in meters and origin is at center between hips

In order to get the aforementioned physical verification we use the MPU6050 which is an inertial measurement unit. It has a 3 axis accelerometer as well as a 3 axis gyroscope. The data from the inertial measurement unit is sent via I2C communication protocol onto the Arduino Uno R3.The circuit diagram is shown in Figure 5.1 and connection table in figure 5.2. After connecting the Arduino board to the internet using an Ethernet shield or Wi-Fi module. We can upload the data by setting up a MySQL database and creating a table to store the sensor data. We specified the columns for the data, such as timestamp, gyroscope readings, angle. Using the Arduino library to connect to the MySQL database we inserted the data.

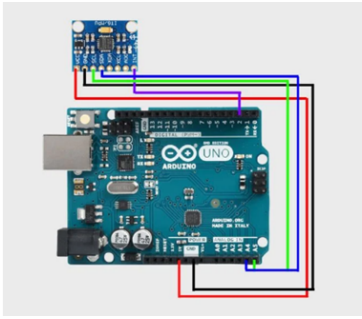


Fig.5.1 Connections of MPU 6050 with Arduino UnoR3

Arduino	MPU6050
5v/3v	VCC
GND	GND
A5/ SCL pin	SCL
A4/SDA pin	SDA
pin 2	INT

Fig.5.2 Connection Table

V. RESULTS

The measurements mentioned above were taken for three subjects of age 21,21,22 respectively and the table in figure 6 summarizes the results obtained. Angle results were verified with MPU6050 and cadence, step length and gait velocity were verified visually.

Subject ID	Angle (in degrees)	cadence (steps per min)	step length (in cm)	Gait velocity (in m/s)
1	153	114	73	1.51
2	152	116	75	1.54
3	155	112	72	1.48

Fig.6 Results obtained

VI. FUTURE SCOPE

1. Clinical evaluation and relevance of the proposed method needs to be examined. By choosing an appropriate gait scale and obtaining their relevant feature data a machine learning model can be trained to classify different types of Gait like Cerebral Palsy, Parkinson's etc. Since our method takes into account only the kinematics data, force measurement and muscle activity can be measured using electromyography sensors to get more insights. A mobile application which integrates all the parametric measurements and provides a user interface could be designed. A powerful microcontroller such as an ESP32 may be used to clock real time data.

VII. CONCLUSIONS

Through this paper we highlighted the use of computer vision and pose estimation for gait observation and analysis. Non wearable techniques are more efficient and do not alter gait. This method could be useful in remotely analyzing and regular monitoring of human gait which can assist doctors in devising treatment protocols.

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Smart Hospital

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***Abstract*—Internet of Things (IoT) technology has attracted much attention in recent years for its potential to alleviate the strain on healthcare systems caused by an aging population and a rise in chronic illness. Standardization is a key issue limiting progress in this area, and thus this paper proposes a standard model for application in future IoT healthcare systems. The primary objective of this project is to help doctors and to take the medical industry a step ahead. This device can be used at hospitals or clinics by doctors or at our homes by common people. This device will help reduce the doctors' workload and time for some pre-medical tests. It will also help in minimizing human errors. This device will help the doctors by measuring the blood pressure, oxygen level, pulse rate, and body temperature of the patient and will also measure the air quality and sanitize the surrounding area. To achieve this Node MCU is used along with various sensors and modules which helps get the desired outcome with max accuracy with a user-friendly experience. The data collected will be monitored/stored on an application/website and different remedies for detected problems would be suggested. Emergency signals would also be sent in case of extreme conditions.**

Keywords—facial Pulse Rate, Sanitization, Oxygen level, Air quality, Healthcare, Node MCU

I. INTRODUCTION

Facial To tackle the problems, we faced during pandemics/ outbreaks and to advance the medical industry, research was conducted that how can AI, robots help tackle this problem. It was noticed that tons of diseases, and viruses show basic symptoms, and hence sometimes it becomes difficult to differentiate. The primary objective of the project was to make a device that can be used by common people and by doctors to save the time spent on a basic check-up. The device made is compact and all in one since it replaces basic monitoring devices like a thermometer and finger caps. the device has 98% accuracy and makes easier for users to monitor different parameters. The device helps us to measure and keep a track of an individual's health. The physical parameters measured are blood pressure, oxygen level, pulse rate, and body temperature. MAX30100 sensor is used to check the oxygen level in blood and pulse rate. The blood pressure measurement setup consists of a belt that is to be attached to the person's arm and a voltage regulator is used to take the reading from the sensor and display it on the device using an I2C EEPROM. The contactless Infrared temperature sensor (MLX90614) is used to measure the body temperature and the ambient temperature and make a rough estimate of the normal or abnormal behavior of the body temperature. The device can be used in different ways, it can be used in a hospital, dispensary, or for personal use at home. The sensors used in the device are all controlled by a Node Mcu. The Node Mcu is used to take inputs from the sensors, process the data, and display the data to the patient/user in a user-friendly language. The Node Mcu is coded in such a way that if the health of the patient in the hospital is not good/normal it will send an emergency signal to the doctor with different emergency levels depending on the health parameters. The sensors selected are of higher accuracy provide near-perfect readings and are convenient to use. The device is designed in such a way that it becomes easy for the patient to use with sensors placed at positions that are quite convenient. The device also takes care of the environment by monitoring the air quality and sanitizing the vicinity. This would be achieved by using a dust sensor that would detect the air quality and the output will be used by an air purifier by regulating the speed of the fan. A 12V pump is used to spray the sanitizer and purify the vicinity. L298 dual H bridge motor driver is used to control the pump. The application plays an important role in communication and keeps records of the patient and improves the communication process.

II. LITERATURE REVIEW

Different papers were studied by the team to compare the device with advancements done in the field and other similar projects. [5]"IoT-based Secure Healthcare Monitoring System" was studied and it was concluded that our sensors achieved higher accuracy and the design was comparatively compact. [8] "An IOT based human healthcare system using Arduino uno board", guided us through the challenges in Arduino uno and how Node MCU could be better in data collection. The Node MCU was later used to store and monitor the data wirelessly on a website/app developed which had better functionality like emergency controls. The sensors are selected depending on their accuracy and size. [9] "Internet of Things-Based Human Healthcare Monitoring System", made use of machine learning and made the system more reliable in terms of data. A different approach of using previously stored data to suggest remedies was taken to decrease the app complexity and thereby make this device a user-friendly one.

III. WORK DONE

Oxygen and Heart Rate Sensor

The MAX30100 is an integrated pulse oximetry and heart rate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals. The MAX30100 operates from 1.8V and 3.3V power supplies and can be powered down through software with negligible standby current, permitting the power supply to remain connected at all times.

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Fig.1

Applications

Wearable Devices, Fitness Assistant Devices, Medical Monitoring Devices

Benefits and Features

Complete Pulse Oximeter and Heart-Rate Sensor Solution Simplifies Design, Integrated LEDs, Photo Sensor, and High-Performance Analog Front -End,Tiny 5.6mm x 2.8mm x 1.2mm 14-Pin Optically Enhanced System-in-Package, Ultra-Low-Power Operation Increases Battery Life for Wearable Devices , Programmable Sample Rate and LED Current for Power Savings • Ultra-Low Shutdown Current (0.7µA, typ).

Temperature Measurement

The MLX90614 is a temperature sensor that operates through contactless infrared (IR) technology, capable of measuring the temperature of an object within the range of -70° C to 382.2°C. Unlike traditional temperature sensors, this sensor uses IR rays to measure the temperature without any physical contact with the object. The sensor communicates the temperature measurement to the microcontroller using the I2C protocol.



Fig.2

MLX90614 Temperature Sensor Specifications: Supply Current: 1.5mA, Operating Voltage: 3.6V to 5V (available in 3V and 5V version), Object Temperature Range: -70° C to 382.2°C, Distance between object and sensor: 2cm-5cm (approx.), Ambient Temperature Range: -40° C to 125°C, Accuracy: 0.02°C, Field of View: 80°,

Working Principle

The MLX90614 sensor can determine the temperature of an object without making any physical contact with it. This is achieved by utilizing the Stefan-Boltzmann Law, which states that all objects and living beings emit IR Energy, and the intensity of this energy is proportional to their temperature. The sensor measures the amount of IR energy emitted by the object to calculate its temperature.

Buzzer Module

Buzzers are a type of electronic device that produce sound and are powered by direct current (DC). They are commonly used in various electronic products such as computers, printers, photocopiers, alarms, electronic toys, automotive electronics, telephones, and timers as sound devices. Buzzers can be classified into two types: active and passive (as shown in the picture below). If you turn the pins of two buzzers upwards, the one with a green circuit board is a passive buzzer, while the one enclosed with a black tape is an active buzzer.

Features

Use an S8550 PNP transistor for drive, Convenient control by program, Working voltage: 3.3 - 5V; PCB size: 2.0 x 2.0 cm, With power light and indicator of digital signal output.



Fig.3

Application

The module is usually used to make sounds via setting under some specific circumstance.

Servo Motor

A servo motor is a precise type of motor that can rotate with great accuracy. It typically consists of a control circuit that provides feedback on the motor shaft's current position, enabling it to rotate with precision. Servo motors are used to rotate objects to specific angles or distances, and they are made up of a simple motor that runs through a servo mechanism. DC servo motors are powered by a DC power supply, while AC servo motors are powered by AC. There are various types of servo motors based on gear arrangement and operating characteristics. Most servo motors are rated in kg/cm, indicating their weight-lifting capacity at a specific distance from the motor shaft. Servo motors are commonly used in applications such as toy cars, RC helicopters and planes, and robotics, among others. The motor's position is determined by an electrical pulse, and its circuitry is situated near the motor.



Fig.4

Servo Motor working mechanism

It consists of three parts:

1. Controlled device

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2. Output sensor
3. Feedback system

It is a closed-loop system where it uses a positive feedback system to control motion and the final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal. Here reference input signal is compared to the reference output signal and the third signal is produced by the feedback system. And this third signal acts as an input signal to the control the device. This signal is present as long as the feedback signal is generated or there is a difference between the reference input signal and reference output signal. So the main task of servomechanism is to maintain the output of a system at the desired value at presence of noises. Servo Motor working principle: A servo motor comprises of a motor (DC or AC), a potentiometer, gear assembly and controlling circuitry. The gear assembly is used to decrease the RPM and increase the torque of the motor. Initially, the potentiometer knob's position generates no electrical signal at the potentiometer's output port, as it is the initial position of the servo motor shaft. An electrical signal is then provided to an input terminal of the error detector amplifier. The feedback mechanism processes the difference between the potentiometer signal and the other source's signal, generating an error signal output. This error signal is then used as input for the motor, which starts rotating. As the motor rotates, the potentiometer's angular position changes, generating a feedback signal. The potentiometer's output signal changes as its angular position changes. When the potentiometer's position reaches a point where its output signal matches the external signal provided, there is no output signal from the amplifier to the motor input, and the motor stops rotating.

MQ-135 Gas Sensor for air quality

The MQ135 is a low-cost gas sensor that comes on a compact printed circuit board. While it is designed mainly for detecting flammable gases, it is advertised as a sensor for air quality in general, rather than a highly accurate device for measuring the concentration of a particular gas.



Fig.5

MQ-135 Sensor Features: Wide detecting scope, Fast response and High sensitivity, Stable and long life, Operating Voltage is +5V, Detect/Measure NH3, NOx, alcohol, Benzene, smoke, CO2, etc., Analog output voltage: 0V to 5V, Digital output voltage: 0V or 5V (TTL Logic), Preheat duration 20 seconds, can be used as a Digital or analog sensor, The Sensitivity of Digital pin can be varied using the potentiometer.

NodeMcu

The NodeMCU is a development platform that combines software and hardware components for IoT projects, centered around the ESP8266 System-on-a-Chip (SoC) manufactured by Espressif Systems. The ESP8266 contains essential elements of a computer system, including CPU, RAM, networking (Wi-Fi), and an operating system with an SDK. However, using the ESP8266 chip can be challenging since it requires soldering wires and low-level programming to interact with it. This complexity is manageable for mass-produced electronics, but not for hobbyists or students who want to experiment with it in their own projects. The Arduino project, on the other hand, is an open-source platform that offers a hardware design and software SDK for a versatile IoT controller. The Arduino board includes a microcontroller, USB connector, LED lights, and standard data pins, along with standard interfaces for interacting with sensors or other boards. Unlike NodeMCU, Arduino boards can have different types of CPU chips and programming environments. Although there is an Arduino reference design for the ESP8266 chip, there are significant variations across vendors. For example, not all Arduino boards have Wi-Fi capabilities, and some have a serial data port instead of a USB port.



Fig.6

IV. IMPLEMENTATION

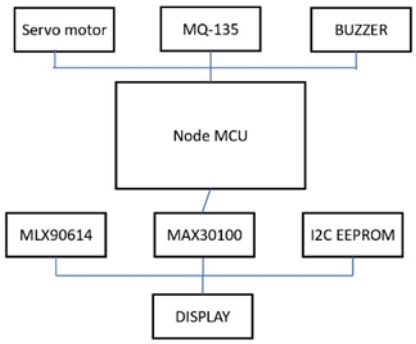


Fig.7

The sensors and other modules were connected to the used development board in the following way. Since all the sensors worked on 3.3V to 5V ratings external batteries were not used for the sensors. The only power supply required was to power the node MCU. Firebase was used to collect the data and then display it on the website and application.

V. RESULTS AND CONCLUSIONS

The device made was able to measure different mentioned parameters of the body in very less time and with high accuracy. The idea of using IoT in healthcare industries was successfully implemented using this device. The main objective of establishing an all-in-one device that can later store the data, display it on an application/website, and suggests remedies to users according to the health quality. The

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device could be used with an external power supply or with batteries which increases its functionality and portability. The emergency conditions were achieved by coding the development board in such a way that if extreme conditions are detected emergency signal would be generated and family members or doctors (depending upon the use) would be notified.

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Heart Rate Monitoring and Disease Detection using Machine Learning

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***Abstract*—In today's era, we are all surrounded by emerging and ever-growing technology around us. Although it has made our lives easier but also made us prone to heart attacks due to extensive sitting such as at the desk, behind the wheel, or in front of the screen. Cardiovascular diseases have emerged as the leading cause of death globally, affecting both developed and developing nations over the past few decades. The mortality rate can be reduced through the early detection of heart disorders and ongoing clinical monitoring. However, identifying cardiac problems reliably requires more intelligence, time, and expertise in all cases. However, it requires more intelligence, time, and skill for reliable identification of cardiac problems in all cases. In this study, a provisional design of a cloud-based cardiovascular monitoring and heart disease prediction system has been put forth to identify imminent heart disease using machine learning techniques.**

Keywords—Heartrate Monitoring, Internet of Things (IoT), ESP8266 Node MCU, Sensors, Machine Learning.

I. INTRODUCTION

Heart disease is a multifaceted condition that can be caused by a variety of factors, including genetics, lifestyle, and environmental factors. Early detection of heart disease can be challenging, and failure to detect it in its early stages can result in serious health complications and death. Pulse sensors, a form of wearable technology, offer a promising solution for detecting heart disease early. They can monitor an individual's heart rate in real-time and provide valuable information about potential risk factors for heart disease. This project aims to develop a system that uses pulse sensors and machine learning algorithms to provide individuals with accurate predictions of their susceptibility to heart disease. To achieve this, the system will utilize NodeMCU's Wi-Fi module to securely transmit pulse wave data to a remote storage platform where it can be analyzed. Machine learning algorithms will be used to analyze the data and identify patterns and risk factors for heart disease. Early intervention and prevention can then be initiated based on the results. The potential impact of this system on improving cardiovascular health outcomes is significant. By providing real-time heart rate monitoring and accurate predictions of heart disease susceptibility, individuals can take control of their health and make informed decisions about their lifestyle and healthcare. This project represents a significant step forward in the development of a more comprehensive approach to heart disease prevention and management, incorporating cutting-edge technology.

II. LITERATURE SURVEY

The human heart is a muscular organ that is an essential component of the circulatory system in the body of a living human being. The lungs and a network of blood vessels throughout the body, including veins, arteries, and capillaries, are also part of the cardiovascular system. These blood vessels are responsible for carrying blood to various parts of the body. When there is an abnormality in the blood flow that originates from the heart, it can lead to a variety of heart diseases, also known collectively as cardiovascular diseases (CVD). According to the World Health Organization (WHO), heart diseases are the leading cause of death all over the world. They estimate that 17.5 million deaths around the world are the result of heart attacks and strokes. The majority of these fatalities take place in countries with low and middle incomes, and strokes and heart attacks are responsible for eighty percent of these deaths. Early detection of cardiac abnormalities and prediction tools can help to save lives by enabling doctors to develop an effective treatment plan, which can ultimately lead to a reduction in the mortality rates caused by cardiovascular diseases.

III.OVERVIEW OF THE PROPOSED SYSTEM

The block diagram of the proposed heart rate monitoring and disease prediction system on ESP8266 is shown in the figure below:

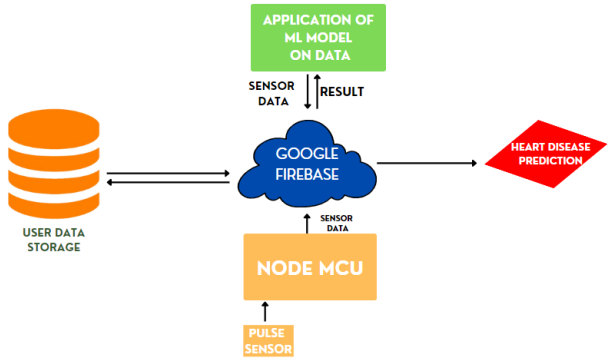


Fig.1

This project involves obtaining pulse wave data from a pulse sensor and transmitting it using Node Mcu's in-built Wi-Fi module. The received analog signal is then converted to a digital signal to obtain a suitable value, which is stored in Google Firebase. This stored data is utilized by a machine learning model to provide an accurate prediction of an individual's susceptibility to heart disease.

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By leveraging the pulse sensor's ability to capture real-time heart rate data, this project aims to provide individuals with valuable insights into their cardiovascular health. The use of NodeMcu's Wi-Fi module enables the transmission of this data to a remote storage platform, where it can be securely stored and accessed for further analysis. The conversion of the analog signal to a digital signal allows for the data to be accurately interpreted by the machine learning model. By leveraging this technology, the model can analyze patterns in the data to provide predictions on an individual's likelihood of developing heart disease. Overall, this project demonstrates the potential of combining cutting-edge technology, such as pulse sensors and machine learning models, with remote data storage platforms to provide individuals with powerful insights into their health.

Hardware

Node MCU

The ESP8266 is a low-cost, Wi-Fi-enabled microcontroller that was developed by the Chinese company Espressif Systems. It has become a popular choice for DIY projects and IoT (Internet of Things) applications because of its low cost, ease of use, and wide range of features. The ESP8266 comes in several different models, each with varying amounts of memory and processing power, and can be programmed using a variety of programming languages, including Arduino, Lua, and Micro Python. It is widely used in projects such as home automation, sensor networks, and remote-control applications.

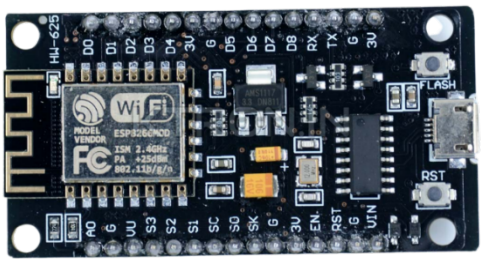


Fig.2

Pulse Sensor

A pulse sensor is a small electronic device that measures the heart rate of an individual. It works by detecting the pulse waves in the blood vessels of the fingertip and converting them into electrical signals. The pulse sensor can be easily attached to the fingertip, and it uses light-based technology to measure the blood flow through the finger.

The pulse sensor is commonly used to showcase real-time heartbeat data. It is often used in wearable fitness devices and health monitoring systems. By measuring the heart rate in real-time, the pulse sensor can provide users with valuable information about their physical exertion levels during exercise, stress levels during daily activities, and general heart health. This real-time data can be displayed on a screen or transmitted wirelessly to a smartphone or other device for further analysis.

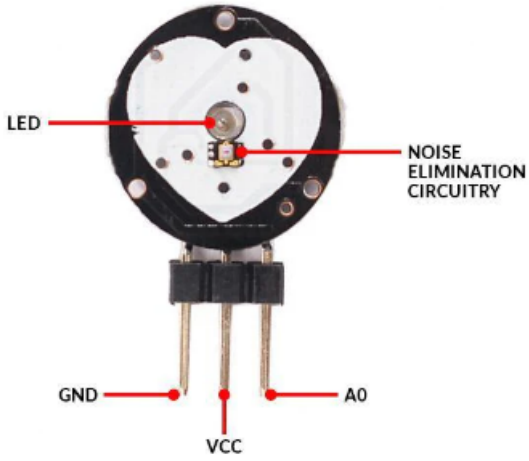


Fig.3

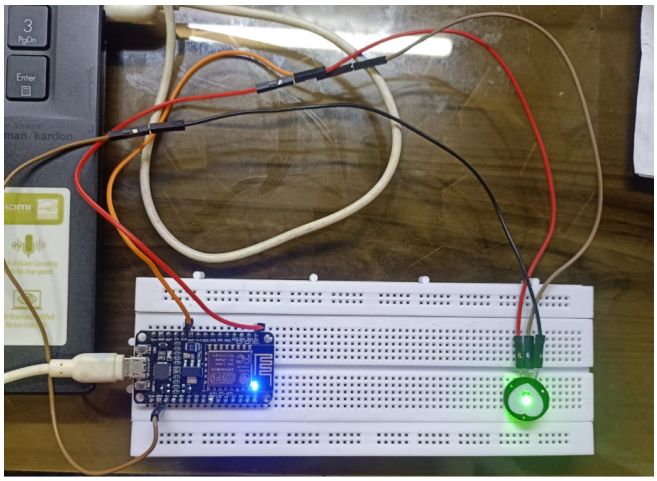


Fig.4

Software

Machine Learning

Machine learning algorithms can be implemented using a variety of data mining methods. WEKA, TANAGRA, RapidMiner, MATLAB, Apache Mahout, Jupyter Labs, Microsoft's Azure Machine Learning Studio, and others are examples of regularly used free and open-source technologies. In this work, Jupyter Notebook was one of them.

To validate the model's performance, machine learning methods were applied on the Statlog Database and the UCI Machine Learning Repository Dataset. For performance measurement, only those of those five with higher accuracy (i.e., more than 80%) are taken into account. A brief description of each is provided below:

Logistic Regression Algorithm:

Logistic regression is a type of supervised learning that is commonly used to predict the probability of a binary (yes/no) event. Its primary application is in forecasting the likelihood of a specific outcome occurring. The logistic function, also

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known as the sigmoid function, is used in logistic regression to calculate probability. It is a simple S-shaped curve that is applied to data to transform it into a value between 0 and 1. The resulting value represents the probability of a specific event occurring, with 0 indicating that the event is unlikely to occur and 1 indicating that the event is highly likely to occur.

```
confusion matrix
[[21  6]
 [ 3 31]]


Accuracy of Naive Bayes model: 85.24590163934425

              precision    recall  f1-score   support

           0       0.88      0.78      0.82        27
           1       0.84      0.91      0.87        34

    accuracy                           0.85        61
   macro avg       0.86      0.84      0.85        61
weighted avg       0.85      0.85      0.85        61
```

Naive Bayes Algorithm:

Naive Bayes is a multi-class and binary (two-class) classification algorithm. When the method is explained using binary or category input values, it is simplest to understand. To make the computation of the probability for each hypothesis manageable, the probabilities are simplified. Instead of attempting to compute each attribute value individually, P(d1, d2, d3|h), they are believed to be conditionally independent given the goal value and calculated as P(d1|h) * P(d2|H), and so on.

```
confusion matrix
[[21  6]
 [ 3 31]]


Accuracy of Naive Bayes model: 85.24590163934425

              precision    recall  f1-score   support

           0       0.88      0.78      0.82        27
           1       0.84      0.91      0.87        34

    accuracy                           0.85        61
   macro avg       0.86      0.84      0.85        61
weighted avg       0.85      0.85      0.85        61
```

Random Forest Classifier:

In the realm of data science, one of the classification strategies that is most well-known and utilized frequently is the Random Forest algorithm. The Random Forest algorithm is a type of Supervised Machine Learning that has found widespread use in the fields of classification as well as regression. This is due to the fact that it can learn from its own mistakes. It first constructs decision trees with the help of a variety of samples, then uses the results of a majority vote on those samples to decide how to categorize them, and finally uses an average to figure out how much they vary. The ability of the Random Forest Algorithm to deal with data sets that contain both continuous and categorical variables, as is the case with regression and classification, respectively, is one of the characteristics that contributes the most significantly to the algorithm's usefulness and is one of the characteristics that makes it possible for the algorithm to deal with data sets that contain both continuous and categorical variables. Classification and regression are two areas in which it performs significantly better than its competitors.

```
confusion matrix
[[22  5]
 [ 3 31]]


Accuracy of Random Forest: 86.88524590163934

              precision    recall  f1-score   support

           0       0.88      0.81      0.85        27
           1       0.86      0.91      0.89        34

    accuracy                           0.87        61
   macro avg       0.87      0.86      0.87        61
weighted avg       0.87      0.87      0.87        61
```

Extreme Gradient Boost:

Extreme Gradient Boosting, also known as XGBoost, is an open-source software package that facilitates the implementation of gradient boosting in a manner that is both highly efficient and effective. Gradient boosting is a set of ensemble machine-learning techniques that can be used for classification or regression predictive modelling problems. Decision tree models serve as the building blocks for ensembles and are used in gradient boosting as a set of techniques. The procedure involves fitting individual trees to the ensemble one at a time, with subsequent models correcting any errors that were present in the earlier models. XGBoost makes use of a technique known as gradient descent, which is an optimization process, in conjunction with gradient boosting, which can use any differentiable loss function. In a manner analogous to that of a neural network, this makes it possible to reduce the loss gradient while simultaneously fitting the model. In the context of ensemble models, the term "boosting" refers to a particular type of model that can be applied to either binary or category input values. On the other hand, Naive Bayes is a classification algorithm that can be applied to problems involving both binary and multi-class predictions. It first determines the probabilities associated with each class, after which it chooses the category that has the best odds. The term "naive" refers to this approach because it makes the assumption that individual characteristics exist in isolation from one another. Text classification is one of the many natural language processing tasks that make use of this algorithm, which despite its simplicity also possesses considerable power..

```
confusion matrix
[[22  5]
 [ 4 30]]


Accuracy of Extreme Gradient Boost: 85.24590163934425

              precision    recall  f1-score   support

           0       0.85      0.81      0.83        27
           1       0.86      0.88      0.87        34

    accuracy                           0.85        61
   macro avg       0.85      0.85      0.85        61
weighted avg       0.85      0.85      0.85        61
```

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K-Nearest Neighbors Algorithm:

The K-Nearest Neighbors algorithm, also referred to as KNN or k-NN, is a non-parametric, supervised learning classifier that makes classifications or predictions about the grouping of individual data points based on their proximity to one another. K-Nearest Neighbors was the company that came up with this algorithm. This algorithm is a form of supervised machine learning algorithm that has the capability of being applied to problems involving both classification and regression predictive analysis. It can be found in the following sentence: It employs a technique known as "feature similarity" to estimate the values of new datapoints, which further denotes that the new datapoint will be assigned a value based on how closely it resembles the points in the training set. This is done in order to make accurate predictions about the values of new datapoints. This additionally signifies that a value will be assigned to it based on how closely it matches the points in the training set.

```
confusion matrix
[[24  3]
 [ 4 30]]


Accuracy of K-NeighborsClassifier: 88.52459016393442

              precision    recall  f1-score   support

           0       0.86      0.89      0.87        27
           1       0.91      0.88      0.90        34

    accuracy                           0.89        61
   macro avg       0.88      0.89      0.88        61
weighted avg       0.89      0.89      0.89        61
```

Decision Tree Classifier:

A decision tree is a non-parametric supervised learning method that may be used for classification and regression tasks. It is a type of decision tree that is called a decision tree classifier. It is organized in a hierarchical tree fashion, with a root node, branches, internal nodes, and leaf nodes in addition to the other nodes. In the field of machine learning, supervised learning algorithms, such as decision trees, are frequently utilized to model and predict outcomes based on the data that is fed into the system. It is organized in the form of a tree, with each internal node representing a decision or test on a particular feature or attribute, each branch representing the result of that choice, and each leaf node representing the conclusion or prediction reached by the model.

```
confusion matrix
[[23  4]
 [ 7 27]]


Accuracy of DecisionTreeClassifier: 81.9672131147541

              precision    recall  f1-score   support

           0       0.77      0.85      0.81        27
           1       0.87      0.79      0.83        34

    accuracy                           0.82        61
   macro avg       0.82      0.82      0.82        61
weighted avg       0.82      0.82      0.82        61
```

Support Vector Machine:

Support Vector Machines (SVMs) are a class of supervised learning models used for classification and regression analysis in the field of machine learning. The SVM method establishes statistics of support vectors and uses them to classify data, even when the data has not been labeled. To classify such data, unsupervised learning algorithms are employed to discover the natural clustering of the data into groups, which are then used to guide the mapping of new data. The SVM technique aims to find the best line or decision boundary to separate the n-dimensional space into classes, allowing new data points to be placed in the correct category in the future. The hyperplane is the term used to describe this optimal decision boundary, and SVM selects extreme points and vectors that contribute to the creation of the hyperplane. These exceptional cases are known as support vectors, which gives the method its name: Support Vector Machines.

```
confusion matrix
[[23  4]
 [ 3 31]]


Accuracy of Support Vector Classifier: 88.52459016393442

              precision    recall  f1-score   support

           0       0.88      0.85      0.87        27
           1       0.89      0.91      0.90        34

    accuracy                           0.89        61
   macro avg       0.89      0.88      0.88        61
weighted avg       0.89      0.89      0.88        61
```

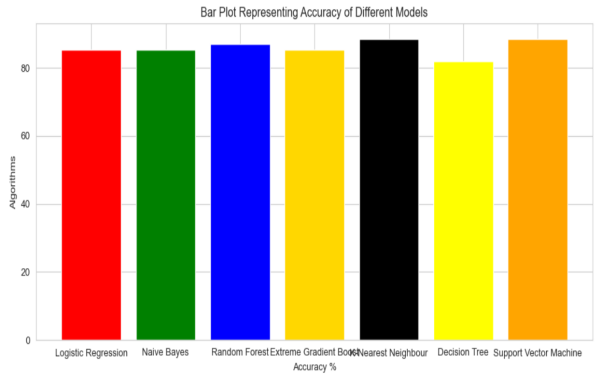


Fig.5

On the application of these Machine Learning Algorithms, we found that Support Vector Classifier gave us the highest and the most accurate results.

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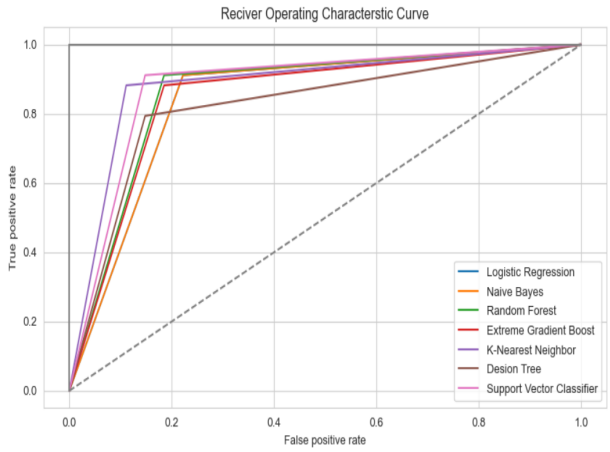


Fig.6

The above choice has been made with reference to the confusion matrix, receiver operating characteristics, area under the curve and the classification reports generated by Scikits's sklearn.metrics package.

	Model	AUC	Accuracy
0	Logistic Regression	84.477124	85.245902
1	Naive Bayes	84.477124	85.245902
2	Random Forest	86.328976	86.885246
3	Extreme Gradient Boost	84.858388	85.245902
4	K-Nearest Neighbour	88.562092	88.524590
5	Decision Tree	82.298475	81.967213
6	Support Vector Machine	88.180828	88.524590

The application of the Support Vector Classifier, we generate a predictive binary variable called svc_predicted which takes into consideration the attributes of our dataset. Using NumPy and MatPlotLib modules, we classify the generated values into Anomalies Detected is represented by 1 and No Disease Detected is represented by 0.

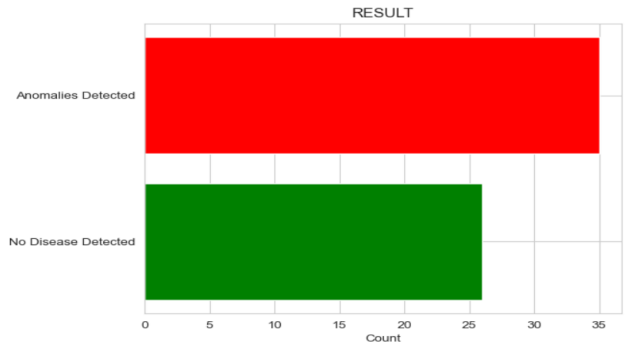


Fig.7

Datasets

The values that are listed represent various characteristics or variables contained within a dataset. An explanation of each of these variables is provided in the following paragraphs:

This dataset contains a number of variables that are frequently utilised in research or models pertaining to cardiovascular health and heart disease. These variables include age, sex, the type of chest pain the patient is experiencing, resting blood pressure, serum cholesterol level, fasting blood sugar, resting electrocardiographic results, maximum heart rate achieved during exercise, exercise-induced angina, ST depression induced by exercise relative to rest, the slope of the peak exercise ST segment, the number of major vessels coloured by fluoroscopy, the presence of thalassemia, and the presence of heart disease. In the chest pain type variable, a value of 1 indicates typical angina, a value of 2 indicates atypical angina, a value of 3 indicates non-anginal pain, and a value of 4 indicates asymptomatic chest pain. The female gender is represented by the value 0, and the male gender is represented by the value 1. A value of 1 indicates that fasting blood sugar is greater than 120 mg/dl, while a value of 0 indicates that this condition does not exist. A code of 0 indicates that the resting electrocardiographic results are normal, a code of 1 indicates that there is an ST-T wave abnormality, and a code of 2 indicates that there is either probable or definite left ventricular hypertrophy. The slope of the peak exercise ST segment variable is coded as 1, which indicates an upward slope, 2, which indicates a flat slope, and 3, which indicates a downward slope. In the thalassemia variable, the value 3 indicates normal, the value 6 indicates a fixed defect, and the value 7 indicates a reversible defect. The presence of heart disease is denoted by the target variable, which is coded as either a 1 or a 0 depending on whether or not it is present. These factors are frequently considered in research and modelling pertaining to cardiovascular health and diseases like heart disease.

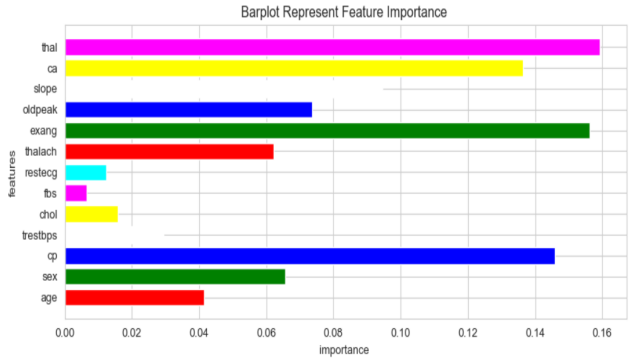


Fig.8

IV.FUTURE SCOPE

A heart rate monitoring and disease prediction system using NodeMCU and pulse sensor has a promising future scope in the healthcare industry. The system can provide real-time monitoring of heart rate and other vital signs, which can help detect any abnormalities or irregularities in the heart rate and identify potential health problems.With the advancement in machine learning and AI, the system can be trained to predict potential diseases based on the changes in heart rate and other vital signs. This can help healthcare professionals to diagnose and treat diseases at an early stage, leading to better patient outcomes.The system can also be integrated with mobile applications, allowing patients to monitor their heart rate and vital signs from the comfort of their homes. This can help in remote patient monitoring, reducing hospital visits and

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improving patient experience.Overall, a heart rate monitoring and disease prediction system using NodeMCU and pulse sensor has a bright future scope in the healthcare industry, and it can revolutionize the way we monitor and diagnose diseases.

V. TECHNICAL ANALYSIS

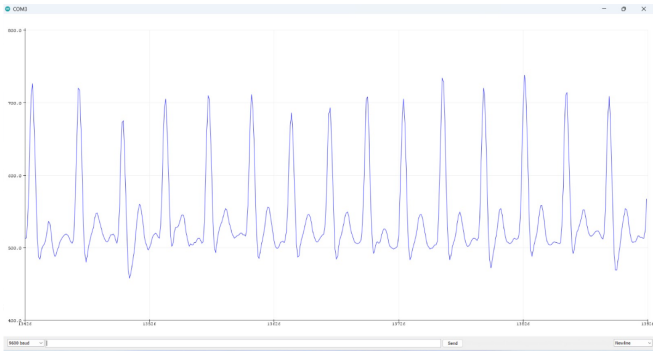


Fig.8

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Sewage Monitoring System

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***Abstract*—The sewage system is a key component of a city and is in charge of handling the accumulation of both rainwater and grey water from residences and businesses. To prevent a major interruption, it is crucial to have a monitoring system and a strategy in place before expanding the sewage management system. If the drainage system is not adequately maintained, it could result in blockages and sewage overflows, which would then contaminate clean water and spread infectious diseases. Sewer blockages are a major contributor to both sewer flooding and pollution. Because they might not be aware of the situation inside the manhole, workers may occasionally experience an accident due to ignorance. However, there is no monitoring system in several overpopulated cities in the world, and the expansion process faces myriad difficulties and takes much time. This paper presents a model for an intelligent sewerage management system that provides real-time monitoring and automatic clearance of blockage, using water-level sensor, flow sensors, blower and a microcontroller. Considering a deficient cost model, this system can intensify the performance of poorly managed sewerage systems.**

Keywords—Sewage Monitoring, WizFi360-Pico, Notecard Wifi, Flow Sensor, Water Level Sensor, AWS cloud.

I. INTRODUCTION

Smart cities are emerging quickly, yet the difficulties they face are still those of the prehistoric era. Modern technological improvements and sophistication in planning systems are greatly needed in the current society. For the age-old issues, smart cities require smart solutions where the infrastructure of the city is maintained by the installation of sensors. Sewage and wastewater management is a critical aspect of modern urban living, as it is essential to maintain a healthy and safe environment for people and wildlife. Poorly managed sewage systems can lead to the contamination of water bodies, which can have severe consequences for human and animal health. If this issue is not addressed, serious consequences result. The presented technology is installed in a few key sewers for early evaluation. Using the capabilities of microprocessors, smart sewage systems. This saves labour and provides a quick assessment of the issue. The system must be compatible with common monitoring and alarm systems so that sewer variations may be carefully examined.. A sewage monitoring system is a complex network of sensors and monitoring equipment that is installed throughout the sewage system. This system is designed to provide real-time data on the status of the sewage system, including the flow rate, the level of contaminants, and the presence of any pollutants or hazardous materials. The data collected by the monitoring system is then analyzed using advanced machine learning algorithms, which can provide insights into the performance of the system. This information can be used to optimize the system, improve its efficiency, and reduce the risk of contamination. One of the primary benefits of a sewage monitoring system is that it can help to identify problems before they become serious. By detecting issues early, it is possible to implement corrective measures before they escalate, which can help to prevent the spread of disease and other health risks. Additionally, a sewage monitoring system can also help to reduce the cost of sewage management. By providing real-time data on the performance of the system, it is possible to optimize the use of resources and reduce waste, which can ultimately save money and reduce the environmental impact of sewage management.

II. OBJECTIVE

The objective of a sewage monitoring system is to improve the management of wastewater and reduce the risk of water contamination. This is achieved by using sensors and monitoring equipment that are installed throughout the sewage system to provide real-time data on the status of the system, including the flow rate, the level of contaminants, and the presence of any pollutants or hazardous materials. The data collected by the monitoring system is then analysed using advanced machine learning algorithms to optimize the system, improve its efficiency, and reduce the risk of contamination. The objective of a plastic elimination system, on the other hand, is to reduce the amount of plastic waste that enters water bodies. Plastic pollution has become a significant environmental issue worldwide, with plastic waste being found in landfills, oceans, and freshwater bodies. One of the main contributors to plastic waste in water bodies is sewage systems. Plastic waste is often flushed down toilets, ending up in sewage systems and ultimately polluting the environment. Therefore, a plastic elimination system aims to detect and remove plastic waste from sewage systems before it enters water bodies, thus protecting the environment and preventing the spread of plastic pollution. the use of a smart sewage monitoring system that uses sensors to detect plastic waste in sewage systems. The system would also use a plastic eliminator unit to remove plastic waste from the sewage system. The study suggested that this approach could significantly reduce the amount of plastic waste entering water bodies.

III. PROPOSED DESIGN

The block diagram of a proposed sewage monitoring system on WizFi360-Pico is shown in the figure below:

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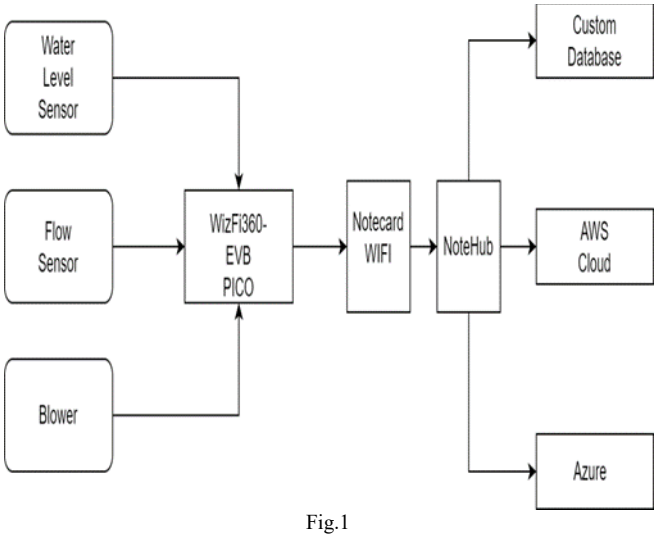


Fig.1

The images obtained using the ESP32 camera module are processed and used to monitor crop health in a visual fashion. The contents of the captured image are identified using a Machine-learning model. The data from the various sensors, for example, pH sensors, level sensor, temperature sensor, etc. is used by the microcontroller to selectively drive the pumping motor, The threshold values considered for turning the motor on and off are decided by keeping the optimal conditions for the growth of that particular crop in mind._WizFi360, based on Raspberry Pi Pico,acquires the data from Water level sensor and flow sensor and the threshold values obtained from this data is considered for turning the blowers motor on or off. When the situation gets out of control the notification is sent to the respected authorities for human intervention.

WizFi360-EVB Pico

Based on the Raspberry Pi Pico/RP2040, the WizFi360- EVB-Pico uses a WizFi360 module to add Wi-Fi connectivity. It is perfect for the creation of IoT solutions and has pin compatibility with the Raspberry Pi Pico board. According to the pinout illustration further down the page, the WizFi360 connector is directly connected to the GPIO of the RP2040. It has the same pinout as the Raspberry Pi Pico board, except the WizFi360 module is linked to GPIO4, GPIO5, GPIO6, GPIO7, and GPIO20. To use the WiFi capability, these pins enable UART communication with the WizFi360.

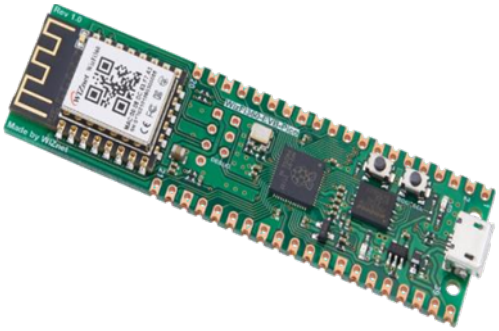


Fig.2

Water Level Sensor

A tool used to monitor and measure liquid (and occasionally solid) levels is called a water level sensor. The sensor turns the sensed data into an electrical signal when the liquid level is identified. When exposed to water, the power and sense traces combine to form a variable resistor (similar to a potentiometer) whose resistance changes. The sensor's resistance varies inversely with its submersion depth in water. The conductivity and resistance improve as the sensor is submerged in more water. The conductivity and resistance are negatively correlated with the amount of water the sensor is submerged in. The sensor produces an output voltage proportionate to the resistance; the water level may be determined by measuring this voltage determined.

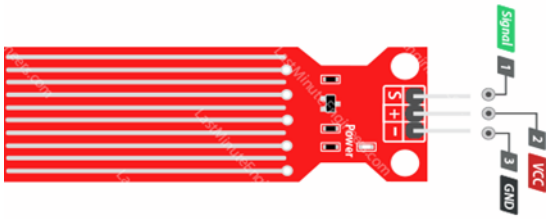


Fig.3

Flow Sensor

We use a water flow sensor to measure the water flow rate. The water flow rate is the volume of fluid that passes per unit time. It's quite simple inside. The main components are the Hall Effect sensor, turbine wheel, and magnet. The water flows in through the inlet and out through the outlet. The water current drove the wheel to turn, and the magnet on the wheel turned with it. Magnetic field rotation triggers the Hall sensor, which outputs high and low level square waves (pulse). For every round of the wheel, the volume of water flowing through is a certain amount, as is the number of square waves.



Fig.4

Blower

Blowers are installation tools that use the force from the motor to rotate the fan while transferring air at high or low pressure in the environment they are used in. Blowers are plumbing devices that move air in an emitted environment at high flow rates or low pressure by rotating a fan with the force of an engine. The blowers' rotating fan draws air into the suction portion. After that, the outlet side receives the trapped air. Air is frequently moved using blowers. For your application areas, MIT brand blowers provide the most

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dependable service in terms of size, performance, and technology.



Fig.5

Blues Wireless Notecard

The Wi-Fi Notecard is a version of the Blues Wireless Notecard with Wi-Fi connectivity in place of cellular. The device is the same size as all cellular Notecards and follows the same m.2 pinout. What's more, the Wi-Fi Notecard uses the same powerful JSON-based programming interface, meaning that developers can easily add Wi-Fi as a deployment option for their IoT solutions, with minimal impact to their existing host applications.



Fig.6

Notehub

Notehub is a cloud-based service designed to connect to Notecard devices and synchronize Notefiles. Notehub.io provides a UI and a Restful API which allow you to explore the vast collection of data and metadata created by the Notecard/Notehub infrastructure. Notehub also provides functionality for interacting with Notecards, securely routing data, managing Notecard and host firmware, as well as managing projects, fleets, and teams. One powerful feature of Notehub is routes, which allow you to forward your data from Notehub to a public cloud like AWS, Azure, or Google Cloud, a messaging platform like MQTT, or a custom HTTP/HTTPS endpoint. Routes are defined in a Notehub for a single project, and can target a single fleet or all devices. A Notehub project can have multiple routes defined and active at any one time.

IV. METHODOLOGY

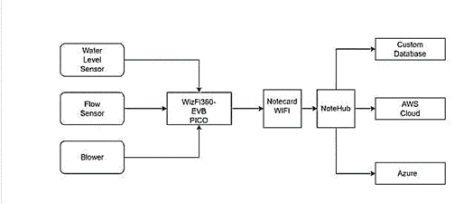


Fig.7

Install two flow sensors at a distance from each other in the sewage pipeline to measure the flow rate of the sewage. The flow sensors should be connected to the microcontroller. The microcontroller should be programmed to constantly compare the input from both flow sensors. If there is a significant difference in the flow rates, it could indicate a blockage in the pipeline. If a blockage is detected, the microcontroller should activate the blower to push the sewage in the forward direction.

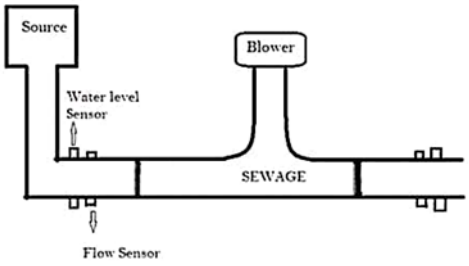


Fig.8

The blower should be installed at a suitable location in the pipeline. Once the sewage has been pushed to a particular manhole using the blower, a robot can be used to remove the sewage. The robot should be equipped with a suitable mechanism for removing the sewage and disposing of it in a proper manner. After the sewage has been removed, the flow sensors and the blower should be checked for any damage or malfunction. The pipeline should also be inspected for any potential blockages or other issues that may require attention. Proper maintenance and regular inspections should be carried out to prevent blockages and ensure the smooth flow of sewage through the pipeline. This includes regular cleaning and flushing of the pipeline, as well as monitoring the flow rate using the flow sensors.

V. RESULTS AND CONCLUSIONS

Early detection of blockages: The use of flow sensors and other monitoring devices can help to detect blockages early, before they become a major problem. This can reduce the risk of damage to the pipeline and prevent downtime. The use of blowers to push the blockage forward in the pipeline is an automated and efficient method of removing blockages, which can reduce the need for manual cleaning or chemical treatments. The use of flow sensors and blowers to detect and remove blockages can be more cost-effective than other traditional methods of wastewater management, such as regular manual cleaning or chemical treatments. The system can be designed to use renewable energy sources such as solar power or biogas, making it a more sustainable and environmentally friendly option for wastewater management. The system can be remotely monitored and controlled, which allows the operators to quickly detect and respond to any

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issues in the system from a central location, reducing maintenance costs and downtime.

VI. FUTURE SCOPE

The sewage monitoring and treatment system described above has several future scope and potential for further development. Some of these include: Smart Sensing: The use of advanced sensors and monitoring systems can provide real-time data on the flow rate, pressure, and quality of sewage in the pipeline. This data can be used to optimize the operation of the blowers and other treatment systems, improve energy efficiency, and reduce maintenance costs.
Artificial Intelligence: The use of artificial intelligence (AI) and machine learning algorithms can help to analyze the data collected from the sensors and other monitoring devices to identify patterns and trends, predict future blockages, and optimize the operation of the treatment system. Internet of Things (IoT): The integration of IoT devices such as smart valves, pumps, and flow meters can provide a more interconnected and efficient sewage treatment system. These devices can communicate with each other and with a central control system to optimize the flow of sewage and prevent blockages from occurring. Green Energy: The use of renewable energy sources such as solar power and biogas can help to reduce the carbon footprint of the sewage treatment system and make it more sustainable. These energy sources can power the blowers and other treatment systems, reducing the reliance on fossil fuels. Remote Monitoring: The use of remote monitoring and control systems can enable the operators to monitor and control the sewage treatment system from a central location. This can improve the efficiency of the system, reduce maintenance costs, and minimize downtime due to equipment failure or blockages. Overall, the future scope of the sewage monitoring and treatment system is vast, and it presents an opportunity for innovation and development in the field of wastewater management. With the use of advanced technology and sustainable practices, the system can become more efficient, cost-effective, and environmentally friendly.

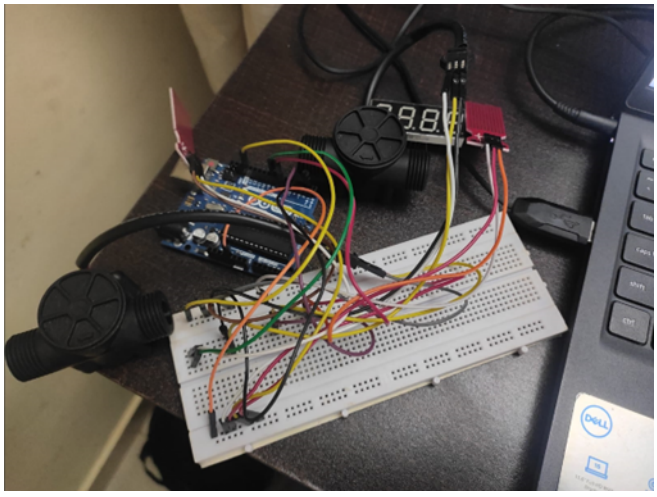


Fig.9

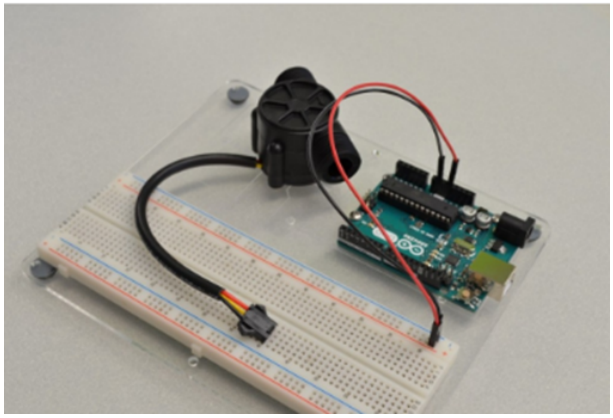


Fig.10

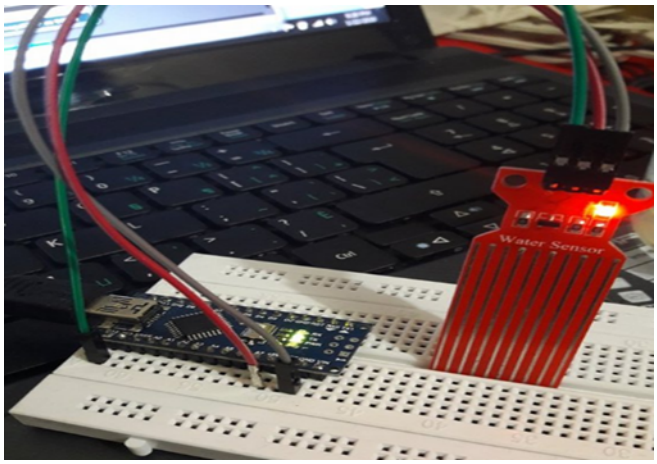


Fig.11

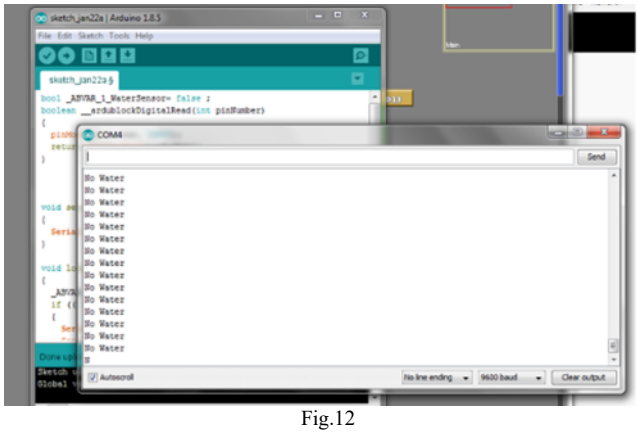


Fig.12

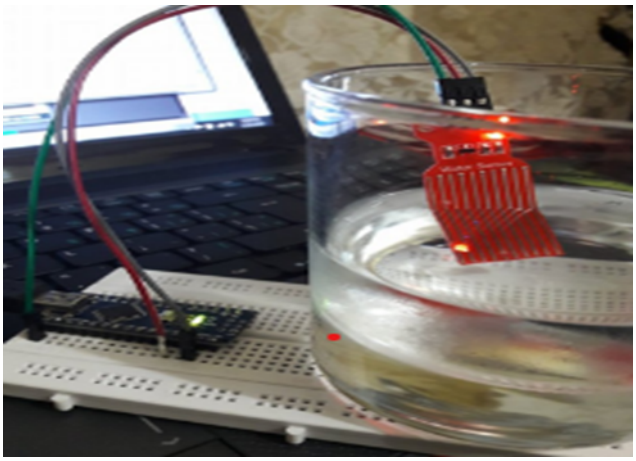


Fig.13

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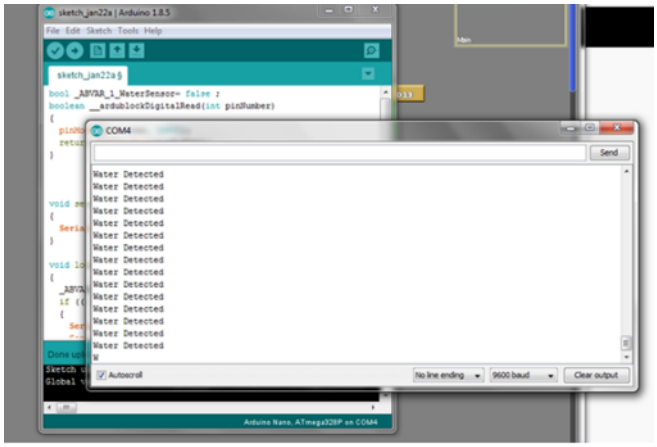


Fig.14

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Decentralized Ecommerce for luxury goods

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***Abstract*— Decentramerce is a decentralized e-commerce platform that is changing the way buyers and sellers engage in secure online transactions for luxury goods. The platform leverages blockchain technology, providing an immutable ledger and a transparent platform for users. By using Flutter for its mobile application and Solidity and Hardhat for its smart contract development, Decentramerce offers a web 3.0 solution for the luxury goods market. With its transparent and reliable platform, Decentramerce provides buyers with access to the full history of high-end items, including watches, handbags, and jewelry. This feature allows buyers to assess the authenticity and value of the product they are interested in. The decentralized nature of the platform ensures that each item's history is transparent and immutable, reducing the risk of fraud and counterfeiting. Vendors can also sell their luxury goods on the platform, eliminating the need for intermediaries and reducing fees. The user-friendly interface makes it easy for vendors to upload product descriptions and images, presenting their items in the best possible light. Overall, Decentramerce offers a web 3.0 solution to the challenges associated with traditional e-commerce platforms, providing a fully decentralized and transparent platform for secure and costeffective transactions in the luxury goods market ensuring the true value of the product.**

Keywords—Decentralized; E-commerce; Blockchain Technology; Web 3.0; Flutter; Solidity; Hardhat; Immutable ledger.

I. INTRODUCTION

In recent years, e-commerce has transformed the way we shop for goods and services. The convenience and accessibility of online platforms have made them increasingly popular, even for luxury goods. However, traditional e-commerce models have limitations, particularly when it comes to the authenticity, transparency, and security of transactions involving luxury items. Counterfeit products, fraudulent sellers, and lack of transparency in the supply chain are just a few of the issues that can plague traditional e-commerce platforms. To address these challenges, a decentralized e-commerce mobile application for luxury goods has been proposed. This innovative platform utilizes blockchain technology to provide a transparent, secure, and trustworthy environment for buying and selling luxury goods. By leveraging the unique features of blockchain, this decentralized platform aims to eliminate many of the issues associated with traditional e-commerce platforms. One of the main advantages of a decentralized e-commerce platform is its increased transparency. The blockchain technology enables every transaction to be recorded and verified, providing a complete and immutable record of each item's journey from the manufacturer to the consumer. This transparency ensures that buyers can trust that they are getting what they paid for, and sellers can prove the authenticity of their products. Another significant advantage of a decentralized e-commerce platform is the enhanced security it offers. Because blockchain technology uses advanced cryptographic techniques to secure transactions, the platform is resistant to tampering and hacking attempts. This increased security is particularly crucial in the luxury goods market, where the high value of products makes them a target for fraudsters. Finally, the proposed decentralized ecommerce mobile application for luxury goods aims to provide an engaging and unique user experience. By utilizing blockchain technology, the platform can offer new and exciting features that traditional e-commerce platforms cannot. For example, the platform could offer a loyalty program based on blockchain tokens or enable users to invest in high-end items. In conclusion, the proposed decentralized e-commerce mobile application for luxury goods has the potential to revolutionize the luxury goods market. By providing increased security, transparency, and authenticity, the platform offers a trustworthy and unique shopping experience. As blockchain technology continues to evolve, we can expect to see even more innovative applications of this technology in the e-commerce space.

II. LITERATURE SURVEY

In recent years, e-commerce has become a dominant trend in the retail industry. With the advent of blockchain technology, decentralized e-commerce platforms have emerged, offering various advantages such as increased security, transparency, and efficiency. The purpose of this literature survey is to explore the existing research on decentralized e-commerce mobile applications. Decentralized E-commerce Mobile

Applications:

Decentralized e-commerce mobile applications are built on blockchain technology, which allows for secure, transparent, and efficient transactions. The literature suggests that decentralized e-commerce mobile applications offer various advantages over centralized ones, such as lower fees, faster transactions, and increased security. Some of the notable decentralized e-commerce mobile applications include OpenBazaar, Syscoin, and Origin Protocol. Security: One of the main advantages of decentralized e-commerce mobile applications is security. Decentralized applications are built on blockchain technology, which offers immutability, transparency, and increased security. Transactions on decentralized platforms are secured using cryptographic protocols, making them tamper-proof and fraud resistant. The

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literature suggests that decentralized e-commerce mobile applications can offer a higher level of security than traditional centralized e-commerce platforms. Efficiency: Decentralized e-commerce mobile applications are also known for their efficiency. Transactions on decentralized platforms are processed faster than those on traditional centralized platforms. Decentralized applications use smart contracts to automate various processes, such as order fulfillment and payment processing, which reduces the need for intermediaries and increases efficiency. The literature suggests that decentralized e-commerce mobile applications can offer a faster and more efficient way of doing business. User Experience: The literature suggests that user experience is an essential aspect of any e-commerce platform, and decentralized e-commerce mobile applications are no exception. Decentralized applications offer a user-friendly interface that is easy to navigate, making it easy for users to buy and sell goods and services. The literature also suggests that decentralized e-commerce mobile applications offer a more personalized user experience, allowing users to interact with sellers directly. Conclusion: In conclusion, the literature suggests that decentralized e-commerce mobile applications offer various advantages over traditional centralized ecommerce platforms. These advantages include increased security, efficiency, and a better user experience. As blockchain technology continues to evolve, decentralized ecommerce mobile applications are likely to become more prevalent in the e-commerce industry.

III. METHODOLOGY

The proliferation of the blockchain technology has resulted in the emergence of new opportunities for the development of applications. Decentralized applications, also known as decentralized applications, are gaining popularity due to the fact that in comparison to traditional centralised applications, they provide higher levels of both security and transparency. Despite this, developing decentralised applications (dApps) can be difficult because they demand a different approach to authentication and the management of data. Flutter is a crossplatform mobile application technology that enables us to create a single codebase that can be used on both Android and iOS devices. We decided to build our mobile application with Flutter so that we could find a solution to the challenges that were presented to us. The hot reload and hot restart features of Flutter contribute to the development process being both quicker and more efficient. Through the use of Flutter, we are able to reach a greater number of users without the need to individually develop apps for both Android and iOS. We came to the conclusion that the Ethereum blockchain would be the best fit for our authentication procedure in order to maintain the decentralised nature of our platform. The addresses of the users' Ethereum Network wallets are used to verify a user's identity; these addresses act as a one-of-a-kind identifier on the chain that verifies the user's credentials. The application makes use of this one-of-a-kind identifier to then keep tabs on a variety of things, including user transactions and rewards, among other things.

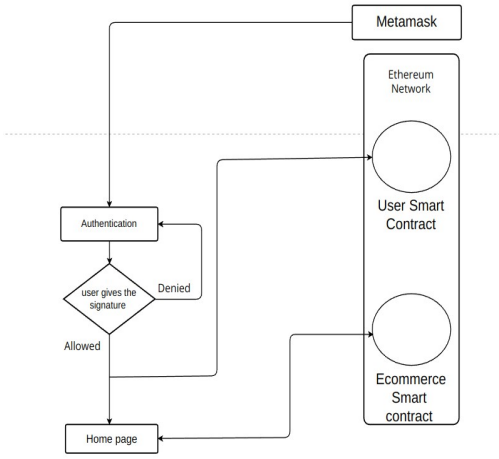


Fig.1 Authentication Flow

MetaMask is a software cryptocurrency wallet that interacts with the Ethereum blockchain. It is used by our application so that users can log in securely. Users are able to access their Ethereum wallets through a browser extension or a mobile app that is provided by MetaMask. Users are then able to use these wallets to interact with decentralised applications. We are able to guarantee the safety and openness of our platform by employing MetaMask as the authentication method of choice. Within our platform, in addition to using it for authentication, we also use MetaMask for conducting transactions. Within the context of the app, users are able to buy, sell, and trade cryptocurrency utilising their MetaMask wallets. This not only increases the functionality of the platform but also provides a streamlined experience for its users. We have created a user interface for our platform that is warm and easy to navigate in order to make it as accessible as possible. The user interface (UI) is designed to ease users into the environment of the application and to encourage frequent use of the application, which in turn raises the profile of the application. Our goal is to create a platform that is not only functional and secure but also enjoyable to use. In general, we are of the opinion that the most effective method for developing a decentralised mobile application that provides users with both safety and an intuitive interface is to make use of the Flutter framework and the Ethereum blockchain technology, in conjunction with MetaMask. We are able to guarantee that our platform is accessible to a diverse group of users by making use of these technologies, while at the same time keeping a very high level of security and transparency. In traditional Web 2.0 applications, data is stored in centralised databases and storage solutions offered by cloud service providers such as AWS, Google Cloud, and Microsoft Azure. These services have a high degree of centralization, which presents a number of challenges, including questions regarding data ownership, data privacy, and data security. The decentralised web, also known as Web 3.0, provides a solution to the problems that have been identified. The acronym IPFS stands for the Inter Planetary File System, which is the name of the distributed file system that is used to store data in a decentralised web application. The fact that IPFS stores and shares files through a peer-to-peer network gives it a high level of security and makes it resistant to censorship. When new information is added to IPFS, that data is immediately and uniformly dispersed

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across the network. This ensures that IPFS is highly available and resistant to failure at a single point. The link to the data is saved in a smart contract on the Ethereum blockchain. This helps to ensure that the data cannot be altered and that it is authentic. Due to the immutability of blockchain technology, the data that has been added to the chain cannot be changed or removed after it has been added. This guarantees that the data will always be accessible and verifiable, making it an extremely valuable asset in the process of maintaining the genuineness and value of luxury goods. Decentralized web applications offer several advantages over conventional Web 2.0 applications. These advantages are made possible by the use of IPFS and the Ethereum blockchain. They provide increased safety, privacy, and ownership of the data, while also guaranteeing that the data cannot be altered and that it is authentic. Because of this, they are ideally suited for use in applications such as marketplaces for luxury goods, where maintaining authenticity and value are paramount considerations. OpenBazaar is a decentralised e-commerce platform that functions in a manner that obviates the requirement for thirdparty intermediaries such as Amazon or eBay. The platform is built on blockchain technology, which allows buyers and sellers to transact directly with each other using smart contracts. Smart contracts are self-executing agreements with the terms of the contract written directly into code, and they ensure that transactions are executed automatically and transparently. Additionally, OpenBazaar offers an escrow service, which is responsible for holding onto funds until both parties have satisfied their obligations. This safeguards the interests of the buyer as well as the seller in the event that there are any disagreements or problems. Because OpenBazaar is an opensource platform, it is possible for anyone to participate in the platform's development and to make use of it without cost. Because of this, there is now a thriving community of users and developers who collaborate to make the platform more userfriendly and improve its overall quality. OpenBazaar gives its users more payment options than traditional e-commerce platforms do because it accepts a variety of cryptocurrencies as payment. This is one of the primary advantages of using OpenBazaar over traditional e-commerce platforms. Users who favour conducting business in cryptocurrencies or who wish to steer clear of the fees associated with conventional payment methods will benefit tremendously from this development. Users have increased protection against unauthorised access to their data thanks to the decentralised nature of the platform. Unlike traditional ecommerce platforms, where users have to provide personal information and trust third-party intermediaries to handle their data, OpenBazaar uses the blockchain to ensure that transactions are secure and private. The removal of middlemen results in a reduction in transaction fees and enables increased levels of direct communication between purchasers and vendors. Because of this, users are able to negotiate directly with one another, eliminating the need for the markups and fees that are typically associated with traditional e-commerce platforms. In general, OpenBazaar has been able to attract a committed community of users and is continuously increasing the number of services it provides as a leading decentralised e-commerce platform. While the open-source nature of the platform and its acceptance of cryptocurrencies give users more options and flexibility, the platform's use of smart contracts and escrow services ensures that transactions are secure and transparent. OpenBazaar is in an excellent position to play an important part in the development of e-commerce in the future as the blockchain ecosystem continues to undergo change.

IV. RESULTS

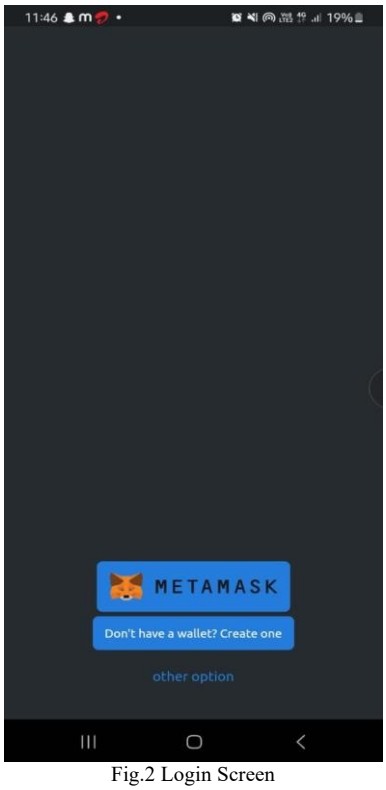


Fig.2 Login Screen

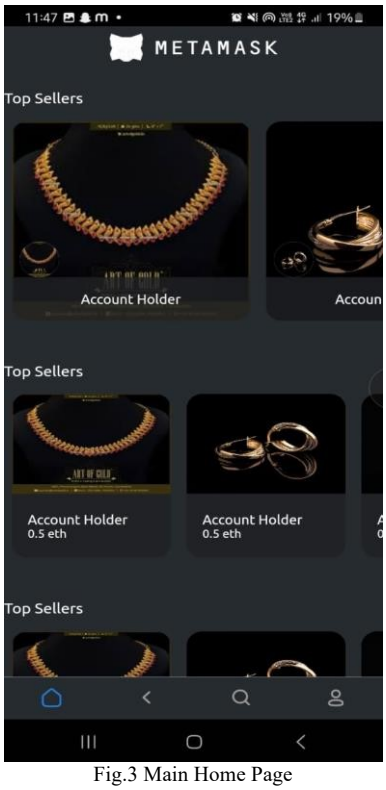


Fig.3 Main Home Page

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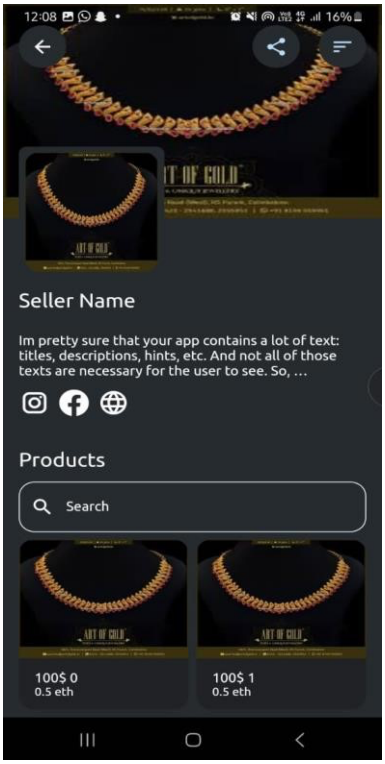


Fig.4 Seller Page



Fig.5 Seller Page

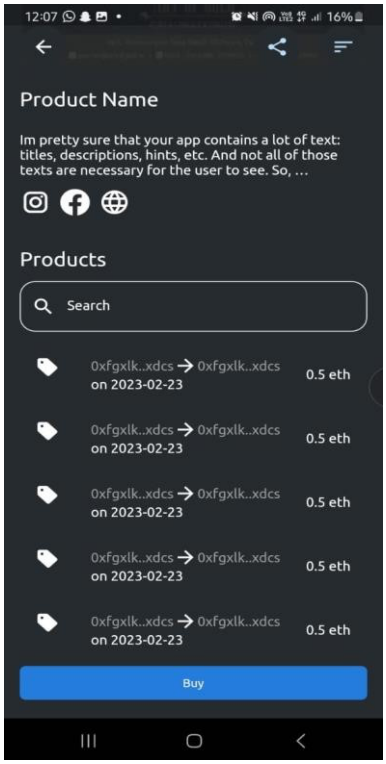


Fig.6 Product Previous Track Record

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Smart Irrigation System

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***Abstract*—The usage of IoT in agriculture is a new concept because IoT sensors can provide information about the agricultural sector and react based on user input. This design is intended to take advantage of the technology that is IoT and smart farming by automation. Internet of Things (IoT) technology is advancing in all areas of ordinary people's lives by making everything smart and intelligent. The IoT is a network of things that form a self-configuring network. With the development different smart farming IoT based products, the aspect of agriculture is changing every day. This not only improves crop yields, but also increases cost effectiveness and reduces losses. The Internet of Things (IoT) transforms agribusiness and enables farmers to address field challenges through a wide range of strategies, including precision and hands-on farming. This design proposes an intelligent IoT-based farming approach that enables farmers to obtain live data such as temperature and soil moisture for effective terrain monitoring, practicing smart farming and overall yield and aims to improve product quality. The technology proposed in this project will be integrated with Arduino technology, breadboards, mixed with a variety of different sensors, and will allow you to access live data feeds online via your mobile phone.**

Keywords—Smart Agriculture, Internet of Things (IoT), Arduino IDE, ESP8266 Node MCU, Thing speak, Sensors.

I. INTRODUCTION

Agriculture is the unquestionably the largest livelihood provider in India. With rising population, there is a need for increased agricultural production. In order to support greater production in farms, the requirement of the amount of fresh water used in irrigation also rises. This suggests that there is an urgent need to develop systems that prevent water wastage without imposing pressure on farmers. Smart irrigation systems are advanced irrigation technologies that use sensors, data analytics, and automated controls to optimize water usage and improve crop yields. These systems allow farmers to irrigate their fields more efficiently by providing real-time information about soil moisture levels, weather conditions, and other environmental factors that can affect crop growth. Smart irrigation systems typically consist of a network of sensors that measure soil moisture levels, temperature, humidity, and other environmental parameters. The data collected by these sensors is then processed by a central computer or cloud-based platform, which uses algorithms and models to analyse the data and make decisions about when and how much to water each crop. One of the key benefits of smart irrigation systems is that they can reduce water waste and help conserve scarce resources. By monitoring soil moisture levels and other environmental factors in real-time, farmers can avoid overwatering or underwatering their crops, which can lead to inefficient water usage and lower crop yields. Another benefit of smart irrigation systems is that they can be remotely controlled and monitored, which allows farmers to adjust irrigation schedules and settings based on changing weather patterns, crop growth stages, and other factors. This flexibility can help farmers optimize water usage and improve crop yields while also reducing labour costs and improving overall farm efficiency. Overall, smart irrigation systems are an exciting new technology that has the potential to revolutionize the way we irrigate crops and manage water resources. By providing real-time data and automated controls, these systems can help farmers make more informed decisions about how to water their crops, reduce waste and conserve resources, and ultimately improve overall farm productivity and profitability. This document and are identified in italic type, within parentheses, following the example. Some components, such as multi-levelled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

II. LITERATURE SURVEY

IoT in Agriculture: A research paper considers IoT connects electronics smartly. Agriculture is a booming industry and with effective intelligence we can achieve efficiency in it. IoT smart garden uses sensors to determine crop parameters and automate irrigation systems. There are various applications of IoT such as computer imaging, livestock monitoring, drones and many more. Our system uses Arduino ide which is connected to esp32 node which collects data and sends it to Blynk server and then we can monitor the reading. By completely bypassing the requirement of manpower, the product both reduces overall cost and scope for human error. The sensor data is also relayed to the user's mobile handset via the Global System for Mobile(GSM) module. The automatic solar based irrigation system with pH sensing technique is an innovative and sustainable solution for agricultural irrigation that reduces water waste and increases crop yields. The system comprises of solar panel, water pump, a pH sensor and microcontroller. Since the soil pH sensing techniques based on ISFET and conductimetric technologies have similar drawbacks when combined proposes a new way. Overall, the hardware and software used for the system produces the desired output needed by the farmers in irrigation field. An IoT based Smart Farming System using Machine Learning: A conference paper considers smart farming. Agriculture uses 85% of available freshwater resources.The farming architecture has been proposed to collect, transmit and process the physical parameters. Two different sources of information are considered. The implemented model was found to be feasible and cost effective. The main objective was to design a new EDGE-Fog-IoT-Cloud based architecture dedicated to smart farming. To achieve water saving, irrigation system frameworks have been proposed based on various techniques, e.g., thermal imaging, Crop Water Stress Index (CWSI), direct soil water measurements, etc. Precision farming is a

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principle that aims to optimize yields and investments, while seeking to better take into account the variability of the environment. This concept appeared in the context of the race for progress in agricultural yields. It notably influenced: tillage, sowing, fertilization, irrigation, spraying of pesticides.

III. OVERVIEW OF THE PROPOSED SYSTEM

The block diagram of a proposed smart irrigation system on ESP8266 is shown in the figure below:

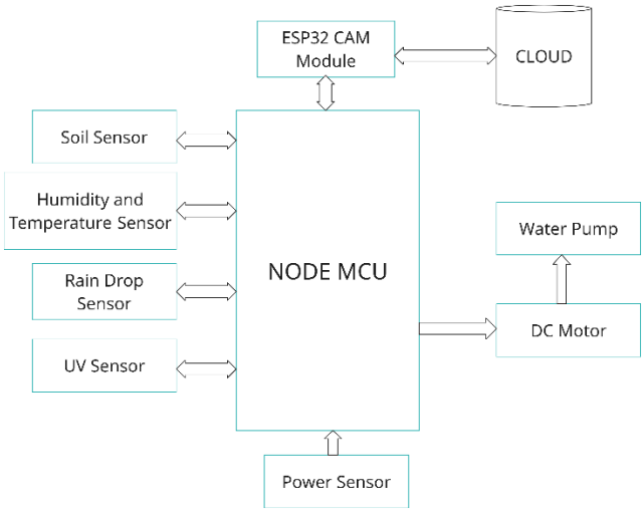


Fig.2

The images obtained using the ESP32 camera module are processed and used to monitor crop health in a visual fashion. The contents of the captured image are identified using a Machine-learning model. The data from the various sensors, for example, pH sensors, level sensor, temperature sensor, etc. is used by the microcontroller to selectively drive the pumping motor, The threshold values considered for turning the motor on and off are decided by keeping the optimal conditions for the growth of that particular crop in mind.

1. Node MCU

The ESP8266 is a low-cost, Wi-Fi-enabled microcontroller that was developed by the Chinese company Espressif Systems. It has become a popular choice for DIY projects and IoT (Internet of Things) applications because of its low cost, ease of use, and wide range of features. The ESP8266 comes in several different models, each with varying amounts of memory and processing power, and can be programmed using a variety of programming languages, including Arduino, Lua, and Micro Python. It is widely used in projects such as home automation, sensor networks, and remote-control applications.



Fig.1

2. Soil Moisture Sensor

A soil moisture sensor module is an electronic device that measures the amount of moisture in soil. It typically consists of a probe that is inserted into the soil, which is connected to a module that provides an output signal that corresponds to the moisture level. The module can be connected to microcontroller or other electronics, allowing the user to monitor and control the moisture level in plants or soil-based projects. Soil moisture sensors can be useful in agriculture, gardening, and environmental monitoring applications, helping to optimize watering schedules and prevent over- or under-watering of plants. Some soil moisture sensor modules may also include temperature and humidity sensors for more comprehensive environmental monitoring.

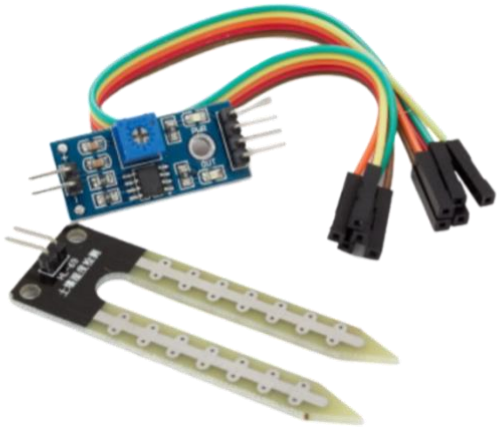


Fig.3

3. Rainfall Sensor

A rainfall sensor module is a device that measures the amount of rainfall that has occurred in a given period of time. It is commonly used in weather monitoring applications and can be installed in a variety of outdoor settings, such as on rooftops, poles, or weather stations. The sensor typically consists of a collection funnel, a tipping bucket mechanism, and a circuit that counts the number of tips. As rain falls into the funnel, it is directed to the tipping bucket, which tips when a certain amount of water has accumulated, typically 0.2mm or 0.01 inches. Each tip is counted by the circuit, and the data can be used to calculate the rainfall rate and total rainfall over a given time period. The rainfall sensor module can be connected to a microcontroller or a single-board computer, such as an Arduino, Raspberry Pi, or ESP32, to enable data logging and automated weather monitoring.

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Fig.4

4. DHT11 Temperature and Humidity Sensor

The DHT11 is a low-cost digital temperature and humidity sensor module that is commonly used in DIY projects and IoT applications. The sensor is able to measure temperature in the range of 0 to 50 degrees Celsius with an accuracy of +/- 2 degrees Celsius, and humidity in the range of 20% to 90% with an accuracy of +/- 5%. The DHT11 sensor uses a one-wire communication protocol and provides a digital output, which can be read by a microcontroller or a single-board computer, such as an Arduino, Raspberry Pi, or ESP32. The DHT11 sensor module is easy to use and can be powered by a 3.3V or 5V power supply. It is commonly used in projects such as weather stations, home automation systems, and plant monitoring systems.

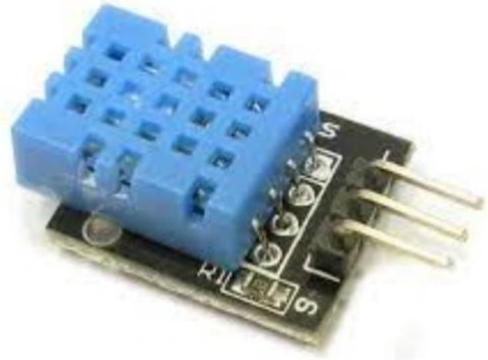


Fig.5

5. ESP32 Camera Module

The ESP32 Camera is a module that combines an ESP32 microcontroller with a camera sensor, enabling users to capture and stream images and video over Wi-Fi. The ESP32 Camera module typically includes a OV2640 camera sensor, which is capable of capturing images with a resolution of up to 2 megapixels and video at resolutions up to 1600x1200. The module also includes an SD card slot for storing captured images and video, as well as built-in Wi-Fi connectivity for streaming data to a web server or mobile device. The ESP32 Camera module can be programmed using a variety of programming languages, including C++, MicroPython, and Arduino. It is commonly used in projects such as security cameras, drones, and robotics, as well as in applications where remote monitoring and surveillance are required.

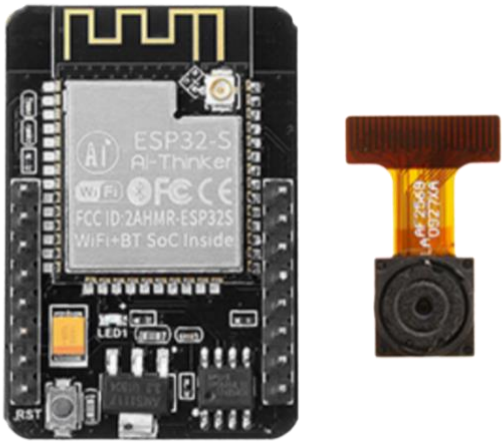


Fig.6

6. ML8511 UV Sensor

A mini micro submersible water pump is a small-sized pump designed to be submerged in water or other liquids. It is typically used for applications where a small and compact pump is needed, such as in aquariums, fountains, and small water features. The pump typically consists of an electric motor, an impeller, and a housing. The impeller rotates, creating a centrifugal force that pushes water through the housing and out through a hose or pipe. The motor is usually low voltage, making it safe for use in water. Mini micro submersible water pumps are often energy efficient and quiet, making them ideal for use in indoor environments. They are also designed to be easy to install and maintain, with many models featuring adjustable flow rates and automatic shut-off features for safety. These pumps are typically made from corrosion-resistant materials, such as stainless steel or plastic, allowing them to be used in a variety of liquids. They come in various sizes and capacities, so it's important to choose the right pump for your specific needs.



Fig.7

7. HCSR04 UltrasonicSensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e., the sound that humans can hear).

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Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target). In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is D = ½ T x C (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second). For example, if a scientist set up an ultrasonic sensor aimed at a box and it took 0.025 seconds for the sound to bounce back, the distance between the ultrasonic sensor and the box would be:

D = 0.5 x 0.025 x 343



Fig.8

8. OLED Display

OLED (Organic Light Emitting Diode) display is a type of display technology that uses organic compounds to emit light in response to an electric current. OLED displays are known for their high contrast ratio, fast response time, and low power consumption. OLED displays can be found in a variety of consumer electronics, including smartphones, televisions, and smartwatches. They are also commonly used in automotive displays and other industrial applications where high contrast and low power consumption are important.



Fig.9

IV. FUTURE SCOPE

Currently, farmers control irrigation method by manually and irrigate their area at a systematic period of time. These mechanisms deplete high amount of water and the outcome is water less. While dry areas have less rainfall and irrigation is challenging. Therefore,ESP8266 Wi-Fi based communication system has been taken because of the ease of application, maintenance and price. The gadget is automated that will accurately monitor and control the water requirement and reliable. The communication through the website authorised the user to interact with sensor from anywhere in the world in nanosecond which is fruitful for the user to interact with sensor from anywhere in the Arduino that diminish power consumption by ascending the system life executes on large for relatively small investment. The system can also be designed for temperature sensor based cooling system. Even after then they need to wait until the field is properly watered, which makes them to stop doing other activities. Here is an idea which helps not only farmers even for watering the gardens also, which senses the soil moisture and switch the pump automatically when the power is ON. The extension work is to make user interface much simpler by just using SMS messages for notifications using GSM module. The idea of using IOT for irrigation can be extended further to other activities in farming such as cattle management, fire detection and climate control.

V. TECHNICAL ANALYSIS

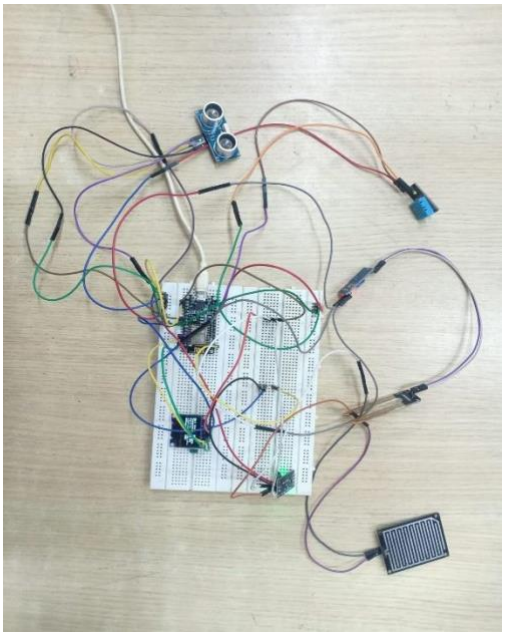


Fig.10

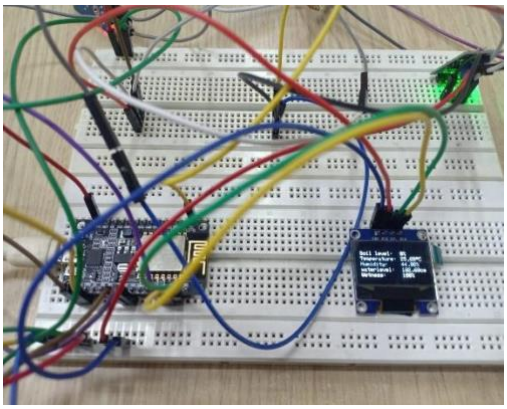


Fig.11

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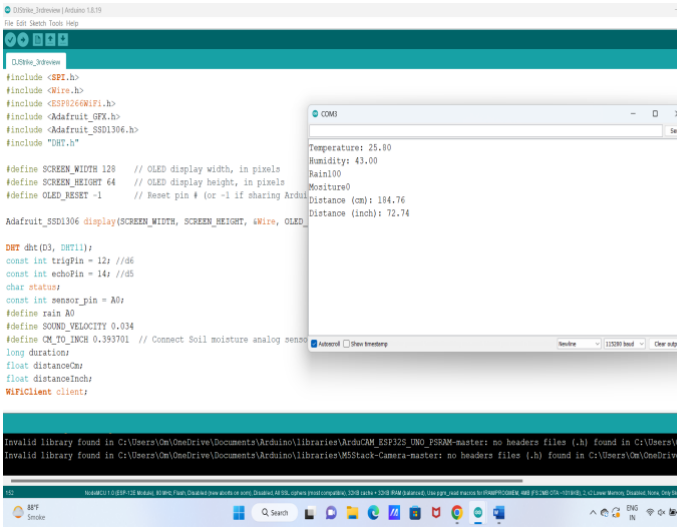


Fig.12

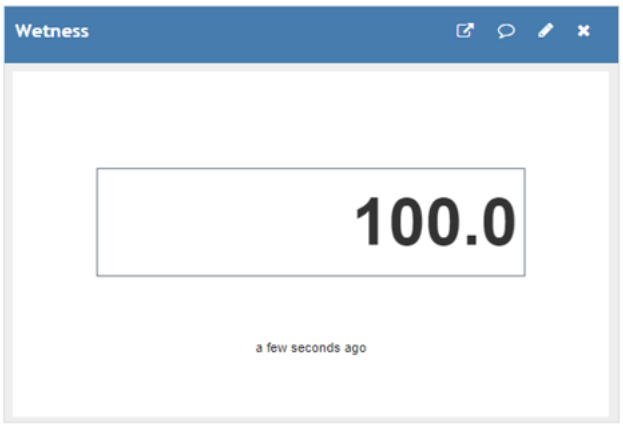


Fig.13

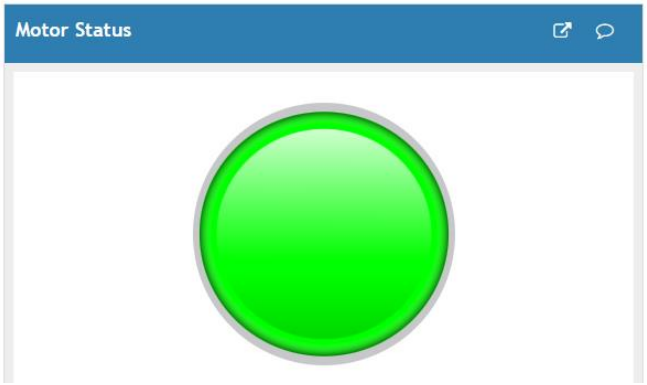


Fig.14

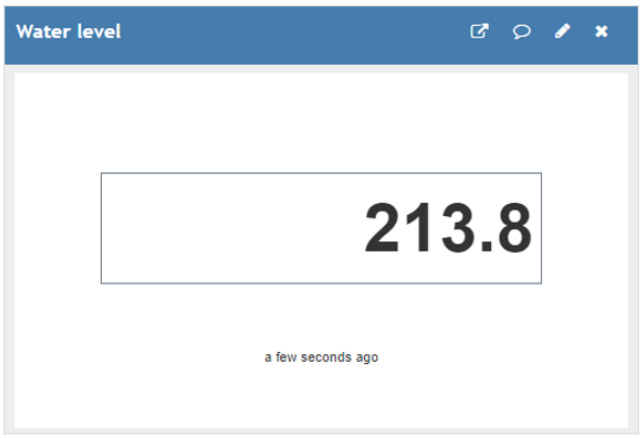


Fig.16

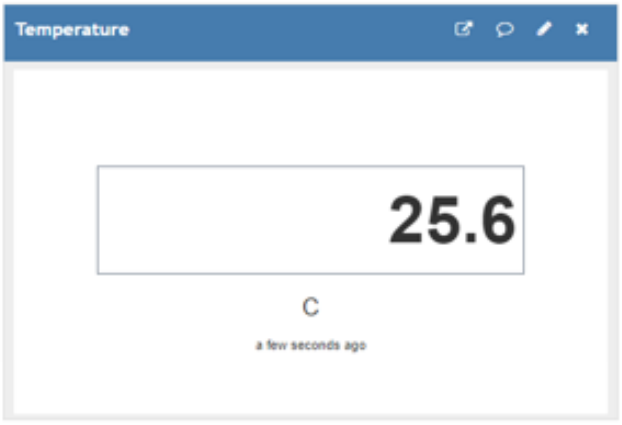


Fig.17

ACKNOWLEDGMENT

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Stopwatch Using VHDL

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***Abstract*—This research paper describes the design and implementation of a stopwatch using VHDL (VHSIC Hardware Description Language). VHDL is a hardware description language used to model digital circuits and is widely used in the design of digital systems. A stopwatch is a simple but useful device that can be used to time events in a variety of applications. The VHDL code for this design was written and simulated using Xilinx ISE Design Suite. The stopwatch design includes a graphical user interface (GUI) that displays time in hours, minutes, and seconds. The design uses VHDL to create a digital circuit that counts clock cycles and converts them into a human-readable format. The design also includes various functions such as start, stop and reset buttons, as well as the ability to save and load previous timing times. The functionality of the stopwatch design was verified by simulation and synthesis using Vivado Xilinx. The results showed that the design met the required specifications and was able to measure time accurately. The proposed stopwatch design can be used in various applications including sports timing, laboratory experiments, and industrial processes.**

Keywords—VHDL, Synthesis, Stopwatch, GUI

I. INTRODUCTION

A stopwatch is a common device used to accurately measure intervals of time. In this research paper, we will explore the process of creating a stopwatch using Vivado Xilinx. Vivado Xilinx is a powerful tool for designing and implementing digital circuits. It is a software suite that includes system-level design and synthesis tools. This article will describe the process of designing a stopwatch using Vivado Xilinx. A stopwatch is an electronic device used to measure the time elapsed between activation and deactivation. It is often used in sports, scientific experiments, and other occasions that require precise timing. This article describes the design and implementationof a stopwatch in VHDL (VHSIC Hardware Description Language). VHDL is a hardware description language for designing and verifying digital circuits. It is a powerful tool that allows designers to describe the behavior of digital circuits and their interconnections. Using VHDL for digital design has many benefits, including faster time to market, easierdesign reuse, and easier verification and testing. A stopwatch is a simple device that measures the time elapsed between two events. The basic function of the stopwatch is to start, stop and reset the stopwatch.

II. OBJECTIVE

Designing a stopwatch involves creating a circuit that can tell the time in seconds, minutes, and hours. This circuit will have input signals to start, stop and reset the timer. The stopwatch VHDL code will consist of two parts the entity declaration and the schema description. The entity declaration defines the input and output signals of the circuit, while the architectural description defines the behavior of the circuit. This circuit will use a clock signal to increment a time value. Time values will be stored in registers and these values will be updated by a clock signal. The input signal will control the operation of the stopwatch. When the start signal is received, the stopwatch starts timing. The stopwatch will stop when a stop signal is received. The timer will reset to 0 when a reset signal is received.

III. LITERATURE REVIEW

The articles discuss the importance of stopwatches in various fields such as sports, industrial processes, and scientific experiments. The white paper also explains the benefits of using VHDL in the design and implementation of digital systems. This article provides the detailed VHDL code for the stopwatch design. The design includes a clock generator, counter, control unit, and display unit. The clock generator generates a 1 Hz clock signal which is used as the time base for the stopwatch. The counter counts the number of clock cycles and the control unit controls the start, stop and reset operations of the stopwatch. The display unit shows the passage of time in hours, minutes, and seconds. This article also covers the simulation and synthesis of VHDL code using Xilinx ISE software. The simulation results show that the design works well, and the synthesis results show that the design respects the time and area constraints. This article presents an elaborate design and implementation of a digital stopwatch using VHDL. This design can be used in a variety of applications requiring precise time measurement. This article also demonstrates the effectiveness of VHDL in the design and implementation of digital systems.

IV. PROPOSED DESIGN

Define specifications and requirements for the stopwatch design, such as display format (e.g., minutes, seconds, milliseconds), accuracy, resolution, and maximum time limit. Create a block diagram of the stopwatch design, identifying the various components required for the design, such as clock sources, counters, and display drivers. Write the VHDL code for the clock source component to generate a clock signal whose frequency meets the design requirements. Write VHDL code for a Counter component that increments a register every clock cycle and resets the register when the maximum time limit is reached. Write the VHDL code for the display driver component, convert the counter register value to the required display format, and display it on the screen. Write high-level VHDL code, integrate all components into a complete design, and simulate the design to ensure it meets specifications and requirements. Synthesize a VHDL design using a synthesis tool such as Xilinx Vivado or Altera Quartus

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to generate a binary stream. Implement the design on a target device (like a development board) and test it to make sure it works correctly. Write a research paper summarizing the design process, including design specifications, block diagrams, VHDL code, simulation results, synthesis results, and implementation results. The document should also discuss any challenges or issues encountered during the design process and suggest future design improvements or modifications.

V. RESULTS AND CONCLUSION

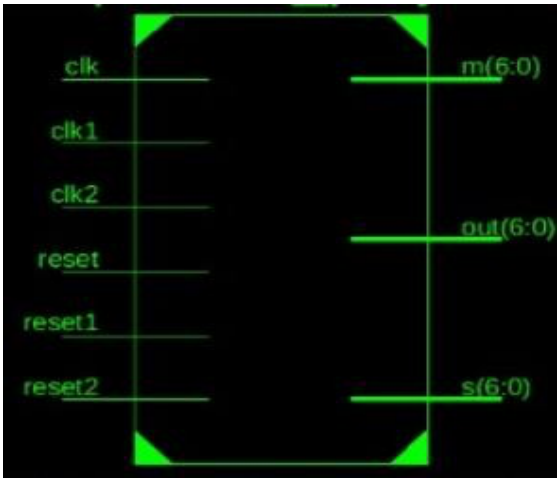


Fig.1 Pin Diagram

The stopwatch design consists of severalmodules, including the counter, the displaycontroller, and the user interface. The countermodule is responsible for counting the elapsed time, and the display control module controlsthe display of the elapsed time. The userinterface module allows the user to start, stopand reset the stopwatch. The counter module is implemented using a simple binary counter. Itcounts from 0 to 99, representing seconds andhundredths of a second respectively. The clocksignal is used to increment the counter every second. The display controller module is responsible for displaying the elapsed time onthe seven-segment display. The elapsed time isconverted from binary format to BCD (BinaryCoded Decimal) format using a BCD converterand then displayed on the seven-segmentdisplay. The user interface module consists ofthree buttons: Start, Stop, and Resume. The start button is used to start the stopwatch, thestop button is used to stop the stopwatch, and the reset button is used to reset thestopwatch to zero. To test the stopwatch implementation, we can create a testbench that generates a clock signal and simulates buttonpresses. We can then analyze the output signalto verify that the timer is working as expected. The results of the implementation can arepresented in a technical document dealing with the design and implementation of the FSM Chronometer, presenting simulation resultsdemonstrating its proper functioning. The document may also discuss potential limitationsor areas for future design improvement. Overall, implementing a stopwatch in VHDL can be a useful exercise in learning about finite-state machines and digital design, and can serveas a foundation for more complex designs in the future.

Code:

```
module stopwatch(
clk,clk1,clk2,reset,reset1,reset2,out,s,m
);
input
clk;
input
clk1;
input
clk2;
input wire reset;
input wire reset1;
input wire reset2;
output reg [6:0] out;
output reg [6:0] s;
output reg[6:0] m;
always @(posedge clk)
begin
if(reset==1)out<=0;
else
if(out<7'd99
)out<=out+1;
end
```

Output:

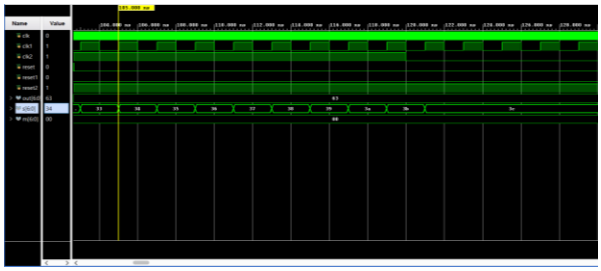


Fig.2 Output

VI. DESCRIPTION

VHDL

VHDL (VHSIC Hardware Description Language) is a hardware description language used to describe digital circuits and systems. VHDL is widely used in the design and verification of digital circuits, especially in the semiconductor industry. VHDL is a high-level language that allows designers to describe circuits and systems using a set of predefined constructs, such as entities, structures, procedures, and signals. Thelanguage is strongly typed and supports a variety of data types, including booleans, integers, and real numbers. VHDL is a powerfullanguage that allows designers to model complex digital systems and verify their correctness before implementation.

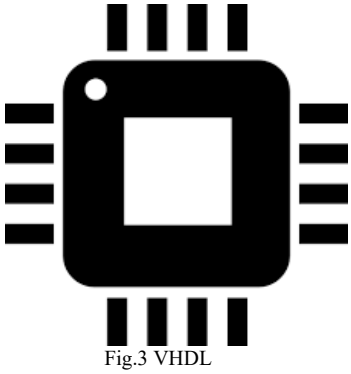


Fig.3 VHDL

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Stopwatch

A stopwatch is a portable device or software application that can be used to measure the passage of time. It is often used in sports, physical training, and other activities that require precise timing. A stopwatch usually hasa start button, a stop button, and a reset button.When the start button is pressed, the stopwatchstarts timing. When the stop button is pressed, the stopwatch stops counting and displays the elapsed time. The reset button can be used to reset the stopwatch to zero and start a newtiming cycle. The stopwatch can measure time with different levels of accuracy depending on the quality of the device or software. Some stopwatches can measure time in milliseconds or even microseconds, while others can measure time in whole seconds or tenths of seconds.

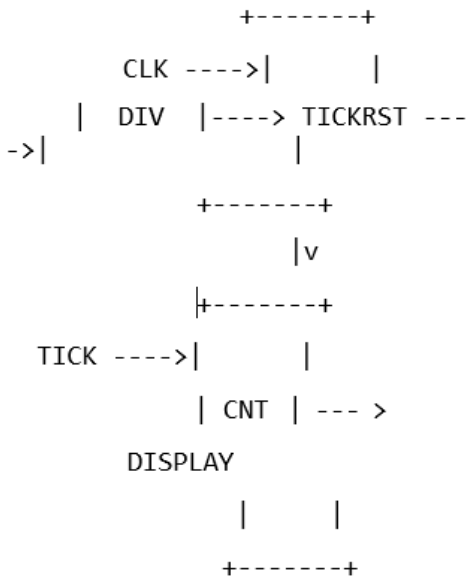


Fig.4 Block Diagram of Stopwatch

Vivado

Vivado is a software package developed byXilinx, a leader in programmable logic devices(PLDs). Vivado is used to design and develop digital circuits and systems that can be implemented on Xilinx Field Programmable Gate Array (FPGA) and SoC (System on Chip)devices. Vivado provides a comprehensive development environment for FPGA and SoC designs, including high-level synthesis,verification, and implementation tools. It allows designers to create custom digital logic designs using various design input methods such as schematic capture, HDL (hardware description language) coding, and IP (intellectual property) embedding. Vivado also includes advanced features such as power optimization, design debugging, and system- level integration to help designers improve design performance and reduce time to market.



Fig.5 Vivado

VII. CONCLUSION

Finally, the timer circuit can be designed and implemented in VHDL (VHSIC Hardware Description Language). A stopwatch is a digitaldevice that can be used to measure the time that elapses between two events. VHDL provides a powerful set of functions for modeling and simulating digital circuits and can be used to create high-precision stopwatch circuits. To design a stopwatch using VHDL, you can first break the stopwatch down into its component parts, such as the clock generator, counter, and display manager. Each of these components can be modeled using VHDL and then combined toform a complete stopwatch circuit. In summary, VHDL provides a powerful set of tools fordesigning digital circuits, including timers. Using VHDL makes it possible to create extremely accurate and reliable timer circuits that can be used in a variety of applications.

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Vikalp – Your Conversing Tool with Divyang

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Abstract— **In this paper, we advocate for the Divyang people using smart gloves. There are 2.2 billion blind persons and almost 9 billion deaf and stupid people in the globe. Given that communication is a crucial component of human life, this leaves very little room for them. The deaf-dumb have their own manual-visual language known as sign language, although the blind can communicate freely using standard language. This initiative will address every aspect of safety and communication for people with disabilities. A non-verbal method of communication called sign language is used by communities of people with disabilities all around the world. Since the languages do not share a common origin, interpretation might be challenging. By the use of a glove-based communication interpretation system, the initiative seeks to assist individuals. Five flex sensors, tactile sensors, and IMU sensors are built on the glove. The flex sensor generates a proportional change in resistance and angle for each individual action, which enables us to recognize sign language. The converted Sign Language will now be translated into audio through the glove's built-in speaker.**

Keywords—Deaf, Dumb, Blind, Sign Language, Arduino, flex sensor,Accelerometer.

I. INTRODUCTION

For three centuries, especially among the deaf community, people have used sign languages as a form of communication and message delivery. Several deaf communities throughout the world are creating new sign languages. Hand shapes, hand orientation and movement, and facial emotions can all be employed at once to convey a speaker's thoughts when utilising sign language. But very few ordinary people are familiar with sign language. So, those who normally express themselves through sign language may find it difficult to have a conversation or even to just state their opinions. The two main techniques are vision-based systems and wearable technologies. In order to determine the movements of the hands and fingers, vision-based systems use feature extraction techniques from image processing. To eliminate connections, the wearable will be connected to a microcontroller, and the smart glove will employ a number of techniques to translate sign language into written or spoken words. The primary objective of this endeavour is to create a wearable gadget that will facilitate communication between deaf populations and the general public. The ultimate goal of this study is to create a gadget that takes user comfort into account. The wearable will be wirelessly connected to a microcontroller in order to do away with the need for cords. The development of a wearable gadget that will facilitate communication between deaf communities and the broader public while taking user comfort into mind is the main objective of this endeavour. The device, a glove-based sign language translator, is made up of an accelerometer, five flex sensors, and cables that connect it to an Arduino microcontroller.

II. OBJECTIVE

With the help of this tool, we aim to converse with the deaf and the mute even if we don't know the Indian Sign Language. There are two most important blocks in this project.

1. Sign Language to Text / Audio

Here a person will be able to understand what a impaired person is trying to say in his sign language with our tool which will detect the hand gestures and process the video and decode it. Upon showing the correct hand gestures the output will be an audio of what the person is trying to say through the speaker.

2. Speech to Sign Language

The live speech of the person who wants to convey his feelings to a deaf person is received from the microphone. For this, we are using a python package called PyAudio which helps us to convert audio to text with the assistance of Google API Convertor. Its role is to convert audio to text by incorporating the neural network models. This is passed to Google Speech Recognizer into smaller parts and then it will be visible on the LCD screen attached to the glove.

III. METHODOLOGY

We have developed a smart glove with the help of which any gesture when made by a Divyang can be easily recognized by the masses. This system uses budget friendly components like Arduino nano, flex sensors etc. With the flex sensor which have been integrated on the glove the degree of bend of each of the finger can be easily recognized and thereby we can decode which sign language or the gesture is being shown by that person. This device makes is very easy for the people who do not understand sign language to be able to understand what a mute person is trying to say. It makes a two-way communication with the Divyang very easy. It eradicates every major barrier of a person who does not understand sign language to easily understand it by simply using these gloves. To implement this method, we used various hardware components and also used a couple of software tools. Hereby, we have mentioned the components which have been used in the making of this project..

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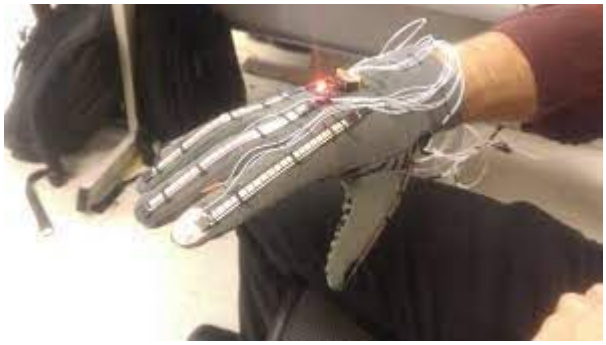


Fig 1. Circuit Diagram

Below is a basic study of the general components which have been used in the making of the smart glove.

1. Arduino

The ATmega328P microprocessor is the foundation of the Arduino UNO (The ATmega328 is a single-chip microcontroller created by Atmel and has a modified Harvard architecture 8-bit RISC processor core). Compared to other boards, like the Arduino Mega board, etc., it is simple to use. The board is made up of shields, various circuits, and digital and analogue Input/Output (I/O) pins. The Arduino UNO has 14 digital pins, a USB port, a power jack, and an ICSP (In-Circuit Serial Programming) header in addition to 6 analogue pin inputs. The programming language used is called IDE, or integrated development environment. It is compatible with offline and online platforms.



Fig 2. Arduino Uno

2. Flex sensor

A flex Sensor is a type of sensor which measures the amount of deflection. A flex Sensor is also called as bend sensor or flexible potentiometer. A flex sensor is generally a flexible strip of conductive ink and material that offers some resistance. This strip is made flexible in order so that it can be bent and alter the resistance. This sensor is fixed on the surface and on bending the surface the resistance changes. Therefore, we can detect the angle depending on the change of the resistance. It is made up of thin copper cladding on a plastic material substrate.



Fig. 3 Flex Sensor

3. Jumper Wires

Jumper wires are a type of electrical cable used to create connections between electronic components on a breadboard or a printed circuit board (PCB). They are often made of flexible, insulated wires with pre-stripped ends that can be easily inserted into the holes of a breadboard or the sockets of a PCB. Jumper wires come in various lengths and colours, allowing for easy identification and organization of connections. They are commonly used in prototyping, testing, and troubleshooting electronic circuits. Jumper wires can be used to connect different components such as resistors, capacitors, LEDs, and microcontrollers, among others



Fig. 4 Jumper Wires

IV. LITERATURE SURVEY

Sign language recognition is a significant field of study that aims to facilitate communication among individuals who are deaf or hard of hearing and those who do not understand sign language. Sign language is a visual language that employs hand gestures, facial expressions, and body movements to convey meaning. Sign language recognition systems can convert sign language into written or spoken language, allowing deaf or hard of hearing individuals to communicate with people who are not familiar with sign language. One promising method for sign language recognition involves the use of an E glove equipped with flex sensors and an accelerometer. The E glove is a wearable device that can be worn on the hand to capture the movements of the fingers. The flex sensors can detect the bending of the fingers, while the accelerometer can detect the orientation and motion of the hand. This literature survey aims to review the existing research on sign language recognition using E gloves with flex sensors and accelerometers. The survey will examine the

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various approaches employed, the performance of these systems, and the remaining challenges.

V. BLOCK DIAGRAM

In this mode, the system will detect the user's motions and search the database for the alphabet to display on the LCD. If the user needs to make a gesture for the letter "F," for instance, he would do so while wearing his smart hand glove. Each of the sensors would then be scanned for their analogue voltage and resistance of each of the flex sensor, which is then given to the controller so it could be converted into equivalent digital signals, which would then be stored in internal memory. The system will now check the look-up table produced during learning mode to determine whether the gesture which has been made is recognizable and can give a proper output, thereby detecting which sign language is being made. If the gesture is made has been put into our database, then the output will be given in the form of audio by the speaker which has been inscribed on the smart glove. This audio output is given in a spoken language and hence can be easily understood by anybody which was the desired output of this project. An LCD display is also attached to the smart glove so that when a deaf person is wanting to understand what others are speaking the audio can be converted into a display of words which can be easily read by the divyang and hence also involving him into the conversation. This smart glove solves all the problems of most divyang people together and hence is a very dynamic use of Iot to solve real world issues.

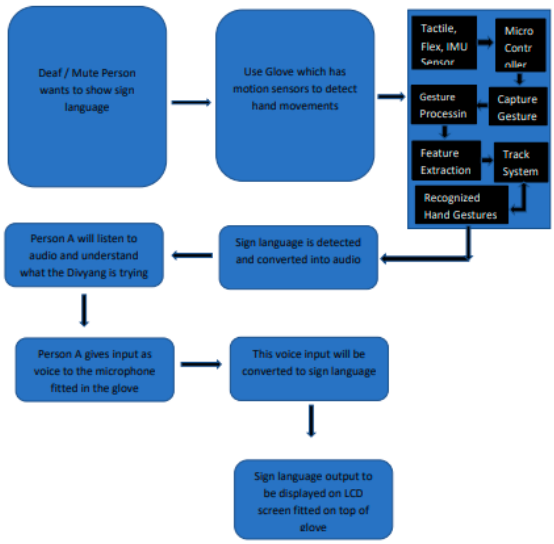


Fig.5. Block Diagram

VI. FUTURE SCOPE

A potential future direction for this project is to create a more comprehensive sign language recognition system that can recognize a wider range of signs and gestures. One approach could be to integrate additional sensors, such as pressure sensors or gyroscope sensors, to capture more detailed hand and finger movements. Another critical consideration for future research is to assess the system's performance in diverse environments and with various users. The use of more diverse and representative datasets could help enhance the system's accuracy and robustness. In addition, the integration of machine learning and artificial intelligence algorithms into sign language recognition systems has the potential to improve accuracy and adaptability. For instance, the incorporation of deep learning models could enable the system to learn and recognize more complex signs with greater accuracy. The future scope of sign language recognition using E gloves with flex sensors and accelerometers is vast and promising, with opportunities for significant advancements and applications in the field of assistive technology.

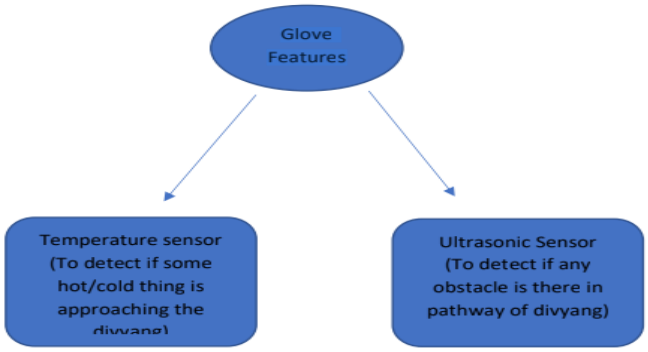


Fig.6. Future Scope

VII. CONCLUSION

The project suggests a method for hearing and speech-impaired individuals employing glove technology, allowing regular people to converse with them as well. The employment of five flex sensors and an accelerometer on a glove shows how useful it is to close the communication gap between speech- and hearing-impaired people and the general population. This device will be a useful tool for those who are disabled naturally as well as those who are disabled as a result of oral diseases and unintentional causes, enabling them to pick up gestures through applications with ease. More terms and various types of standard sign language could be added to the project to make it even better. Accidental cause make them to learn gesture through application easily.

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Broadband Rectangular Microstrip Antenna Gap Coupled

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***Abstract*— In this work, we address the mechanism of wide BW gap coupling in rectangular microstrip arrays and describe a multi-resonator approach in planar form. With an operating centre frequency of 2.96 GHz, the microstrip antenna is small, has an impedance bandwidth of 339 MHz (11. 8%), and has a VSWR of 2. Very high BW is achieved at low centre frequencies without increasing board height.**

***Keywords*— Edge Gap Coupling, Broadband Microstrip Antenna, 339MHz (11.48%), Multiresonator Coupling.**

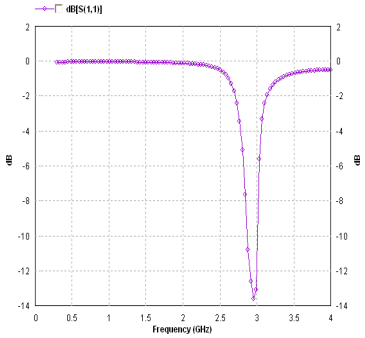
I. INTRODUCTION

These microstrip antennas (MSAs) have several advantages such as light weight, small size, and manufacturability to fit the host surface. In addition, since the MSA is manufactured using printed circuit technology, it can be mass-produced at low cost. Used in defense and commercial applications, MSAs replace many traditional antennas. However, the application types of MSA are limited by the inherently narrow bandwidth (BW) of the antenna. Therefore, increasing MSA BW has become a major goal of research in this area.

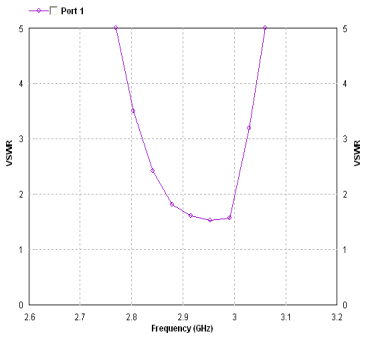
II. TECHNOLOGY

Microstrip patch antennas have a very high antenna quality factor Q. Q represents the loss associated with the antenna, a large Q reduces the bandwidth and reduces efficiency. Q can be reduced by increasing the thickness of the dielectric substrate. However, as the thickness increases, an increasing proportion of the total power delivered by the source is converted to surface waves. This surface wave contribution can be counted as an unwanted power loss, as it will eventually scatter in the dielectric bending and cause degradation of the antenna performance. This paper describes a planar multi-cavity technique using a rectangular microstrip patch with four edge gaps for broadband operation. Although larger in size, he can increase the BW without increasing the thickness of the MSA. As a result, it retains its planar properties and conforms to a variety of host surfaces. Coupling between multiple resonators was achieved by using small gaps between patches. First, we discuss the effect of parasitic patches on radiating edges. Later, we analyze the effect of the parasitic patch on his four edges of the coaxial-fed patch.

Effect of parasitic patches on the radiating edges, when a parasitic patch is placed next to the fed patch with a gap of s = 0.1 cm, it gets agitated due to coupling with fringing fields along the range of the fed blockish patch. The antenna has been anatomized. The return loss characteristics and the VSWR response is depicted in 1(a) and Fig. 1(b) independently



(a)



(b)



Fig.1. (a) Plot of S11 (dB) Vs Frequency (GHz);(b) VSWR plot of two gap-coupled RMSA;(c) Measured value as observed from VNA

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The return loss is S11=-13.568 dB at resonant frequency fr =2.9GHz. From the VSWR plot in Figure 1(b), we can see that the VSWR value is ⩽2 in the frequency range between 2.85 GHz and 3.01 GHz. The resulting impedance bandwidth is 156 MHz. The calculated percentage bandwidth is about 5.31%. Measurements are performed on an Agilent Vector Network Analyzer. From the measurement results in Figure 1(c), we can see that the antenna resonates at a center frequency near 2.87 GHz. The S11 value is -11.85 db. From the above results, we can see that the bandwidth of the coupled MSA increases when the resonant frequencies of the feed patch and the parasitic coupling patch are close to each other. Therefore, the performance of the four parasitic patches is analyzed considering the presence of multiple resonant frequencies of radiating and non-radiating edges.

III. ANALYSIS OF FOUR EDGE GAP COUPLED PATCHES

As shown in Figure 2, placing parasitic patches along all four edges of the RMSA increases both gain and bandwidth. Patches along radial and non-radiating edges are considered unequal separately. Their resonant frequencies are different but close together to give them bandwidth. The gap along the non-radiating edge is smaller than that of the radiating edge because the field varies sinusoidally along the non-radiating edge.

Antenna Configuration

Figure 2 shows the geometry of a square-edge gap-coupled RMSA with dimensions L = 2.4cm, L1 = 2.4cm, L2 = 2.3 cm, L3 = 2.25 cm, L= 2.225 cm, and W = 2.225 cm. increase. 3.0 cm. The distances between the radiating edge s1 and the non-radiating edge s2 are 0.10 cm and 0.05 cm respectively. The antenna is simulated using substrate epoxy glass(FR).The parameters are Ɛr=4,4, h=0.159 cm, tan δ=0.01.

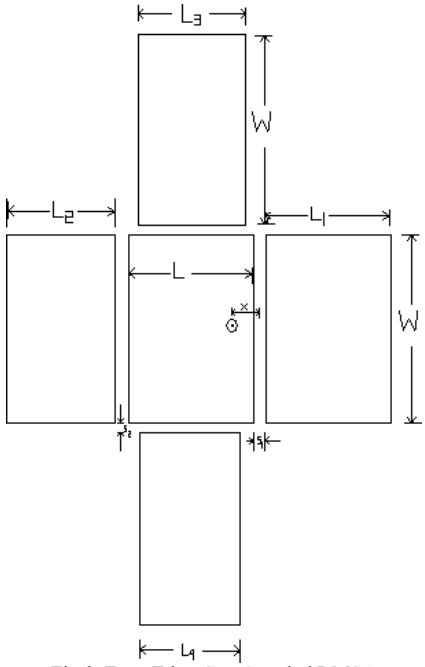


Fig.2. Four-Edge Gap Coupled RMSA

Simulated Results

Here, we used the MoM methodology to simulate various MSA configurations. From the return loss curves shown in Figure 3 below, it can be seen that four resonant frequencies are excited, ultimately resulting in a wider impedance bandwidth. The corresponding input impedance is shown in Figure.4.

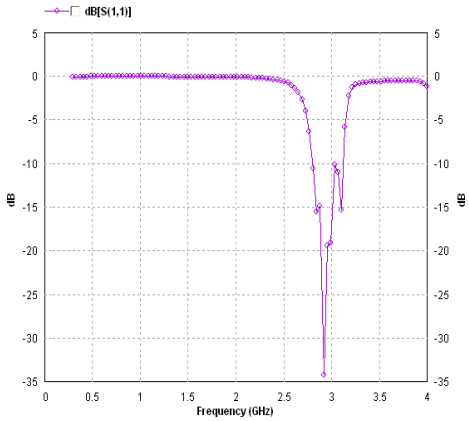


Fig.3. Plot of S11(dB) vs Frequency(GHz)

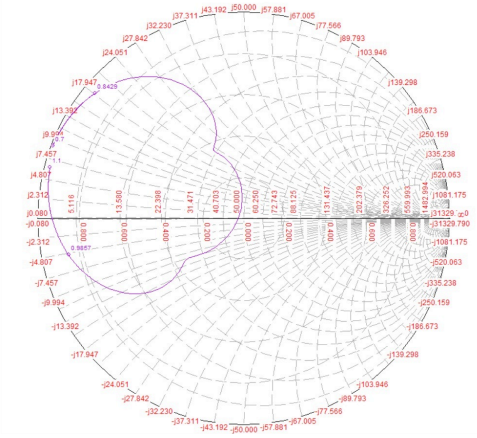
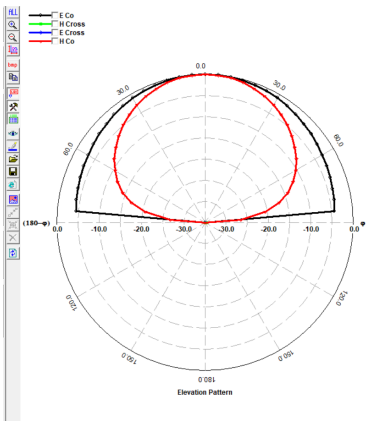


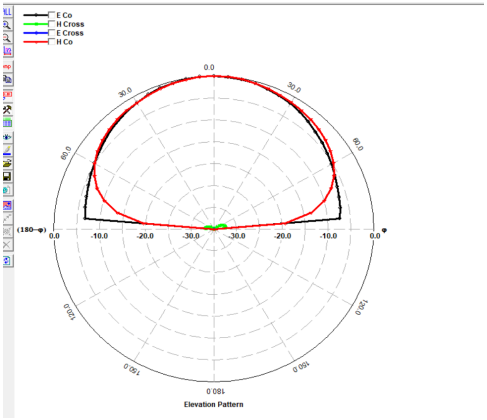
Fig.4.Input Impedance Variation

Simulated Results



Simulated at 905MHz (a)

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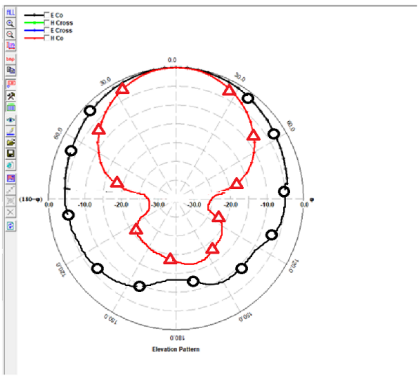


Simulated at 925Mhz (b)

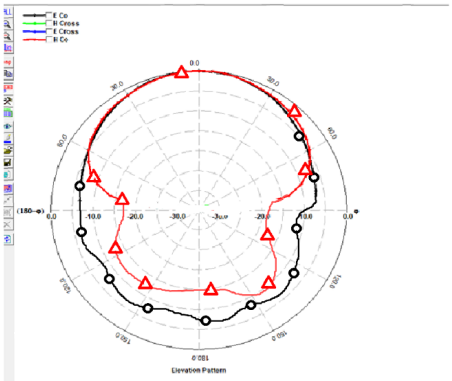
Radiation patterns Fig.5(a,b,c,d)

The corresponding S11 values at resonant frequencies fr = 2.837 GHz, 2.915 GHz, 2.993 GHz, and 3.097 GHz are -15.593 dB, -3.138, -19.0dB, and -15.269 dB, respectively. The calculated percentage bandwidth is 11.8%. The radiation pattern of the antenna at a centre frequency of 2.96 GHz is shown below. E-plane and H-plane coplanar components are shown in Figure 5(a,b,c,d).

Measured Results:



Measured at 905MHz (c)



Measured at 925MHz (d)

The beamwidth of 3dB is (59.235, 128.92) degrees. The radiation efficiency η of is 56.38%. The directivity D of the antenna is 7.5883 dBi. Gain G is 5.059 dBi. The -edge gap-coupled RMSA antenna therefore offers a significantly improved response in terms of bandwidth and gain.

IV. CONCLUSION

This paper describes an aperture switching technique in a planar junction to produce a broadband response. The coupled MSA BW increases when the resonant frequencies of the preset chip and the parasitic coupled chip are close to each other. The four rectangular regions are connected by a slot along the radiating and non-radiating edges, taking the best possible match between the entry point location, the slot location, and the parasitic length variation. The main advantage of this design is that the BW is increased without increasing the thickness of the microstrip antenna. This concept resulted in a low Q value, higher gain and a stable radiation pattern throughout the BW.

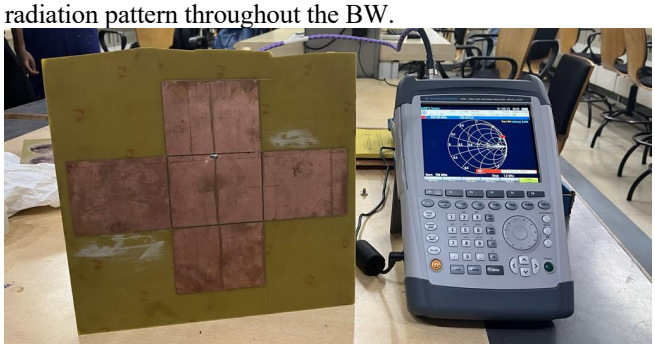


Fig.6(a) Broadband Rectangular Microstrip Antenna Gap Coupled with output smith chart

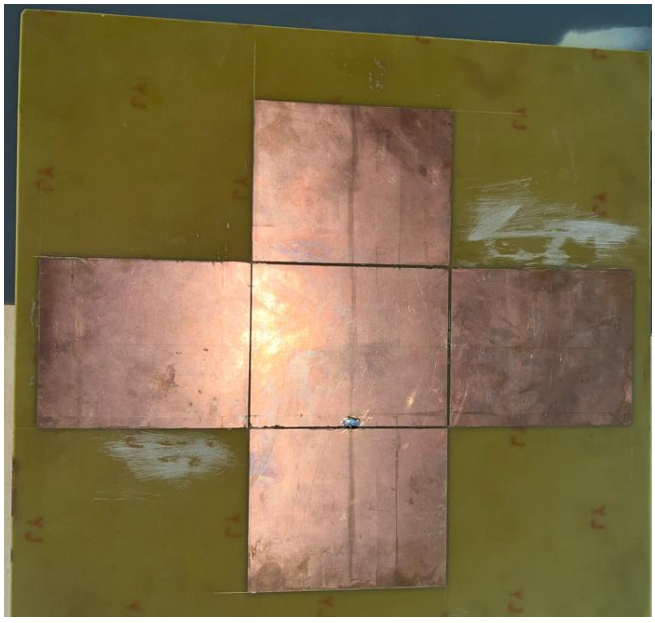


Fig.6(b) Broadband Rectangular Microstrip Antenna Gap Coupled.

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Smart Wheelchair using Hand Gesture

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***Abstract*— This study provides a framework for an affordable smart wheelchair that provides those with impairments with a range of functions. The development of a smart electric wheelchair prototype will allow the user to move around unrestrictedly without the aid of outside devices. Because to recent developments in robotic artificial intelligence, a more sophisticated and intelligent wheelchair can be made to transcend the limitations of the present conventional wheelchairs. In order to operate the prototype smart wheelchair that was demonstrated in this work using hardware implementation, an accelerometer installed on the hand glove detects the tilt angle of the user's hand movements and sends a control signal to a receiver mounted on the wheelchair. The movement will be interpreted as the user intended. The wheelchair control device is built using an Arduino UNO and ATMEGA328 microprocessor. The wheelchair is made to boost mobility safety and the dependability of carrying out many essential daily duties.**

Keywords*— Smart Wheelchair, Hand Gestures, Accelerator, Arduino UNO.

I. INTRODUCTION

A wheelchair is necessary for a disabled person who lacks hands and feet and needs it to do tasks that call for movement. He has two options for doing this: physically pushing the wheelchair with his hands or getting assistance. It is highly taxing to push a wheelchair when you are disabled. We tried to get them a wheelchair that would lessen their difficulties. The need for wheelchairs is constantly growing due to the growing population of elderly people and people who are physically disabled. There are many people in the world who are disabled, both physically and otherwise. The World Health Organization estimates that 75 million people, or 1% of the global population, use wheelchairs as a result of different disabilities. The term "mobility impairment" refers to a variety of different categories of disability. Disabilities may be neuromuscular, which affects nerves and muscles, or orthopedic, which affects bones and muscles. Amputation, paralysis, muscular dystrophy, and spinal cord injury are some of the frequent disease forms. Some folks find it challenging to move from one location to another. In order to assist these folks in traveling from one location to another, a wheelchair was created. The wheelchair that was created required a carer or the person using it to manually maneuver it, which was stressful for the individual. They become powerless and miserable due to their dependence on others. Hence, electronic wheelchairs were created. George Westinghouse published the first concept for an electronic wheelchair in 1914, making it the first electric-powered wheelchair. This chair's commercial production commenced in 1956. Many researchers have presented various systems or approaches to control electric wheelchairs since their development.

II. OBJECTIVE

The ideal assistive gadget for the elderly and crippled is a wheelchair. Driving and managing a conventional wheelchair is a significantly more difficult undertaking. Our goal is to create a strong, affordable wheelchair that enables persons with disabilities to travel independently.

III. PROPOSED DESIGN

The sensor in this hand gesture-controlled wheelchair is an ADXL335 accelerometer. When moved in the X, Y, and Z axes, it will, correspondingly, output an analogue signal. Using an LM324 operational amplifier, the analogue and digital signals are contrasted. Using a 434 GHz radio frequency transmitter, the signal is wirelessly sent. The data is first encoded with an encoder IC HT12E to shield it from interference from other devices. After then, the signal is wirelessly delivered. Now, the signal is picked up by the receiver, decoded by the decoder, and the data from the receiver is fed into the microcontroller as input. The microcontroller compares the data that is already preloaded in the controller when it receives the input or signal. A signal is then supplied to the L293D IC, which then transmits the signal to relays, causing the wheelchair to move, if the input data matches the preinstalled data. Because it captures even the smallest changes, the ADXL335 accelerometer was selected as the sensing device. The accelerometer must first be adjusted to the project's requirements in order for us to properly regulate the wheels' motion. To accomplish this, we use variable resistors, and we look at the output for different voltage levels that we altered by adjusting the variable resistance. To appropriately compare the two inputs and present the result, we need comparators. We must adjust the tilting angle in line with the hand motion. After taking various values we set the reference values of the comparator as:

Table 1 — Reference value of comparator circuit connected to the accelerometer

Direction	Reference Voltage
Forward	1.15 V
Backward	1.92 V
Left	1.85 V
Right	1.76 V

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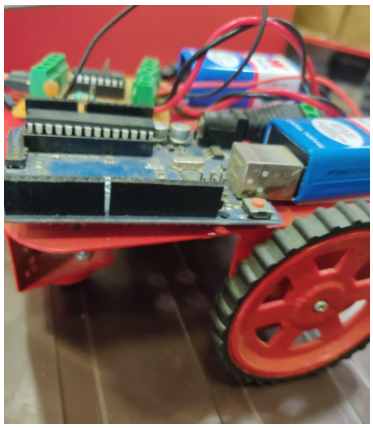


Fig.1 Small model of Smart Wheelchair

IV. IMPLEMENTATION

In Hand Gesture grounded Smart Wheelchair the microcontroller known as Arduino UNO is used to perform tasks and interface with other components. Flux detectors detect hand gestures, MEMS detectors are used to translate digital signals into mechanical actions, motor ICs control the motors, and GSM modules communicate with the appropriate parties. As a result, our design is more affordable than joystick- or voice-controlled wheelchairs

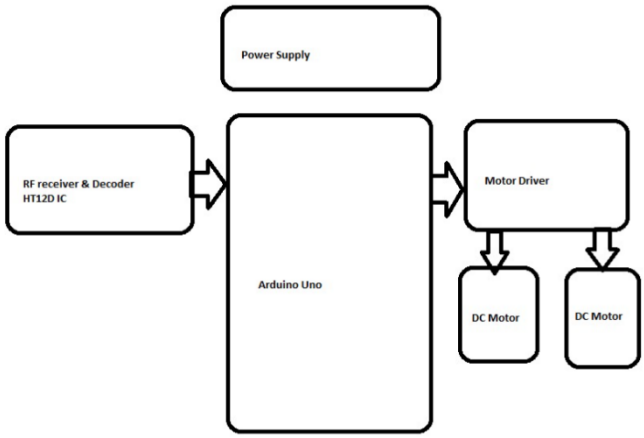


Fig.2 Flowchart of Arduino UNO connections

Arduino Nano: The ATmega328P-based Arduino Nano is a compact, comprehensive, and breadboard-friendly board. For interacting with a computer, another Arduino, or other microcontrollers, the Arduino Nano includes a number of installations. The Arduino Nano may be reset using software running on a linked computer because to the way it is built.

NRF24L01: It is a wireless transceiver RF module, where each module can shoot and admit data. When operated efficiently, this module can cover 100 measures (200 bases), making it suitable for wireless remote control systems. The NRF24L01 module is powered by 3.3 Volts so that it can be fluently used in both 3.2 Volts and 5 Volts systems. NRF24L01 is a radio transceiver module (SPI protocol) used to shoot and admit data at ISM operating frequency from2.4 to2.5 GHz.

L2938N Motor: It is a simple circuit used for controlling a DC motor. A regulator like Arduino provides the low voltage input to a motor driver module. The direction of DC motors attached to the driver is managed by this input sense. So, by providing the motor driver module with appropriate logic, you may regulate how DC motors move.

MPU6050 Gyro Accelerometer: A three-axis accelerometer and a three-axis gyroscope make up this Micro Electro-Mechanical System (MEMS). We can measure hurry, exposure, acceleration, relegation, and other stir-like characteristics with its assistance. Because of this, it simultaneously captures a three-dimensional stir.

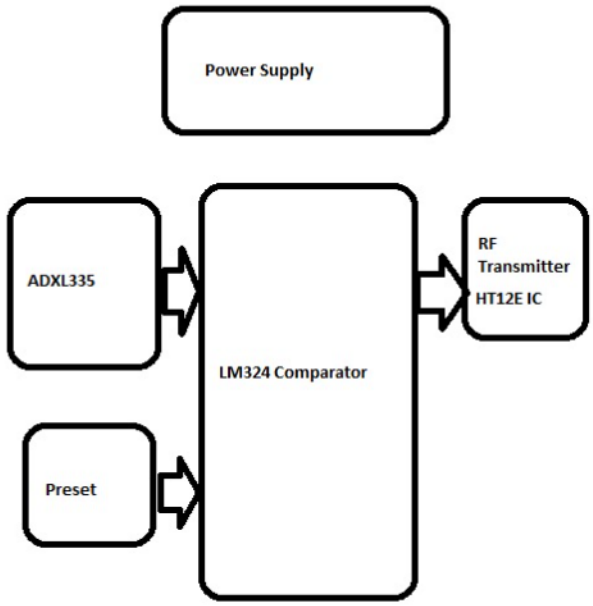


Fig.3 : Flowchart of LM324 Comparator connections

This hand gesture controlled wheelchair uses an MPU6050 accelerometer as a detector that will produce analogue signals when moved independently in the X, Y, and Z axes. An nRF24 is used as a comparator to transform an analogue signal into a digital signal, or we may refer to it as a wireless transceiver module because it can send and receive data wirelessly. After that, the signal is transferred wirelessly. Now the receiver receives the signal and also it is reused through the decoder so as to crack the signal further the data entered through the receiver is transferred to the microcontroller as input. On entering the input signal L298N binary H- Ground motor motorist starts and also the wheelchair starts moving. We also used Arduino Nano to upload the law so nRF24 can read the instruction and transmit the signal to the receiver & at the receiver point there's also Arduino Nano which compares the data which are coming from the transmitter and the wheelchair move according to it. There's one further module in this wheelchair which is an ultrasonic detector that will help to avoid obstacles by indicating. So, the wheelchair can stop and for that ultrasonic detector measures distance by using ultrasonic swells. The detector head emits an ultrasonic surge and receives the surge reflected from the target so the wheelchair automatically stops.

V. RESULTS AND CONCLUSIONS

Smart Wheelchair that's operated by hand gestures the microcontroller known as Arduino UNO is used to perform tasks and affiliate with other bias. Flux detectors are used to descry hand gestures, MEMS detectors are employed to restate digital signals into mechanical conduct, motor ICs are

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used to drive the motors, and a GSM module is used to warn the applicable parties. Because of this, our result is more affordable than joystick- or voice-controlled wheelchairs. The Arduino Nano is a small, complete, and breadboard-friendly board built on the ATmega328P. The Arduino Nano may be programmed using the Arduino Software integrated development environment (IDE), which is available both online and offline and is utilized by all Arduino boards. The Arduino Nano has 30 tiny I/O heads that are arranged in a DIP-30-like configuration. The Arduino Nano may be reset using software running on a linked computer because of the way it's erected. The wheelchair works according to the instruction given by the stoner through hand gestures. According to the stoner's gesture, both motors work as shown in Table 2. The Wheelchair will go in the direction in which our hand gesture shows.

Table 2 — Working of the motors in the wheelchair

Direction of hand gesture	**Movement of the left motor**	**Movement of the right motor**
Forward	Forward	Forward
Backward	Backward	Backward
Right	Forward	Stop
Left	Stop	Forward

VI. FUTURE SCOPE

In order for smart wheelchairs to be a commercial success and be widely utilised, there are a number of difficulties that manufacturers and academics must overcome in future work. Cost versus accuracy is a typical major problem. Affordable and sophisticated sensors can aid in resolving this issue. There are yet no smart wheelchairs that can be utilised universally for all types of disabilities. Additionally, intelligent wheelchairs ought to be able to keep an eye on the patient's condition and respond appropriately. Moreover, research should be done on intelligent wheelchairs for mentally challenged people to utilise independently. Future applications for smart wheelchairs are vast, and sensor and robotics technology advancements will also boost their economic viability.

ACKNOWLEDGMENT

Professor Ranjushree Pal gave a lot of support to both this initiative and the technical report. This article would not have been possible without her efforts; her thorough guidance and skilled coaching were invaluable to us throughout the entire endeavour. We are appreciative of our colleagues who helped us with the research and provided their expertise along the way.

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American Sign Language Detector

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***Abstract*—This report presents the design, prototype implementation and testing of Machine Learning Model that detects characters from American Sign Language and outputs the corresponding English Characters on the screen.**

Keywords—Tensor flow, OpenCV, Machine Learning.

I. INTRODUCTION

Without the use of sound, communication is possible with sign language. In-store sign language relies on sign patterns, including body language, orientation, and arm movements, to facilitate communication between individuals. There are about 200 or so sign languages in use around the globe. India is the country with the highest number of deaf individuals and, consequently, sign language users, with between 0.9 and 14 million hearing-impaired people and "one of every five deaf people in the world," according to estimates. On the other hand, there has always been a communication barrier between the speaking community and the deaf and mute since, aside from those who are deaf or mute, relatively few people are familiar with sign language. A human translator is frequently used for translation. But it is possible that a translation won't always be accessible. Communication between the deaf and mute populations and the broader public is also limited as a result of this factor. Our project, "To construct a Machine Learning Model to recognise characters from Sign Language," was developed to get around this problem. The assignment is finished using machine learning and image processing in OpenCV. Very effective techniques like machine learning and image processing are commonly used to categorise and recognise images. The image, its components, and the procedures used to extract data from it are all addressed by image processing. The study of algorithms and statistical data used to complete tasks utilising various data patterns and judgements is known as machine learning. A camera will be used to take pictures of sign language for this project. The features are retrieved from the photos after image processing. Next, using widely available datasets, these photographs are compared, and deep learning is used to understand the indicators. A screen is used to display the information so that a person who is deaf or mute can see and understand it. So that a person observing a deaf or mute person may understand their sign language, the information is displayed on a display. To detect static American sign language motions, we have created a straightforward and lightweight deep learning method.

II. DATASET USED

As a common benchmark for image-based machine learning techniques, researchers have stepped up their efforts to update the original MNIST image dataset of handwritten digits. They have also increased their efforts to create drop-in resections, which are more difficult for computer vision and particularly for practical applications. The same CSV format with labels and pixel values in single rows is used in the Sign Language MNIST, allowing the community to produce more drop-in replacements. The American Sign Language letter database of hand gestures presents a multi-class challenge with its 24 classes of letters (with the exception of J and Z, which require motion and are therefore outside the scope of this project). The dataset format is comparable to the common MNIST format. In contrast, each training and test case represents a label (0–25) as an alphabetic one–to–one map for each letter A–Z. There are no examples where 9 = J or 25 = Z due to gesture gestures. Both the test data (7172 cases) and the training data (27,455 examples) have header rows that read label, pixel, pixel2..pixel784 and each of them represents a single 28x28 pixel image with grayscale values ranging from 0-255. The original hand gesture image data showed several people doing the action on varied backgrounds. The scans (1704) of colour images that weren't cropped around the hand region of interest were greatly expanded to generate the MNIST data for sign language. For the purpose of producing new data, an ImageMagick-based image pipeline was used, which comprises hand-only cropping, grey-scaling, resizing, and at least 50+ variants to boost the amount. The alteration and enlargement plan made use of the filters "Mitchell," "Robidoux," "Catrom," "Spline," and "Hermite," as well as 5% random pixelation, +/- 15% brightness/contrast, and lastly 3 degrees rotation. Because there are so few photos, these tweaks essentially vary the resolution and class difference in interesting, controllable ways.



Fig.1

The Fashion-MNIST 2 and Srihari 4 machine-learning gesture pipelines had an impact on this dataset. In addition to providing new standards for cutting-edge machine learning methods like Convolutional Neural Nets, a potent image recognition system could really help the deaf and hard of hearing by enhancing communication through computer vision applications. The National Institute on Deafness and Other Communications Disorders states that American Sign Language, which has been around for 200 years, is a

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comprehensive and sophisticated language (of which letter motions are only a small portion) (NIDCD). With OpenCV and some Text-to-Speech, one may incorporate computer vision into a cheap board computer like the Raspberry Pi to enable better and automatic translation applications.90380 pictures are present in all. As a result, this dataset was preferred.

III. THEORY

Convolutional Neural Network

A Convolutional Neural Network (ConvNet/CNN) technique for deep learning can use a picture as input to distinguish between different elements and objects. A ConvNet requires significantly less pre-processing compared to other classification techniques. Unlike to basic techniques, where filters must be hand-engineered, ConvNets may learn these filters and properties given enough practice. The design of a ConvNet was based on how the visual cortex is organised and mirrors the human brain's linking network of neurons. The only region of the visual field where individual neurons respond to stimuli is called the Receptive Field. The entire field of view is enclosed by these organised fields.

Convolution Layers

The convolutional layer's name was inspired by the convolutional algorithm. Two functions are combined by a mathematical procedure known as convolution to create a third function, which is one of the original functions in a modified (complex) form. As a function of how much one of the original functions is translated, the new function integrates the pointwise multiplication of the two functions. An individual convolutional layer is made up of clusters of neurons called kernels. The depth of the kernels is always the same as the input, notwithstanding their modest size. In the case of high-dimensional inputs like photographs, all neurons in a kernel are connected to a subset of the input known as the receptive field since connecting all neurons to all past outputs would be incredibly wasteful. For instance, the result has 10,000 pixels or 1,000,000,000 parameters if the image is 100 100 and the first layer has 100 neurons. Each neuron keeps weights for the dimension of the kernel input rather than storing the complete dimension of the input. The input is traversed by the kernels, which build a two-dimensional activation map after collecting high-level information. A supplied parameter7 specifies the stride at which a kernel slides. Convolutional layers produce outputs by stacking the resulting activation maps, which are then utilised to provide the input for the subsequent layer. An activation map of size 28 X 28 is produced by adding a convolutional layer to an image of size 32 X 32. The size will be even less if we add more convolutional layers, which will substantially reduce the image size and cause loss of information and the vanishing gradient problem. To fix this, padding is used. An input data set is padded by adding constants to make the set bigger. The method is referred to as zero padding because this constant is frequently zero. "Same" padding indicates that the spatial dimensions of the input and output feature maps are same. This will add a column to the right while still attempting to pad left and right equally if the number of columns to be added is odd. Valid padding is equivalent to having none. Because of the strides, a kernel will skip over and not output some pixels. The strides determine how a convolution process utilising the kernel performs when a larger picture and more intricate kernel are used. The strides option allows a kernel to specify the number of spots to skip when slidding the input. ReLU, or Rectified Linear Units Layer, makes the most of the activation function (0, x). The nonlinear properties of the network are strengthened, not its size is reduced.

Pooling Layers

On the one hand, pooling layers are used to reduce the network's processing power and the spatial resolution of the representation. Furthermore, pooling layers are utilised to avoid overfitting. The most popular pooling layer has filters that are 2 x 2 with a 2 stride. As a result, the input is practically reduced from its original size by half.

Fully Connected Layers

Layers in a typical neural network are fully linked. When a layer is fully linked, each output from that layer is coupled to each neuron in that layer. The same techniques as fully linked layers are used with convolutional layers. Conversion between the two is therefore possible.

Lossless Layers

Using loss layers, the network is penalised for departing from the desired output. This frequently serves as the network's base layer. There are other loss functions, such as sigmoid cross-entropy, which predicts multiple independent probabilities, and softmax, which forecasts a class from numerous disjunct classes (from the [0, 1] interval).

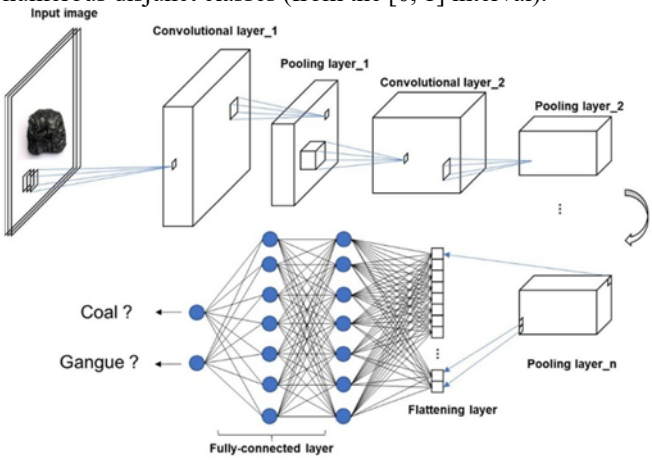


Fig.2

IV. LIBRARIES USED

Tensorflow

An open-source library for quick numerical computing is called TensorFlow. TensorFlow was created to be used in both production systems and research and development, in contrast to existing numerical libraries for Deep Learning.

Keras

On top of the TensorFlow machine learning framework, Keras is a Python-based deep learning API. It was developed to make quick experimenting possible.

Open CV

For image processing, machine learning, and computer vision, people use the large open-source package known as OpenCV. Real-time operation, which is essential in contemporary systems, is one area where it is currently essential. Users can use it to search for particular people, objects, and even human handwriting in images and movies. If Python is used in conjunction with a number of modules, such as NumPy, it can trace the origin of an array structure for examination. To recognise visual patterns and their numerous qualities, we use vector space and mathematical operations on these features.

OpenCV Functionality:

1. Object/feature detection
2. Image/video I/O, processing, display

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3. Monocular or stereo computer vision based on geometry
4. Computer-aided imaging
5. Clustering and machine learning

V. MODEL PROPOSED

Layer (type)	Output Shape	Param #
conv2d_6 (Conv2D)	(None, 26, 26, 32)	320
max_pooling2d_6 (MaxPooling 2D)	(None, 13, 13, 32)	0
conv2d_7 (Conv2D)	(None, 11, 11, 128)	36992
max_pooling2d_7 (MaxPooling 2D)	(None, 6, 6, 128)	0
conv2d_8 (Conv2D)	(None, 4, 4, 512)	590336
max_pooling2d_8 (MaxPooling 2D)	(None, 2, 2, 512)	0
flatten_2 (Flatten)	(None, 2048)	0
dense_6 (Dense)	(None, 1024)	2098176
dense_7 (Dense)	(None, 256)	262400

...
Total params: 2,994,649
Trainable params: 2,994,649
Non-trainable params: 0

Fig.3

VI. WORKING ON THE MODEL

1. We used OpenCV to capture live imagesfrom the device. We also cropped the region from (0,300) pixels to (300,600) pixels for capturing the hand gesture for prediction.

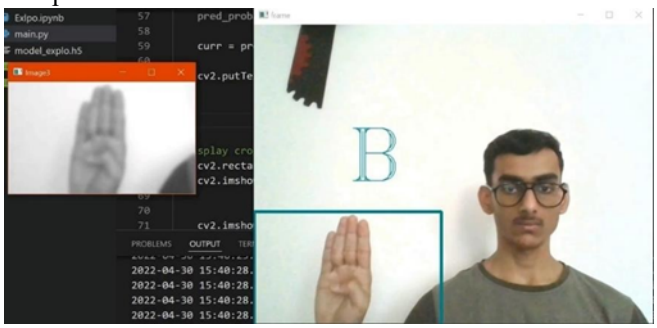


Fig.4

2. The captured image was pre-processed using the following operations:

a) Converting the image to grayscale
b) Applying Gaussian Blur
c) Resize the image to (28x28)pixels using cv2.INTER_AREA

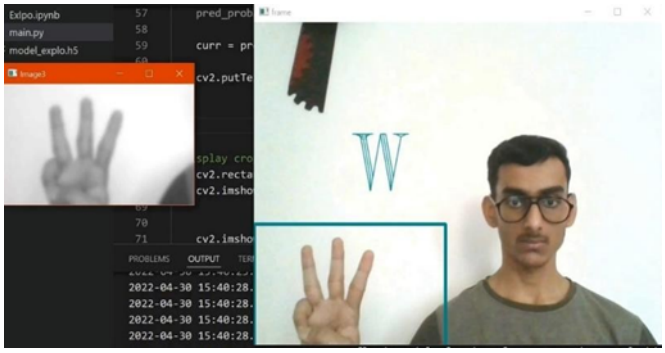


Fig.5

VII. ALGORITHM

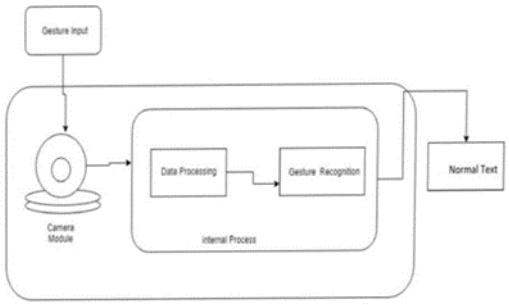


Fig.6

VIII. RESULTS AND DISCUSSIONS

a) This Machine learning program can bridge the gap between deaf and mute people and rest of the society.
b) Thus, the communication gap between the deaf and mute and the people thatcould not understand sign language is bridged.
c) By making it a portable device usage will be increased.
d) The improved speed and accuracy help us use the device in real-time withless lag.
e) It can be deployed in potential places like hospitals and police stations where emergency communication is of at most importance.
f) It will help us to make a better society.

IX. FUTURE SCOPE

The model thus generated can be used to develop mobile applications, websites,translation devices, etc that can be put to use to improve the interaction of the deaf and mute people with society. As for the future, the system recently can recognize the ASL character only andcan be enhanced to recognize the digits and the dynamic gesture too. Also, the 2 characters that required motion could be added in future. A depth-sensing camera can improve the system's ability to recognise gestures, which is especially dependent on ideal lighting conditions. This camera also makes it possible to understand 3D gestures and motion motions.

X. CONCLUSIONS

So, by using a Machine Learning CNN model, a Convolution Neural Network-based system for recognising American Sign Language was created. Under favourable lighting, it had

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a recognition accuracy of over 98% for straightforward static ASL motions and over 85% for identifying real-world environments in photos.

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Home Automation using IoT

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***Abstract*—Home automation systems are becoming increasingly popular due to their convenience, energy efficiency, and security benefits. In this paper, we present a design and implementation of a home automation system that uses the ESP32 microcontroller, ultrasonic sensor, DC motor, and motor driver to control home appliances such as lights and fans. The ultrasonic sensor detects movement, while the DC motor and motor driver control the speed and direction of the fan. The system can be controlled through a smartphone, tablet, or computer, and it can be programmed to perform certain tasks automatically.**

Keywords— IoT(Internet Of Things), ESP 32, ultrasonic sensor, DC motor, automatically .

I. INTRODUCTION

Home automation systems provide convenience, energy efficiency, and security to homeowners. A home automation system can be defined as a set of interconnected devices that allow for the remote or automatic control of household appliances and devices. The system can be controlled through a smartphone, tablet, or computer, and it can be programmed to perform certain tasks automatically. In this paper, we present a design and implementation of a home automation system that uses the ESP32 microcontroller, ultrasonic sensor, DC motor, and motor driver to control home appliances such as lights and fans. The ESP32 is a low-cost, low-power microcontroller that provides Wi-Fi and Bluetooth connectivity, making it an ideal choice for home automation systems. The ultrasonic sensor is a device that detects movement by emitting high-frequency sound waves and measuring the time it takes for the waves to bounce back. The DC motor is used to control the speed and direction of the fan. The motor driver is used to control the motor.

II. OBJECTIVE

The objective of this paper is to present a design and implementation of a home automation system that uses an ultrasonic sensor, ESP32 microcontroller, DC motor, and motor driver to control household appliances such as lights and fans. The system will detect the presence or absence of individuals in a room and automatically control the connected devices accordingly, providing convenience, energy efficiency, and security benefits to homeowners. The paper aims to demonstrate the feasibility and effectiveness of the proposed system in a real-world setting and provide insights for future development of similar systems.

III. SYSTEM ARCHITECTURE

The proposed home automation system consists of an ESP32 microcontroller, an ultrasonic sensor, a DC motor, a motor driver, and a power supply. The ultrasonic sensor is connected to the ESP32 microcontroller, which reads the sensor data and decides whether to turn on or off the connected device. The DC motor and motor driver are connected to the ESP32 microcontroller and are used to control the speed and direction of the fan. When a person enters the room, the ultrasonic sensor detects the movement and sends a signal to the ESP32 microcontroller. The ESP32 microcontroller reads the sensor data and sends a signal to the motor driver to turn on the DC motor. The motor driver controls the speed and direction of the fan, which creates air circulation in the room. When the person leaves the room, the ultrasonic sensor detects the movement and sends a signal to the ESP32 microcontroller. The ESP32 microcontroller reads the sensor data and sends a signal to the motor driver to turn off the DC motor. The motor driver stops the fan, which conserves energy. The system can also control the lights in the room based on the presence or absence of people. When a person enters the room, the ultrasonic sensor detects the movement and sends a signal to the ESP32 microcontroller. The ESP32 microcontroller reads the sensor data and sends a signal to the connected light to turn on. When the person leaves the room, the ultrasonic sensor detects the movement and sends a signal to the ESP32 microcontroller. The ESP32 microcontroller reads the sensor data and sends a signal to the connected light to turn off.

IV. SOFTWARE DESIGN

Programming the ESP32 microcontroller to read sensor data and control connected devices is included in the software design. The code is developed in the Arduino IDE, an integrated development environment that facilitates programming. The data from the ultrasonic sensor is retrieved using the interrupt function, which activates the microcontroller when motion is detected.

The code then determines whether the room is occupied or not and switches the lights on or off accordingly. Pulse-width modulation (PWM) is a method for altering the voltage provided to the motor in order to change its speed, and is used to control the fan's speed.

V. TEST RESULTS

The software design includes programming the ESP32 microcontroller to read sensor data and control linked devices. The code is developed in the Arduino IDE, a programming-friendly integrated development environment. Using the interrupt function, which activates the microcontroller whenever motion is detected, the data from the Ultrasonic sensor is obtained. The code then identifies whether the room is occupied, and appropriately turns the

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lights on or off. Pulse-width modulation (PWM) is used to control the fan's speed by adjusting the voltage supplied to the motor in order to modify its speed.

ESP-32

ESP32 is an affordable System on Chip (SoC) Microcontroller manufactured by Espressif Systems, the makers of the famed ESP8266 SoC. Tensilica's 32-bit Xtensa LX6 Microprocessor with built-in Wi-Fi and Bluetooth is the replacement for the ESP8266 SoC and is offered in both single-core and dual-core variants.



Fig.1 ESP-32

Ultrasonic Sensor

The ultrasonic sensor uses to determine the presence of an object, or to measure the distance to the object. This type of Sensor determines the distance from the Sensor to an object based on the time required from when the ultrasonic waves are sent until they are received using the speed of sound. There are also Through-beam Sensors* that detect the presence of an object by detecting the attenuation or interrupted condition of ultrasonic waves caused by an object passing between the emitter and detector.



Fig.2 Ultrasonic Sensor

DC Motor

Direct current (DC) motors are electric motors that run on direct current. The operation of an electric motor is dependent on elementary electromagnetism. When placed in an external magnetic field, a current-carrying conductor will experience a force proportional to the current in the conductor and the strength of the external magnetic field. It turns electrical energy into mechanical energy. A conductor carrying a current that is placed in a magnetic field receives a force that causes it to spin relative to its initial location. The field windings of a practical DC motor produce the magnetic flux, while the armature serves as the conductor.



Fig.3 DC MOTOR

Motor Driver L293D

DC motors are electric motors that operate on direct current. Basic electromagnetism is required for the operation of an electric motor. A current-carrying conductor will experience a force proportional to the current in the conductor and the strength of the external magnetic field when placed in an external magnetic field. It converts electrical to mechanical energy. A current-carrying conductor put in a magnetic field experiences a force that causes it to spin relative to its initial position. The magnetic flux is produced by the field windings of a practical DC motor, while the armature serves as the conductor.

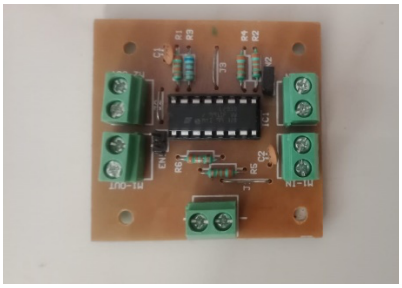


Fig.4 Motor Driver L293D.

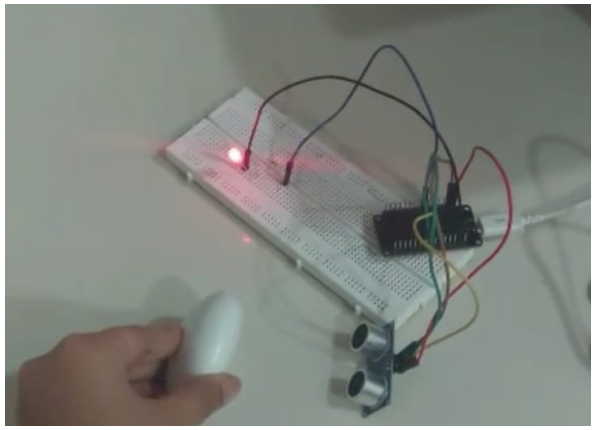


Fig.5 Implementation

VI. RESULT AND CONCLUSIONS

The proposed home automation system offers a practical and effective method for controlling home appliances and devices. The system detects motion and controls devices

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using an ESP32 microcontroller, a ultrasonic sensor, a DC motor, and a motor driver. It is simple to control the system using a smartphone, tablet, or computer, and it may be programmed to execute specific activities automatically. The system delivers energy economy, convenience, and security by preventing lights and fans from being left on needlessly.

ACKNOWLEDGMENT

We would like to express our sincere gratitude to all those who have contributed to the completion of this technical paper. First and foremost, we would like to thank our supervisor Prof. Rahul Taware , whose guidance, support, and expertise were invaluable throughout the research process.Finally, we would like to extend our appreciation to the institutions that provided the funding and resources necessary to carry out this project..

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IOT Smart Garden

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***Abstract*—This paper has analysis on how an automated smart garden works on the principles on Internet of Things through the use of various sensors and how it can be accessed remotely via an app and internet connection.**

Keywords—automated, smart garden, Internet of Things, sensors, app, internet connection.

I. INTRODUCTION

Without oxygen, living beings won't be able to sustain for long. Plants play a major role in providing the required amount of oxygen by maintaining the carbon dioxide and oxygen ratio in the air. Nowadays we see plants and trees been cut down rapidly for human requirement and the number of plantations have been reduced as well. Internet of Things i.e. IOT is one of the solutions to the arising problem as it allows objects to be sensed and monitored between the physical world and computer thus creating opportunities for more and more production of such devices which would ensure the survival of plants for a long term duration. There has been scarcity in water level and with the help of sensors, we can supply the appropriate amount of water to be supplied to the plants and data analysis of soil moisture, humidity and other factors.

II. OBJECTIVE

The main aim of this project is to utilize technology to automate and optimize the gardening process, resulting in a more efficient and effective way to grow plants. A smart garden can help monitor and control environmental factors such as temperature, humidity, and water level, ensuring that plants receive the optimal conditions for growth. By incorporating sensors, irrigation systems, and automated fertilization systems, a smart garden can minimize water and fertilizer waste while maximizing plant growth. It can also enable remote monitoring and control, allowing gardeners to manage their garden from anywhere in the world using a mobile app. Overall, the objective of creating a smart garden is to provide a more convenient, sustainable, and productive way to grow plants while reducing the environmental impact of traditional gardening methods.

III. METHODOLOGY

Creating a smart garden involves the use of technology and automation to optimize plant growth, conserve resources, and simplify garden maintenance. Here are some components and methods which were used:

ESP 32 Sensor

ESP32 is used for Wi-Fi authentication by using its built-in Wi-Fi library to connect to Wi-Fi networks, storing SSID and password information, and supporting various Wi-Fi authentication protocols. Additionally, the ESP32 can be used for advanced Wi-Fi authentication protocols or custom authentication solutions.

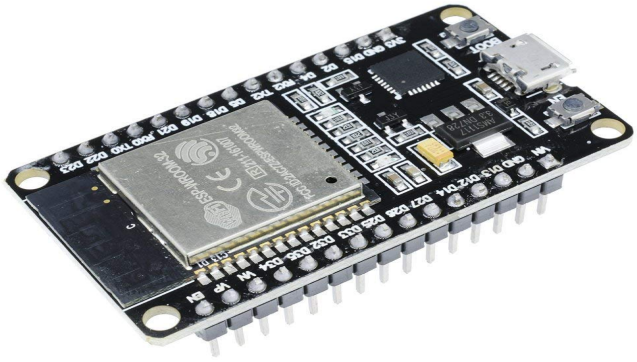


Fig.1 ESP 32 Sensor

Soil Sensors

Soil sensors are used to monitor the moisture, pH level, and nutrient content of the soil. This information can be used to automate watering and fertilization, ensuring that plants receive the right amount of water and nutrients.

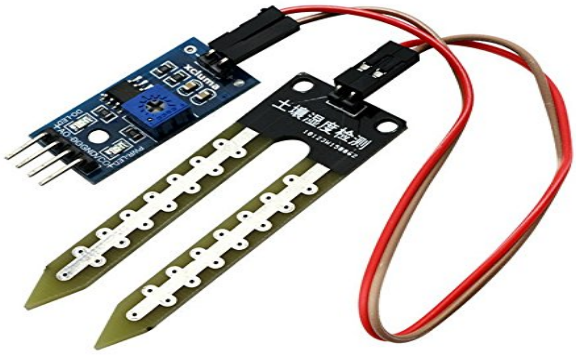


Fig.2 Soil Moisture Sensor

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Temperature and Humidity Sensors

Temperature and humidity sensors provide real-time data on temperature, humidity, and other weather conditions. This information can be used to adjust watering and lighting schedules to ensure that plants are not stressed by extreme weather conditions. Here DHT 11 sensor is used which is useful for measuring temperature and humidity in various applications, including smart gardens. Its low power consumption and intuitivity make it a good choice for smart gardens.

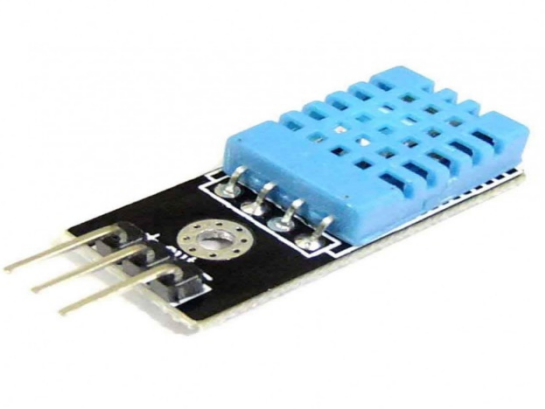


Fig.3 DHT 11 Sensor

Water Level Sensors

Water level sensors are an essential component as they make sure that plants are watered optimally and also conserving water and preventing waste. By using water level sensors along with soil sensors, temperature and humidity sensors we can create a smart garden that is efficient, productive and sustainable.



Fig.4 Soil Moisture Sensor

Plant Monitoring Systems

These systems can provide real-time data on plant growth, health, and productivity. This information can be used to adjust watering, lighting, and fertilization schedules to optimize plant growth and yield. For monitoring purpose we have created an app using Blynk App which gives real-time analysis regarding all the above parameters and we can monitor and control the required amount of light, water required etc. solely by this app.

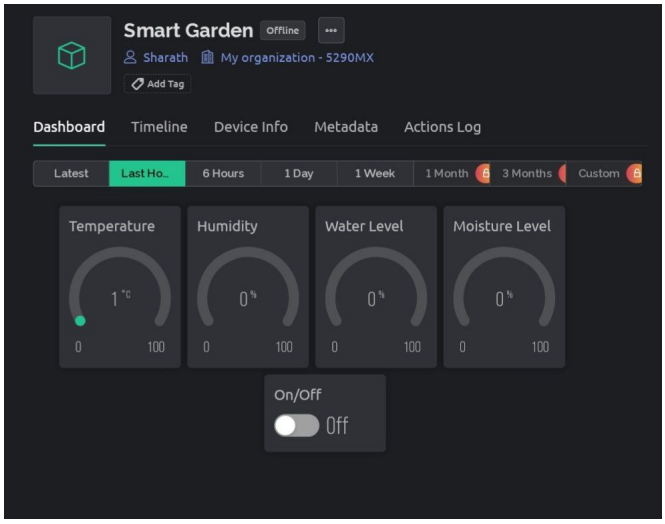


Fig.5 Plant Monitoring System

Relay Module

The relay module allows the system to control the irrigation system based on the data received from the sensors. It is a switch that is used to turn on or off the water pump based on the control signals received from the ESP32 which processes the data received from the sensors and sends the necessary control signals to the relay module to switch the water pump on or off.



Fig.6 Relay Module

LED and Resistors

LEDs and resistors are used for a variety of purposes, including providing supplemental lighting to plants, indicating the status of sensors or other devices, and regulating the flow of current in the system. They provide additional functionality and protection to the system. By incorporating LEDs and resistors we can create a more efficient and effective system that maximizes plant growth and yields.

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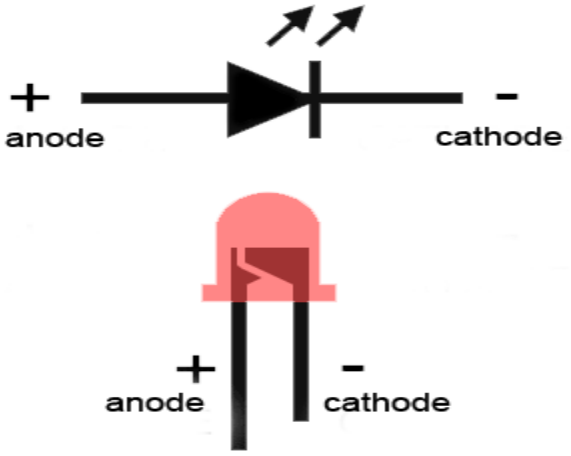


Fig.7 LEDs and Resistors

IV. LITERATURE SURVEY

The concept of IoT-based smart gardens is gaining popularity in recent years due to its potential to enhance the efficiency and productivity of agriculture and horticulture practices. Various research studies have been conducted to explore the design, development, and implementation of IoT-based smart garden systems. These studies emphasize the use of advanced sensors, communication technologies, and data analytics tools to monitor and control environmental factors such as temperature, humidity, light, soil moisture, and water levels. The systems developed in these studies provide real-time data analysis and decision-making support to farmers, enable remote monitoring and control of garden parameters, reduce water and energy consumption, and promote sustainable farming practices. Overall, the literature survey on IoT-based smart gardens suggests that these systems have the potential to revolutionize the agricultural sector by providing efficient and sustainable solutions for food production.

V. BLOCK DIAGRAM

The soil moisture sensor, temperature sensor, and water level sensor are connected to the ESP32 microcontroller. The soil moisture and water level sensors are connected to the ESP32's analog input pins, while the temperature sensor is connected to the digital input pin. The ESP32 processes the data received from the sensors and sends the necessary control signals to the relay module, which is connected to the ESP32's digital output pin. The relay module controls the irrigation system based on the data received from the sensors and the control algorithm running on the ESP32. The system is powered by a 5V power supply, and a communication module such as Wi-Fi or Bluetooth can be added to enable communication between the smart garden system and the user's smartphone or computer. Overall, this schematic diagram shows how the smart garden system can be designed using a combination of sensors, microcontrollers, and actuators to automate the monitoring and control of different garden parameters, such as soil moisture, temperature, and water levels.

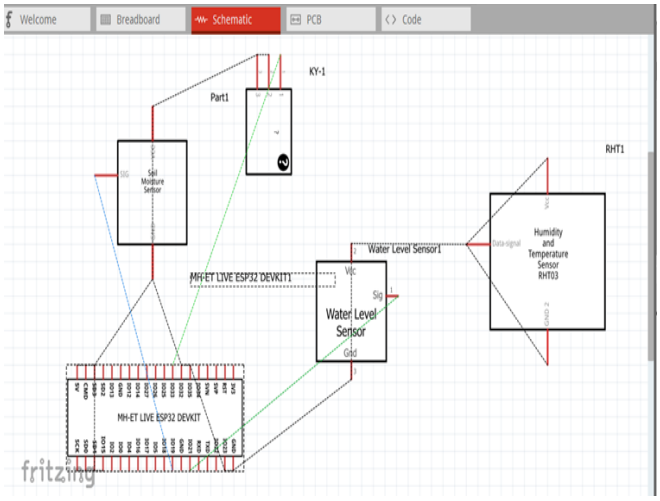


Fig.8 Schematic Diagram

VI. FUTURE SCOPE

The future scope of IoT-based smart gardens is bright and full of possibilities. One of the most promising areas of development is the integration of IoT and AI technologies to create autonomous gardening systems. With the help of advanced sensors and machine learning algorithms, these systems can monitor the garden's conditions and take actions accordingly. For instance, the system can detect when plants need water or nutrients and automatically adjust the irrigation or fertilization schedules. This will not only reduce the workload for gardeners but also improve the efficiency and yield of the garden. Another area of development is the use of blockchain technology to create a secure and decentralized platform for managing smart gardens. The blockchain can help track the origin of the plants, monitor the quality of the soil, and ensure that the produce is free from harmful chemicals. This can be particularly useful in urban farming, where there are concerns about food safety and security. Moreover, the integration of smart garden systems with the smart home ecosystem can lead to more personalized and convenient gardening experiences. Smart gardeners can receive notifications about their garden's status, control the irrigation and lighting systems with voice commands, and even receive recipe suggestions based on the plants they are growing. Overall, the future scope of IoT-based smart gardens is vast, and with technological advancements, we can expect to see more efficient, sustainable, and personalized gardening experiences in the years to come.

VII. CONCLUSIONS

In conclusion, the development of IoT-based smart gardens is a promising solution to the challenges of modern food production and the increasing demand for sustainable and efficient gardening practices. The use of smart gardens can also provide a personalized and convenient gardening experience for users, promoting healthy living and food security. With further research and development, we can expect to see more efficient, sustainable, and innovative solutions for smart gardens, leading to a more sustainable and healthier lifestyle for individuals and communities.

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We would sincerely thank our faculty guides Dr. Sanjay Deshmukh and Prof. Rahul Taware for their precious time and efforts in guiding us and making this project worth making. They have been our support system who supported us in our decisions and prompted us to carry on. We would love to express our gratitude towards them.

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Accident Prevention and Detection System

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***Abstract*—"Drowsiness and sleepiness are significant factors that contribute to accidents in various settings, including transportation, healthcare, and manufacturing. The use of accident prevention and detection systems has become increasingly important in mitigating the risks associated with these states. This project presents an accident prevention and detection system that effectively reduces the number of accidents in a given environment with a high level of accuracy. The system utilizes various sensors and algorithms to detect potential hazards and alert users of potential dangers, including drowsiness and sleepiness. It was built using Python and tested in a simulated environment. Future improvements to the system could include expanding the types of sensors used and incorporating real-time monitoring for faster response times. Transportation has become an integral part of our daily routine, simplifying many of our tasks. However, in recent years, road accidents caused by driver drowsiness, distractions, and exceeding speed limits have led to catastrophic consequences. Such incidents may result from factors such as drowsiness, dozing, or alcohol consumption, which can cause loss of focus and impede driving. To address this issue, this study introduces a prototype system that utilizes a Raspberry Pi, Pi Camera, and various sensors to monitor the driver's eye movements, detect yawning, and identify alcohol consumption. The Internet of Things and machine learning technologies are leveraged to enable the system to transmit data on the driver's behaviour and driving patterns to the cloud for immediate action in case of emergencies. By alerting drivers through a sound system, the device has helped prevent distractions before they occur, potentially saving lives. Cloud services and machine learning techniques are used to identify fatigued drivers through the collection and analysis of data stored in the cloud. Experimental testing of the system has demonstrated its efficiency and effectiveness in preventing accidents and providing safety assistance to drivers.**

Keywords—Alcohol consumptiom, Accident, Prevention, Dlip, Euclidean formula

I. INTRODUCTION

Driving while sleepy or under the influence of alcohol is the primary cause of traffic accidents and the resulting financial losses. Road crashes cost most countries approximately 3.14% of their GDP and lead to around 1.35 million deaths every year. In India, despite accounting for only 1% of the world's vehicle population, the country experiences 6% of global road accidents, with around 151,000 deaths resulting from road accidents. The national highway traffic safety administration is one of the main agencies that conducts research on road and driver safety. According to a study that looked at the critical reasons for road accidents, 94% of car accidents are caused by drivers, and drowsy or drunk driving accounts for 25 to 30% of accidents. Although improved automobile structures have helped reduce accidents, drivers' attitudes while driving are not evaluated properly. There are three main approaches to evaluating driver attention: visual-based, driving behaviour-based, and physiological techniques involving the analysis of vital signals such as brain activity, heart rate, and pulse rate. However, the use of electronic devices that are attached to drivers' bodies can be inconvenient. The driving behaviour- based approach evaluates drivers' behaviour over time by observing variations in speed, steering wheel angle, acceleration, lateral position, and braking. Liang et al. demonstrated a real-time approach to detecting driver distraction using eye movements and driving performance, and both support vector machines (SVM) and logistic regression models (LRM) were trained and tested to recognize driver distraction. The visual-based approach analyzes drivers' facial images, such as eye blinks, yawning, and head movements. Hammond et al. proposed a drowsiness detection system that assesses eye status in the near-infrared spectrum. Moriyama et al. predicted eye status by using templates to match with eye lids, and the number of eye blinks can also detect drowsiness. Visual-based approaches are preferred because they do not interfere with the driver.

II. OBJECTIVE

The objective of an accident prevention and detection system is to reduce the occurrence of accidents in vehicles by identifying potential hazards, providing early warning signals, and alerting individuals or systems to take preventive measures.Accidents can have significant consequences, including loss of life, serious injury, and financial damage. Therefore, preventing and detecting accidents is critical for maintaining a safe environment and protecting human life and property.

The following are some specific objectives of an accident prevention and detection system:

1. Identify potential hazards: The system should be able to identify potential hazards in various environments and provide a warning before an accident occurs. This could include identifying unsafe work practices, hazardous materials, or dangerous equipment.
2. Provide early warning signals: The system should provide early warning signals to alert individuals or systems to take preventive measures. This could include alarms, notifications, or other types of alerts.

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3. Improve safety protocols: The system should provide feedback to improve safety protocols and procedures. This could include identifying areas for improvement, providing recommendations for training or equipment upgrades, or other suggestions.

Overall, the objective of an accident prevention and detection system is to create a safe and secure environmentthat minimizes the risk of accidents and protects the healthand safety of person By identifying potential hazards, providing early warning signals, and improving safety protocols, such a system can significantly reduce the occurrence and severity of accidents on roads.

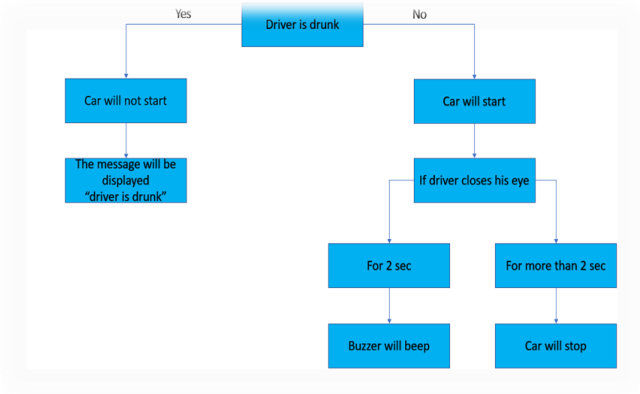


Fig.1 Block Diagram of Accident Detection System

III. DESCRIPTION

OpenCV in Python:

OpenCV(Open Source Computer Vision) is a popular open-source computer vision and machine learning software library. It provides a wide rangeof tools and algorithms that can be used for image and video processing tasks, such as object detection, tracking, and recognition. Open CV has a Python interface that makes it easy to use and integrate with other Python libraries. Here are some key features of Open CV in Python:

1. Easy installation: OpenCV can be installed in Python using pip, the Python package manager, making it easy to get started with the library.
2. Rich set of image processing functions: OpenCV provides a rich set of functions for image processing tasks, such as filtering, thresholding, edge detection, and morphological operations.
3. Video processing: OpenCV provides a number of functions for processing video streams, such as capturing frames from a camera, writing frames to a video file, and performing object detection and tracking in real-time.
4. Machine learning: Open CV includes machine learning algorithms for tasks such as object detection, face recognition, and image classification.
5. Integration with other libraries: OpenCV can be easily integrated with other Python libraries such as NumPy, SciPy, and Matplotlib, allowing for more advanced imageprocessing and data visualization.
6. Cross-platform support: OpenCV in Python is crossplatform and can run on various operating systems,including Windows, macOS, and Linux.
7. Large community: OpenCV has a large community of developers who contribute to the library by providingsupport, bug fixes, and new features.

IV. EUCLIDEAN FORMULA

The Euclidean formula, also known as the Pythagorean theorem, is used to measure the angle of vision for both eyes and is a common test used by most optometrists to diagnose refractive errors. The formula can help detect astigmatism, hyperopia, myopia and other vision problems. By measuring objects from different distances and angles, the optometrist can accurately determine the state of a patient's eyes. The formula is used by measuring the curvature of the eyes, which is a key factor in determining refractive errors.

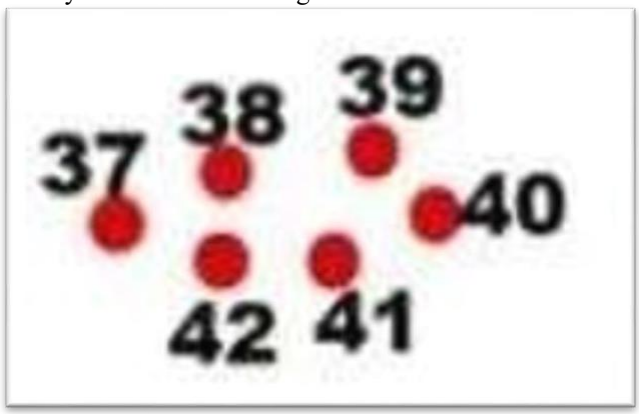


Fig.2 Diagram for Euclidean Formula

The EAR is a measure of the eye's openness, and it is calculated using the following formula:

EAR = (||p2-p6|| + ||p3-p5||) / 2(||p1-p4||) where p1, p2, p3, p4, p5, and p6 are the coordinates of six landmarks on the eye.To calculate the Euclidean distance between two points.We use the following formula:

||p1-p2|| = sqrt((p1x-p2x)^2 + (p1y-p2y)^2)

where p1x, p1y, p2x, and p2y are the x and y coordinates of the two points.To calculate the EAR using the Euclidean distance formula.

We substitute the formula for Euclidean distance into the EAR formula as follows:

EAR= (sqrt((p2x-p6x)^2 + (p2y-p6y)^2) + sqrt((p3xp5x)^2 +(p3y-p5y)^2)) / (2 * sqrt((p1x-p4x)^2 + (p1yp4y)^2))

So, to calculate the EAR using the Euclidean distance formula, we need to first obtain the coordinates of the six eye landmarks using dlib's facial landmark detection algorithm. We can then plug these coordinates into the above formula to calculate the EAR.

V.DESCRIPTION

The Dlib library is a popular open-source C++ library for machine learning, computer vision, and image processing tasks. It was developed by Davis King and first released in 2002. The library is widely used in both academic research and industry for a variety of applications, such as face detection, object tracking, image segmentation, and clustering. Here are some key features of the Dlib library:

Machine learning algorithms

The Dlib library provides a number of machine learning algorithms, such as support vector machines (SVMs), k-nearest neighbors (KNN), and deep neural networks (DNN).

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These algorithms can be used for classification, regression, clustering, and dimensionality reduction tasks.

Image processing algorithms

The Dlib library provides a number of image processing algorithms, such as convolutional neural networks (CNNs), histogram of oriented gradients (HOG), and Canny edge detection. These algorithms can be used for image classification, object detection, and feature extraction tasks.
Facial landmark detection: The Dlib library provides a powerful facial landmark detection algorithm that can detect the location of 68 key facial landmarks, such as the corners of the eyes, mouth, and nose. This algorithm is widely used in facial recognition and facial expression analysis applications.

Cross-platform support

The Dlib library is designed to be cross-platform and can run on Windows, Linux, and macOS operating systems. It also provides interfaces for Python, Java, and MATLAB programming languages.

Efficient performance

The Dlib library is known for its efficient performance and scalability. It can handle large datasets and complex models with ease, and it can take advantage of multi-core CPUs and GPUs to accelerate computation.
Overall, the Dlib library is a powerful and versatile tool for machine learning, computer vision, and image processing tasks, and it is widely used in both research and industry for a variety of applications.

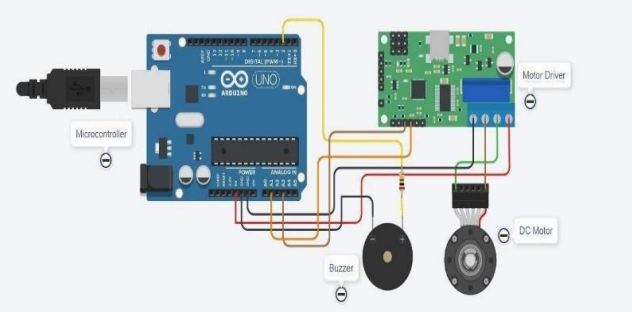


Fig.3 Circuit Diagram

VI.IMPACT

The accident prevention and detection system presented in this project has the potential to make a significant impact on society by reducing the number of accidents caused by drowsiness and sleepiness. These accidents can cause serious injuries, fatalities, and property damage, leading to significant economic and social costs. By detecting potential hazards and alerting users of potential dangers, the system can help prevent accidents from occurring in various settings, including transportation, healthcare, and manufacturing. In particular, the transportation sector can benefit greatly from this system, as it can help reduce the number of accidents caused by driver drowsiness, distractions, and exceeding speed limits. This can lead to a safer and more efficient transportation system, reducing the number of injuries and fatalities, and decreasing the economic costs associated with accidents. Moreover, the use of cloud services and machine learning techniques can enable the system to collect and analyze data on driving patterns and behaviour, providing insights into driver fatigue and other risk factors. This can help improvedriver training and education programs, leading to safer driving practices and a more responsible driving culture. Overall, the implementation of this accident prevention anddetection system can have a positive impact on society by improving safety, reducing the number of accidents, and minimizing the associated economic and social costs.
Applications of proposed system:

The accident prevention and detection system presented in this project can be applied in various settings to enhance safety and prevent accidents caused by drowsiness and sleepiness. Some of the potential applications of this system include:
Transportation

The system can be installed in vehicles to monitor driver behavior and detect potential hazards, such as drowsiness and distractions. It can also alert drivers of potential dangers, helping prevent accidents and promoting safe driving practices

Healthcare

The system can be used in healthcare settings to monitor the sleep patterns and behavior of patients, helping prevent accidents and promoting better sleep hygiene.

Manufacturing

The system can be installed in manufacturing plants to monitor worker behavior and detect potential hazards, such as drowsiness and distractions. It can also alert workers of potential dangers, helping prevent accidents and promoting safe working practices.

Mining

The system can be applied in mining environments to monitor workers' behavior and detect potential hazards, such as drowsiness and fatigue. It can also alert workers of potential dangers, helping prevent accidents and promoting safe working practices.

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Aviation

The system can be used in the aviation industry to monitor pilots' behavior and detect potential hazards, such as drowsiness and distractions. It can also alert pilots of potential dangers, helping prevent accidents and promoting safe flying practices.

In summary, the application of this accident prevention and detection system is not limited to any specific industry or environment. It can be utilized in various settings to enhance safety and prevent accidents caused by drowsiness and sleepiness.

VII.RESULT AND CONCLUSIONS

After completing all necessary procedures, our project on "Accident Prevention, Detection System" was successfully implemented. The project's final output is presented below. In the 21st century, as science and technology continue to advance, there is increased emphasis on vehicle safety. The number of road accidents is also on the rise with the growing number of vehicles, making it our responsibility to address the issue. Most accidents occur due to drunk driving, drowsiness while driving.This project's implementation can help reduce accidents caused by these reasons. The system is automated, cost-effective, and energy-efficient, making it easy to install in vehicles. A non-intrusive system has been developed for monitoring driver drowsiness and detecting alcohol consumption, with no disturbance to the driver. The system employs self-determined algorithms to collect information on the driver's head and eye positions, and triggers an automatic alert if the eyes remain closed for an extended period. In extreme cases, the engine is shut down. The system leverages image processing techniques to achieve highly accurate and reliable drowsiness detection. Additionally, a buzzer immediately alerts the driver if someone with alcohol consumption enters the vehicle. By addressing these major factors contributing to fatal crashes, an embedded kit for drowsiness detection has been developed and is designed to be installed in vehicles.

VII.FUTURE SCOPE

Accident prevention and detection systems are becoming increasingly important in the automotive industry as car manufacturers strive to improve safety for drivers, passengers, and pedestrians. The future scope of accident prevention and detection systems in cars is vast, with new technologies and advancements being developed to prevent accidents caused by human error, improve driving conditions, and enhance the overall driving experience. One of the key areas of development in accident prevention and detection systems in cars is the use of sensors and cameras to detect potential hazards and avoid collisions. For example, some cars are now equipped with lane departure warning systems that use cameras to monitor the vehicle's position in its lane and alert the driver if they start to drift out of the lane. Some cars are also equipped with adaptive cruise control, which uses radar or liar sensors to detect the distance between the car and the vehicle in front, automatically adjusting the speed to maintain a safe distance.

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Design of Center Slotted Circular Microstrip Antenna for Circular Polarized Response

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***Abstract*—Design of a circularly polarized center slotted circular microstrip antenna at 900MHz is proposed. The feed is placed at a 45 degree angle from the slot axis, which excites the two orthogonal modes with equal amplitude and phase difference of 90 degree. The design is presented on thinner FR4 substrate having dielectric constant 4.33 and loss tangent 0.02 and a thickness of 0.16cm. In this design, the antenna yields impedance bandwidth of 4 – 5% with an axial ratio bandwidth of 0.7 – 1%. With these antenna characteristics, both the proposed low profile designs satisfy the requirement of circular polarization. To authenticate the simulated results, measurements have been carried out, which show similar values.**

Keywords—Circular-polarization, Circular microstrip antenna, Rectangular-slot.

I. INTRODUCTION

Because of the diverse advantages like low profile conformal design, microstrip antenna (MSA) finds greater utilization in the field of wireless communications. In these applications, antenna used must receive signals from all the possible directions as well as different orientations of the incident wave. Here the different orientation refers to the different polarization. This design feature in the radiation pattern is required by the antennas as signal undergoes multipath propagation effects that changes the polarization of the transmitted wave. Thus, if signal polarization does not match with the polarization of the antenna at the receiver, then signal loss will result into. To minimize this, antenna offering elliptical polarization or circular polarization are selected. In the case of elliptical polarization, the difference between the co polarization and cross polarization levels is in the range of 6 to 10 dB. A cross polar level indicates the sensitivity of the antenna to receive the orthogonal signal incident. Higher the cross polar levels, lesser is the signal loss. In the case of circular polarized antennas, antenna offers almost equal levels of co and cross polarization levels in the radiation pattern. This gives minimum possible receiver signal loss. Thus, in case of multi-path propagation, circularly polarized (CP) antennas are adopted in global positioning system tracking applications. Another design feature that is needed in this antenna is the small volume, which maintain the low profile nature of the design. Effective substrates are used to increase the gain of the MSA, which has lower loss tangent or the air suspended patches are also used. The efficient substrates are costly whereas use of suspended patches lead to increment in patch area and volume. Thus the design of MSA is preferable that offers higher gain with the impedance bandwidth (BW) as required by the specific application, by using low cost substrate and keeping the low profile nature of the overall design. Keeping all these design features in consideration, this paper presents the design of center slotted Circular MSA (CMSA) offering CP response at 900MHz operating frequency. This design is done on thinner FR4 substrate(εr = 4.3, h = 0.16 cm. tan δ = 0.02). Parametric study for changes in slot length is conducted to realize optimum CP response. The feed is placed at a 45 degree angle from the slot axis, which excites the two orthogonal modes with equal amplitude and phase difference of 90 degree. In this design, the antenna yields impedance bandwidth of 4 – 5% with an axial ratio bandwidth of 0.7 – 1%. The configurations presented in the current paper are analyzed using IE3D software at first followed by experimental verification. All antennas were excited using an SMA connector. In the measurements, ZVH – 8, FCS 6 and SMB 100A instruments were used.

II. CENTER SLOTTED CMSA FOR CP RESPONSE

Various techniques can be used to realize the CP response in MSA like, cutting slot in the patch, loading the patch with open circuit stub, using modified shape of the radiating patch in MSA, loading shorting post on the patch, using resonant slots in the patch and by employing the modified ground plane designs.Amongst the above techniques, resonant slot cut MSAs, modified patch shape designs are implemented on thicker substrate whereas slot, stub and shorting post loaded MSAs employs efficient substrate, which is not a cost effective solution. Therefore, in this study, low cost FR4 as well as its suspended variation is selected to provide a cost effective solution on a thinner substrate. Fig. 1(a) shows the design of center slotted CMSA. Design is presented on FR4 substrate. The CMSA dimensions are selected so that its fundamental frequency is around 900 MHz. Thus, CMSA radius is, Rp 4.7 cm. Dimensions of the ground plane are, Lg = Wg = 10.00 cm. The modal current distributions and resonance frequency plots at the observed resonant peaks, displayed in Fig. 1(b – d) are obtained by carrying out the parametric study for the width of the slot of dimension 'Ws'. When the width of the slot is increased, this creates unequal diagonal lengths in the patch. The coaxial feed at xf = yf= 1.8 cm from the patch center which excites the two orthogonal modes in phase quadrature. This yields Circular Polarized response for less than 3 dB AR. The optimum CP response for AR < 3 dB for maximum possible frequency points is obtained for Ws = 1.4 cm, xf = yf= 1.8 cm and results for the same is shown in Fig. 2(a).

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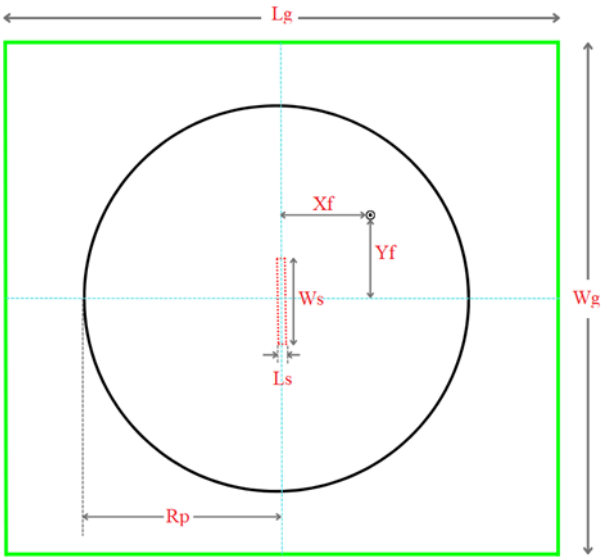


Fig.1

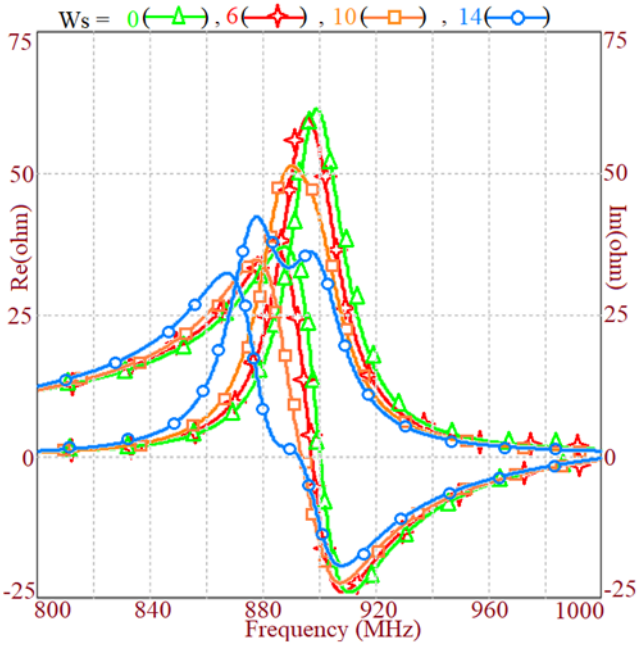


Fig.2

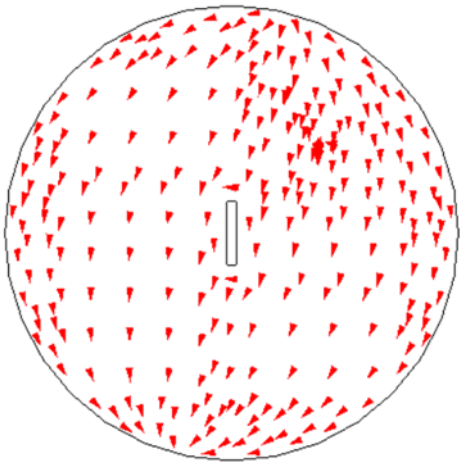


Fig.3

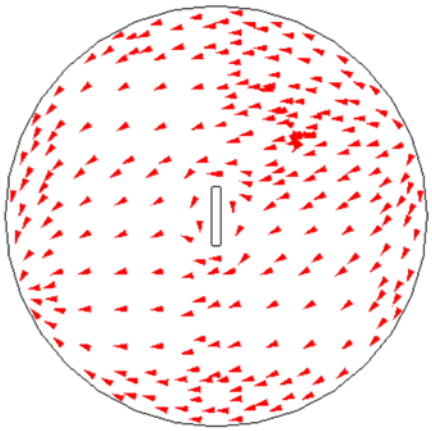


Fig.4

The measured and simulated impedance BW is 68 MHz (7.55%) and 62 MHz (6.88%), respectively. The experimental and simulated values of the AR BW are 8.3 MHz (0.92%) and 7.93 MHz (0.88%), respectively. As the antenna is designed on FR4 substrate, broadside gain is lower than 0 dBi.

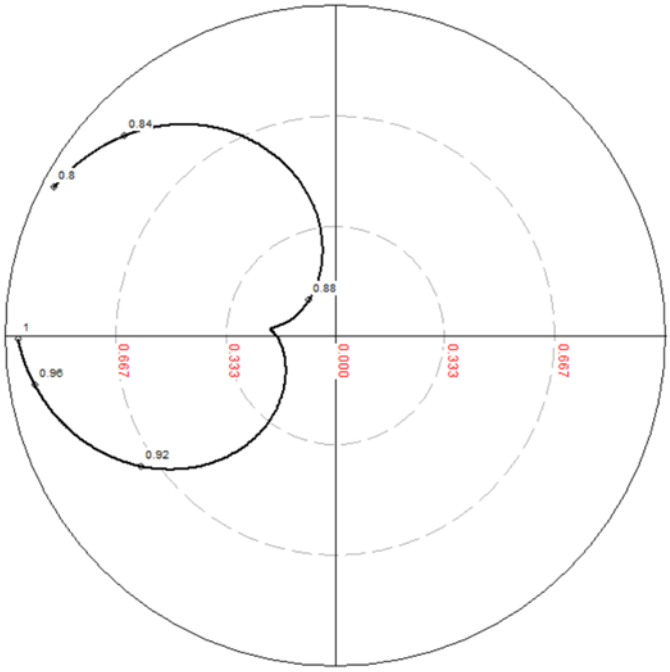


Fig.5

III. DESIGN METHODOLOGY

The radius of the circular patch is obtained by the formula given below:

$$r_e = \frac{K_{nm}\, c}{2\pi f_0 \sqrt{\varepsilon_e}}$$

where K_{nm} is the mth root of the derivative of the Bessel function of order n. For the fundamental TM_{11} mode, the value of K_{nm} is 1.84118. The r_e and ε_e are the effective radius and the effective dielectric constant of the CMSA, respectively. At f_0 = 900MHz, using the above formula, the radius of the patch comes out to be around 4.71cm. The slot length is taken as 2mm and parametric study is done on the width of the patch to yield optimum circular polarized response. By considering these design requirements, design of center slotted CMSA on FR4 substrate is considered here as shown in Fig. 6, below.

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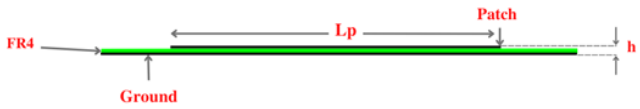


Fig.6

IV. CONCLUSIONS

This paper presents the design and optimization of a circular patch microstrip antenna (MSA) with a rectangular slot in the middle for circular polarization. To achieve circular polarization, we incorporated a rectangular slot in the square patch's center, creating a phase difference between the orthogonal modes. We performed a thorough parametric study to optimize the dimensions of the patch and the slot for circular polarization. The study involved evaluating the effects of changing the dimensions of the patch and the slot.The results showed that the optimal dimensions for the proposed antenna were 2mm by 14mm.The proposed antenna offers a compact and low-profile solution, making it suitable for space-constrained applications. The rectangular slot in the patch provides additional degrees of freedom to tune the antenna's performance. The study also highlights the importance of selecting an appropriate feeding technique for MSAs, which can significantly affect the antenna's performance.

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Dr. Amit A. Deshmukh and Dr. Venkata Chavali provided significant help for this study and technical report. Our project was made possible by their invaluable mentoring and comprehensive direction, which supported us at every level. Without them, this article would not have been conceivable. We would like to express our gratitude to our colleagues for their insight and assistance during the research process..

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Swachh.bin

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***Abstract*—— The application of the Internet of Things, to solve everyday problems is not a recent concept. From developing systems that can control the temperature of the room at demand to home automation systems, the touch of smart devices has enhanced every aspect of our daily life. Now, to tackle the age-old problem of Waste Management in Public Areas, urged us to reach out to an automated Internet of Things device that enables the user to resort to commands that do not require them to make physical contact with the Garbage Accumulator (dustbin). Along with gesture recognition, our smart dustbin sends notifications to the user about its capacity and when it needs to be emptied out thus preventing the garbage from overflowing and negatively impacting the aesthetics of the place. This is specifically helpful in offices, malls, monuments, and buildings that have specific monumental or aesthetical values.**

Keywords— facial recognition, emotion recognition, python, JavaScript, visual studio, CSS3, HTML, Tensor flow, OpenCV, Machine Learning, Autism.

I. INTRODUCTION

The application of the Internet of Things (IOT) to solve everyday problems is not a recent concept. From developing systems that can control the temperature of the room at demand to home automation systems, the touch of smart devices has enhanced every aspect of our daily life. Now, to tackle the age-old problem of Waste Management in Public Areas, urged us to reach out to an automated IOT device that enables the user to resort to commands that do not require them to make physical contact with the Garbage Accumulator (dustbin). Along with gesture recognition, our smart dustbin sends notifications to the user about its capacity and when it needs to be emptied out thus preventing the garbage from overflowing and negatively impacting the aesthetics of the place. This is specifically helpful in offices, malls, monuments, and buildings that have specific monumental or aesthetical values. While the application of the Internet of Things is to observe the levels of waste collected in a bin, an additional feature of noise sensing is added to the project which makes the dustbin competent to respond to claps and foot-tap sounds and open as a response to this disturbance generated. The scope of the project is to convert every ordinary dustbin into a smart dustbin just by adding a combination of hardware and software additions to the regular dustbin. Not only does this make the entire procedure simpler and cost-effective but it also provides a much more advanced and smart solution to the burning problem of incompetent management of waste in public spaces.

II. OBJECTIVE

The objective of making a smart dustbin that opens with a clap and has ultrasonic sensors to detect the level of garbage is to provide a convenient and hygienic solution for waste disposal. The smart dustbin aims to make the process of throwing away trash easier and more efficient by incorporating technology that allows it to detect when it is full and needs to be emptied. The use of ultrasonic sensors enables the dustbin to accurately measure the level of garbage, thus reducing the likelihood of overflowing and promoting cleanliness. Furthermore, the dustbin's ability to open with a clap promotes hands-free operation, thereby minimizing the spread of germs and promoting a hygienic environment. Overall, the objective of this smart dustbin is to provide a user-friendly, efficient, and hygienic solution to waste disposal, thereby promoting a healthier and more sustainable living environment. The use of ultrasonic sensors which helps to provide IOT notifications through the WIFI module also helps to keep a track of garbage levels and aids in central monitoring of garbage at public places. This would also further the concept of Swachh Bharat Abhiyan. Swachh.bin brings us closer to the future which integrates usage with technology. The pandemic has infused a sense of precaution and increased the need to maintain sanitary standards in society. Swachh.bin helps the work of management of various dustbins easier.

III. REVIEW OF LITERATURE

The working principle and using it as a study tool and research are explained in [1] This paper examines an Arduino board's operation and potential uses. This also examines its potential as a tool for academic and research endeavours. An efficient tool for developing a VLSI test bench, particularly for sensors, is the Arduino board. Fast processing and a simple interface are the main benefits. Today, technology is creating a new dimension by making complex things appear simple and engaging as more and more people use open-source hardware and software. These open sources offer free or almost free, highly dependable, and reasonably priced technology. The different varieties of Arduino boards, operating concepts and key features, software implementation, and applications are briefly discussed in this paper. Arduino is a microcontroller which is open source that can be programmed, erased, and reprogrammed at any instant in time with ease. This paper helped us understand the basic pin functioning of Arduino and helped us understand programming basics. This research paper highlights the elements of an Arduino. Distance Sensing with Ultrasonic Sensor and Arduino [2]. In this paper, we understood how to

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integrate ultrasonic sensors with Arduino. The research paper highlights an object that changes one form of energy into another a sensor. A USB plug is used to connect the small microcontroller board known as Arduino to a computer. The Arduino board may influence its surroundings by controlling LCDs, speakers, motors, and GS modules. It can perceive the environment by receiving input from a range of sensors. Using "non-contact" technology, ultrasonic sensors can measure the distance between target materials or objects in the air. They are simple to use and measure distance without being harmed. The result the analogue signals that the sensor receives are converted to digital signals by the microcontroller and output in the analogue form. It is used to identify obstacles in the current work and determine their precise distance. The project's objective was to create an ultrasonic distance meter from scratch. The device described here is capable of both target detection and target distance calculation. The ultrasonic distance meter is a cheap and straightforward tool for measuring distance. The gadget calculates the distance with the proper precision and resolution. It is a practical method of determining distance without having to touch anything. The device has applications in many fields. [3] This article provides a comprehensive examination of the diverse uses of Internet of Things (IoT) technology. It discusses how IoT emerged from earlier technological advancements in mobile and ubiquitous computing, highlighting the fact that the internet now connects objects instead of just people. Key features of IoT include the ability to access product information, use electronic tags, establish standardization, and upload data. IoT makes use of technologies like wireless sensor networks and radio frequency identification (RFID) (WSN). IoT has a wide range of uses in industries like healthcare, supply chain management, defence, and agriculture. The study also focuses on IoT-related challenges. Although being a hot topic, IOT has some serious problems, like security and privacy. This study improved our understanding of IOT's vast applications. It emphasised the need of utilising modern technology to address fundamental yet distressing issues. [4] We took the fundamental concept development from this study. The amount of trash in the trash can must be known so that we can advise individuals on when to use the trash can or not. The Smart Dustbin idea was inspired by this research., we have designed a prototype where the lid of the dustbin is opened, upon detection of the human clap and tap. The level of waste inside the dustbin is sent as a notification through the WIFI module. This prototype's major components are Arduino, Servo Motor, mic sensors and ultrasonic sensors. In this we learnt how to integrate the software component is the application named IOTgecko which is used to get notifications. This dustbin can be a building block for an efficient Waste Management Unit. Here the officials can clean or empty the dustbin depending on the notifications received by them and not wait for a call from a person in society who would inform them about the same. Understood how to integrate ultrasonic sensors and helped us innovate on this idea. The project aims to create a smart dustbin that can detect human clapping or foot-tapping signals and automatically open and close its hatch. The dustbin contains an ultrasonic sensor that continually monitors the level of garbage in the dustbin and sends this information to the facility's garbage collector via the internet. To create the online portion of this IoT system, IOTgecko is utilized. This bin is widely used for garbage disposal in offices, houses, and even public locations. As a result, we have a completely automated smart dustbin that can clean itself. The software and hardware aspects of the project work together. The mic sensor picks up the clap/tap disturbance and relays the pulse to the servo motor which in turn causes the dustbin to open and close automatically. The ultrasonic sensors are used to measure the level of waste as well as the separation between it and the dustbin's rim. An ultrasonic sensor unit with a transmitter and receiver is used in the project. The maximum receiver can only pick up sounds at a frequency of 40 KHz, although the transmitter can create ultrasonic sound at this frequency. The receiver ultrasonic sensor, which would be kept close to the transmitter, must be able to pick up reflected 40 KHz when the module runs into an obstruction up front. Because time and distance are connected for sound waves travelling at 343.2 m/sec through the air, the ultrasonic module determines the time it takes from sending the signals to receiving them if a barrier is in its path. When the signal is received, the MC program shows the data, i.e., The distance of garbage from the rim of the bin is measured and then displayed on a 16X2 LCD interfaced to the microcontroller in cms. A 12V supply from the adapter is fed into the circuit via a bridge diode. This bridge diode protects the4 circuit components from being damaged in case there is a reverse flow of current.

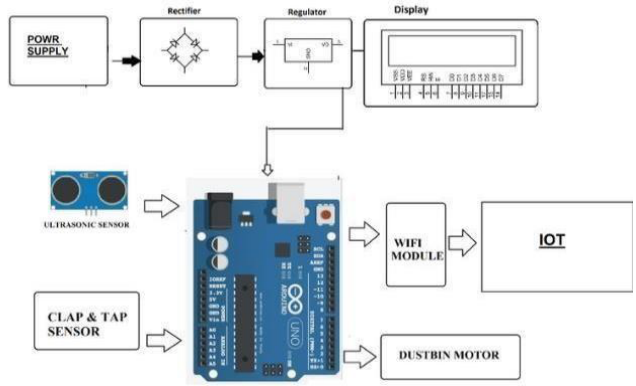


Fig.1 Block Diagram of the circuit

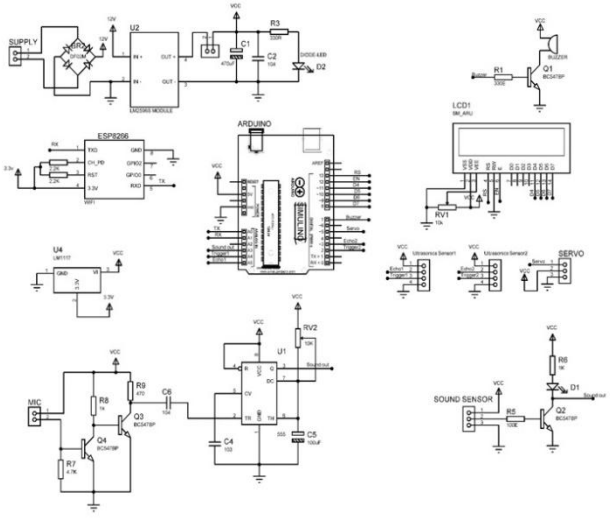


Fig.2 Circuit Diagram of the connections on the PCB

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IV. DESIGN

Part One: The first circuit consists of the Arduino Uno, Mic sensor and voltage regulators and the servo motor which when relayed through the Arduino disturbance created at the mic sensors causes the dustbin to open or close.
Part Two: The second circuit consists of the ESP8266-01 WiFi module which is rated to operate at 3.3V. If a greater voltage is supplied, a voltage regulator might be required. The circuit also consists of a buzzer. This circuit also consists of an LCD display.

Description (Part One)

1) Arduino Uno: Arduino UNO, a microcontroller board. It contains a ceramic resonator working at 16MHz, six analogue inputs, 14 digital pins (six of which can be used as PWM outputs)as input-output pins, a USB connector, a power jack, and a reset button. The board has every component needed for operating the microcontroller. Simply attach a USB cable, an AC-to-DC adapter, or a battery to commence using it.



Fig.3 Arduino Uno

2) Ultrasonic Sensor: An ultrasonic sensor is an electronic device that determines the distance of a target object by emitting ultrasonic sound waves and converting the reflected sound into an electrical signal. Ultrasonic waves are faster than audible sound waves, which humans can hear. Ultrasonic sensors are less affected by smoke, gas, and other airborne particles than infrared (IR) sensors when used in proximity sensing applications (although physical components may still be impacted by factors such as heat). The garbage level in the bin is monitored by a circuit that employs two ultrasonic sensors.



Fig.4 Ultrasonic sensor

3) Mic Sensors: The sound sensor functions in a way that is similar to the human ear. Just as the ear's diaphragm converts detected vibrations into a signal, the sound sensor's microphone converts vibrations into an audio signal through the use of an inbuilt diaphragm made of magnets that are coiled by metal wire. The diaphragm vibrates when sound waves hit it, causing the magnets to move, and inducing a current in the coil. The sensor includes a microphone which performs the function of a transducer, a potentiometer for intensity adjustment, an LM386 audio amplifier which requires low power, an LED, and other passive components like resistors and capacitors. This sensor is important for opening and closing the lid.
4) LM2596S Voltage Regulator: The voltage regulator is one of the most important components needed to control the voltage in a circuit. LM2596 is an Adjustable Step-Down Power Supply Module which is a DC-DC Buck Converter the LM 2596 is a voltage regulator that converts the input voltage to 5V. A 12V supply from the adapter is fed into the circuit via a bridge diode. This bridge diode protects the4 circuit components from being damaged in case there is a reverse flow of current.



Fig.5 Voltage Regulators LM2596S

5) LM1117 Voltage Regulator: The LM1117 is a commonly used linear voltage regulator that can provide a consistent voltage to projects using Arduino and ATMega. It has the ability to handle up to 800 mA of current and can operate in harsh conditions such as extremely low temperatures (-40 degrees Celsius). This feature makes it suitable for outdoor use or high-altitude balloon flights. Additionally, the LM1117 has built-in current limiting and thermal protection. The ESP 8266 WIFI module requires a 3.3V supply to operate, so the LM1117 is used to convert the 5V supply to 3.3V, ensuring that the WIFI module remains undamaged.



Fig.6 LM1117 Voltage Regulator

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Description (Part Two)

1) ESP8266-01 Wi-Fi Module: The ESP8266-01 Wi-Fi in The module is connected to the circuit. The main role of this module is to establish a local connection which can be accessed by the IP address assigned. It uses the TCP/IP Protocol.



Fig.7 ESP8266-01 Wi-Fi Module

2) IOT Gecko: IoT Gecko is a no-cost platform for developing IoT systems. It allows for the creation of internet-controlled physical devices and provides resources and assistance for designing IoT-based systems tailored to individual users. The platform collects data from sensors and presents it online for visualization. With IoT Gecko, creating custom IoT solutions is made easy. With IOTGecko, we can monitor and control rubbish in bins. Create personalized trash level control systems with IOT code libraries and online GUI builders on IOTGecko. The usage of IoTGecko can be summed up as Open a new account Decide the application you want to design an IoT system for.

3) LCD 16X2: LCD, or liquid crystal display, is a popular electronic display technology used in various devices like calculators, mobile phones, computers, and TVs. This type of display is often used in conjunction with light-emitting diodes, which can have multiple or seven segments. One of the main benefits of using LCD technology is its affordability and programmability. It's an inexpensive way to display information and can be easily customized to fit a variety of applications.

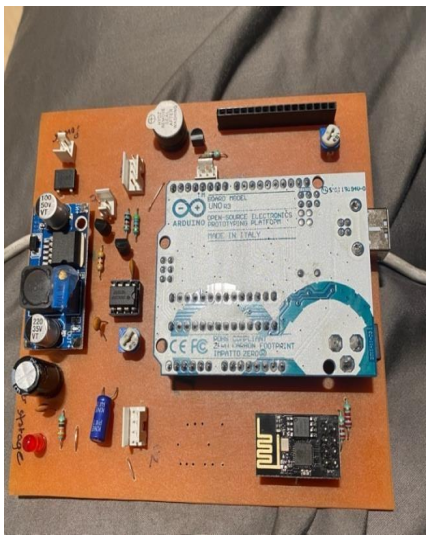


Fig.8 PCB



Fig.9 LCD Display



Fig.10 IOT notification

V. RESULTS AND CONCLUSIONS

The research paper on smart dustbins with IoT notifications aimed to develop a system that can efficiently manage waste disposal while utilizing IoT technology to enhance the system's functionality. The paper proposed a smart dustbin system that can detect the level of waste constantly and notify the concerned authority to take necessary actions when it reaches a specific threshold. The results of this research paper showed that the proposed system was successful in detecting the level of waste in real-time accurately. The system was able to send it. The results of the research showed that the proposed system was successful in detecting the level of waste in real-time accurately. The system was able to send notifications to the concerned authority when the dustbin reached the threshold level. Additionally, the proposed system helped in reducing the time and effort required for waste management and improved the overall efficiency of the waste disposal process,The conclusion of the research paper suggests that the smart dustbin with an IoT notifications system is a viable solution for effective waste management. The system can help in reducing the environmental impact of waste and improve the overall cleanliness of the area. Moreover, it can save the time and effort required for waste management and increase the efficiency of the process. Overall, the research paper demonstrates that the use of IoT technology in waste management systems can significantly enhance the system's functionality and improve the overall waste disposal process. The proposed system can serve as a blueprint for further creative solutions in the field of waste management.

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