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## International Conference Engineering Innovations in Emerging Technologies
**ICEIET-2024**

**5th Sep 2024**

**Organized By**

Department of Information Science and Engineering,
East Point College of Engineering & Technology,
Jnanaprabha Campus, Bidarahalli,Virgonagar Post,
Bengaluru - 560049, Karnataka, India

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## About the Department (ISE)

The Department of Information Science and Engineering, established in 2001, has 180 students and is accredited by NBA. It focuses on design principles and development of Artificial Intelligence, Machine Learning, Deep Learning, Cloud Computing, Big Data Analytics, Information Systems and Cyber Security, LoT, Networking and Data Communications, Image Processing, and Software Engineering. The department's strength lies in its cohesive faculty team, attracting innovative technology creators and outstanding computer professionals with ethical and human values.

## About Society of Science, Technology and Humanity, Kalyan

The Society of Science, Technology and Humanity , Kalyan is established by Prin. Dr. Vasant Mali with the registration no. MAH/92/2020/THANE. The prime objective “Shaping a Empowerment.”The vision of society is grounded in a profound commitment to advancing society through education, empowerment, and innovation. The picture a future in which the relentless pursuit of knowledge, social advancement, and individual empowerment transform the world. The objective is to impact education in diverse fields, including Science, Management, and Social Sciences. We believe that education is the cornerstone of progress, and through our efforts, we strive to make quality education accessible to all.

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The International Conference on Engineering Innovations in Emerging Technologies provides common forum for deliberations, sharing of recent trends, advancement research in the area of Information Science and Computer Science Engineering. This Conference will be very good platform for academia, researchers, industry practioners and technologist to discuss and present recent advances and research outcomes in the field of Information Science andComputer Science Engineering.

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- ✓ Cloud Computing
- ✓ Data Mining
- ✓ Big Data Analytics
- ✓ Wireless Sensor Networks
- ✓ Machine Learning
- ✓ Network Communications
- ✓ Artificial Intelligence
- ✓ Deep Learning
- ✓ Image Processing
- ✓ Blockchain Technology
- ✓ Internet of Things (IoT)
- ✓ Cyber Security

# CONTENT

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# Enhancing Virtual Voice Assistance by Integrating With Generative AI

**Dr. Vaishali Shende[1], Abhishek Biradar[2], Keerthana T B[2], Impana M C[2], Vishrutha Shree M[2]**

[1]Associate Professor, Department of Information Science, East Point College of Engineering and Technology Jnana Prabha, Bidarahalli, Virgo Nagar post, Bangalore, Karnataka, India

[2]Student, Department of Information Science, East Point College of Engineering and Technology Jnana Prabha, Bidarahalli, Virgo Nagar post, Bangalore, Karnataka, India

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ABSTRACT

Voice controls represents a significant shift in how people manage their lives, increasingly integrated into smartphones and laptops. Virtual assistants are continually improving, providing consumers with greater advantages, as advancements in voice recognition and naturals language processing enhance comprehension and task completion. The rapid evolution of these technologies enables machine to recognize and respond to human behavior of these technologies enables humans to effortlessly tackle daily tasks, while artificial intelligence enables machines to recognize and respond to human behavior effectively. Voice assistant has achieved a significant breakthrough, and its possibilities are now rapidly expanding. It is installed in billions of devices and is now being used in the home .The most common way to send messages to each other is Email. In this project, we aim to create an AI-based email voice assistant. The Voice assistant will listen to user voice input and convert the input as text. Then it will be sent to the respective person as an email message. Before sending an email users need email id and his/her Gmail account's s password. To use python and to executed in Pycharm community IDE to do that. SMTP is the protocol most widely used for email. It stands for Simple Mail Transfer Protocol.

## I. INTRODUCTION

Artificial Intelligence (AI) system have surged in popularity for facilitating natural human -machine interaction through various modalities such as voice ,communication, gestures, and facial expressions. Voice assistant engage whenever computers converse with human. They diligently analyses input to determine appropriate response, ensuring clear understanding for users. Recent advancements predominantly manifest in virtual assistants, shaping user interaction and experience. This paradigm proves beneficial for voice-based virtual assistant technology, enabling control over Automated devices at home, managing emails and messages scheduling tasks and more over through voice commands. Virtual assistants continuously enhance, offering users additional features and value. As speech recognition and language processing improve, virtual assistants' ability to comprehend and execute requests also improves. A virtual assistant a computer program proficient in understanding natural language and voice commands, facilities various user functions, including answering questions and managing daily schedules. It should be capable of generating a reliable model for unconventional tasks and utilizing such models to propose advanced user programs .The overarching aim remains the creation of personalized assistant proficient in aiding humans with their daily tasks. These assistants are tailored to specific functions, comprehending and executing user requests via voice and written commands. The proposed AI- based voice assistant streamlines these tasks seamlessly.

## II. LITERATURE SURVEY

Several literature papers have been reviewed that utilize email voice assistant and a few have been identified. Using AI to attack VA: A Stealthy Spyware Against Voice Assistances in Smartphones Author Rong junchen Zhang, Xiao Chen, Sheng Wen, XI Zheng, [1] Yong Ding voice assistants (VA's) are becoming more and more popular with smart Phones that have human computer communication (HCL) capabilities High privileges and access to sensitive system resources are often necessary for these tools to assist us eras in conducting various tasks automatically. A VA that is comprised can be a means for aggressors to hack into user's phones and previous experiments have shown that Vas can be a promising tool. To activate Vas that are not too complicated in exercise and usually restricted, ceremonial-of-the-sculpture approaches require ad-hoc mechanisms. In order to deal with the boundaries that the current state-of-the-sculpture faces. By silently listening to phone call, Vaspy, a new attack approach, is Proposed to create the users' activation voice. Vaspy is able to choose the ideal time to launch an attack once the activation voice is formed. Intelligent Attributes of Voice Assistants and User's Love for AI: A Sem- based study Author Debajyoti Pal, Mahammad Dawood Babakerkhell [2], Borworn Papasratorn, Suree Funilkul. Voice Assistant (VA) are currently a subject of research. However, the existing studies rely on models such as the Technology Acceptance Model, which may not be ideal for examining the adaptation of AI based technologies like VA's. This is because these conventional models overlook the human characteristics of AI based technologies that can potentially create connections between humans and machines Therefore in our research we introduce the concepts of autonomy as an attribute of intelligent AI grounded in three fundamental tasks sensing, thinking and acting autonomously. Additionally we explore the notion of love, human AI relationship based on Sternbergs Triangular Theory of Love. A system for Galician and mobile Opportunidfic Scenarios Author Van Froiz-Miguez [3], Paula Fraga-Lamas, Tiago M. Fernandez-Carames. Voice controlled systems offer a way to enhance integration catering not just to individuals with limited tech know how or internet access constraints but also to those with certain disabilities. Moreover gadgets like Alexa or Google Home present an avenue for interacting with Internet of Things (IOT) devices albeit their functionality typically hinges on a connection to a cloud server. Additionally many speech recognition tools are accessible, in a few languages mainly those spoken by minority languages. To deal with the formerly stated problems, this write-up provides a service based upon Side Computer as well as voice commands that accomplishes offline voice handling as well as that has the ability to communicate with IOT-based system. The recommended system does regional speech reasoning, offering an interaction user interface with IOT gadgets in a Bluetooth fit together all in a rapid method and also without the requirement for a web link. Exploring the determinants of users' Continuance Usage Intention of Smart Voice Assistants Author: Debajyoti Pal, Mohammad Dawood Babakerkhell, and Xiangmin Zhang [4]. The use of individual voice -assistants like Amazon.com Alexa as well as Google aide has actually gotten on the increase just recently. To make certain a lasting success coupled with extensive diffusion of these items it is very important to access their proceeded use circumstance as opposed to the first frosting purpose. Bulk of study accessing the connection use situation do so by means of an exception-confirmation strategy. Nonetheless, in this job a customer engagement-based strategy is taken for examining the practical along sensory perspectives of the individuals in the direction of the proceeded use situation. This is enhanced with extra contextual constructs like depends on, personal privacy danger plus complete satisfaction. Currently there is little empirical proof of customer interaction with voice assistants. Monkey Says, Monkey Does: Security and privacy on Voice Assistants Author: Efithimios Alepis, Constantinos Patakis [5] .The intro of clever cell phones geared up with various sensing units making application context-aware. To even more enhance customer experience , many mobile os and also company are gradually delivering wise gadgets with voice regulated smart individuals aides , getting to a brand new degree of human and also modern technology convergence. While these systems promote customer communication, it has actually been lately revealed that there is a possible danger relating to gadgets, which have such capability. The raised as well as substantial threat linked with voice-controlled smart individuals assistants on wise mobile tool. Enhancing AI Voice Assistance Using Machine Learning and NLP, Author: J Gowthamy, a Senthilselvi, Aniket Kumar, S Aakash, and Gandikota Sridhar [6]. The project's primary intent is to emphasize an Enhanced AI Voice Assistant that wields machine learning (ML) and Natural Language Processing (NLP) to carry through the tasks using voice commands. With a minimal, user-friendly graphical interface in the idea, the automated voice- controlled assistant has been designed to execute a comprehensive set of voice commands. This provides users with an openly and effective way to cop up with their computers. The achievement of this voice assistant is in alignment with the more general goal of enhancing user interface performance with computers. The purpose of the enhanced AI voice assistant is to serve as an intelligent assistant that enables users to carry out activities easily with voice commands by combining speech recognition, NLP, and machine learning .Short Research on Voice Control System Based on Artificial Intelligence Assistant, Author: Tae-Kook Kim [7]. This paper proposes a voice control system based on artificial intelligence (AI) assistant. The AI assistant system using Google Assistant, a representative service of open API artificial intelligence , and the conditional auto-run system, IFTTT(IF This, Then, That)was designed . It cost-effectively implemented the system using Raspberry Pi, voice recognition module, and open software. The proposed system is expected to be applied to various control systems based on voice recognition. An Advanced Computer Vision Techniques for Object Recognition and Navigation Assistance for the Visually Impaired, Author: B S Satish, Bhuvan R, Suhas B S , Tina Popli, Spoorthi R , Rachana R Hebber[8] . In this project, we present a mobile application designed to assist visually impaired individuals in navigating their daily lives. The application incorporates several features, including Text-to-speech, currency detection, calculator, object detection using trained machine learning models, and reminders. These features are all integrated with voice command functionally and can be accessed with a single button touch. Our research demonstrates that this mobile application is an effective tool for visually impaired individuals, as it provides a range of features that can help them easily navigate and pass their daily time. An Efficient, Precise and User Friendly AI based Virtual Assistant, Author: Aman Annand, R Sudha, Sanjith Rajan, Nisha Bharathi, and Aryan Kumar Srivastava [9]. Artificial Intelligence (AI) developments in recent years have enabled the creation of virtual assistants that can mimic human communication and interaction. The creation of a virtual assistant has the power to completely alter how people use technology. Using open-source technologies, a prototype virtual assistant system has been designed and implemented in this study. The virtual assistant will be able to interpret user requests using natural language processing (NLP) abd speech recognition. Machine Learning (ML) algorithms have been used to increase the responsiveness and efficacy of virtual assistant over time. And system also uses Graphical User Interface (GUI). The virtual assistant may be used in a variety of fields, such as personal assistance, responsiveness, and user- experience, its performance has been assessed. Analysis and Design of Voice Assisted Learning System based on Baidu AI Author: Ru Zhang, Weiyang Chen, Min Xu, Yang [10]. With the development of educational information in the era 2.0, the education industry has gradually turned into intelligent technology. More and more new intelligent technologies are used in class room teaching, but few of them are used to assist students in automatic learning after class. The study attempts to build a language assisted learning system based on aAI to help students learns independently. The application of the voice assisted learning system can create favorable conditions for personalized and autonomic learning of students , and provide students with a new learning pattern to meet the requirements of the information Era.

## III.PROPOSED DESIGN

The job will certainly offer a reasonable expertise concerning the smart aide which can recognizing the commands provided by the customer. Our aide can quickly comprehend the commands provide by the customer via singing media as well as reacts as called for. Our aide executes the most often asked demands from the individuals and also makes their job simpler. Our voice aide pays attention to the command provided by the individuals with the microphone .After paying attention it will consequently which provides a selection of solution. Thus these solutions the system must function effectively as well as can take care of numerous jobs at once so to boost the efficiency of the system it needs the information that is gathered throughout the transmission ought to be tidy (history sound complimentary) to make sure that desktop computer voice aide can recognize the input voice and also can analyses the provided input commands efficiency of desktop compiler voice aides can likewise be boosted by incorporating voice aide with 3rd party applications such as sound termination function which will certainly eliminate the undesirable history sounds plus can filter the tidy voice. The key feature is offline voice acknowledgement that is a voice acknowledgement engine that might run individually of anent link. When is introduced it will certainly welcome the individuals can carry out different jobs simply by offering individuals input voice. Typically this vector's dimensions typically very tiny, perhaps as reduced as 10, nevertheless extra exact systems might have a measurements of 32 or even more. The Hidden Markov Model's last outcome might be a series of such vectors. To transform voice to message, vector are clustered as well as matched to a minimum of one or even more phenomes, which considering might be basic device of speech that the audio of a phoneme modifications from one person to another and also from one as expression to the following by a matching audio speaker .
The overall System design must consider the following stages:

- A Data collection technique based on speech.
- Converting the voice analysis into texts.
- Running a python script.
- Turn the results of text to speech and output

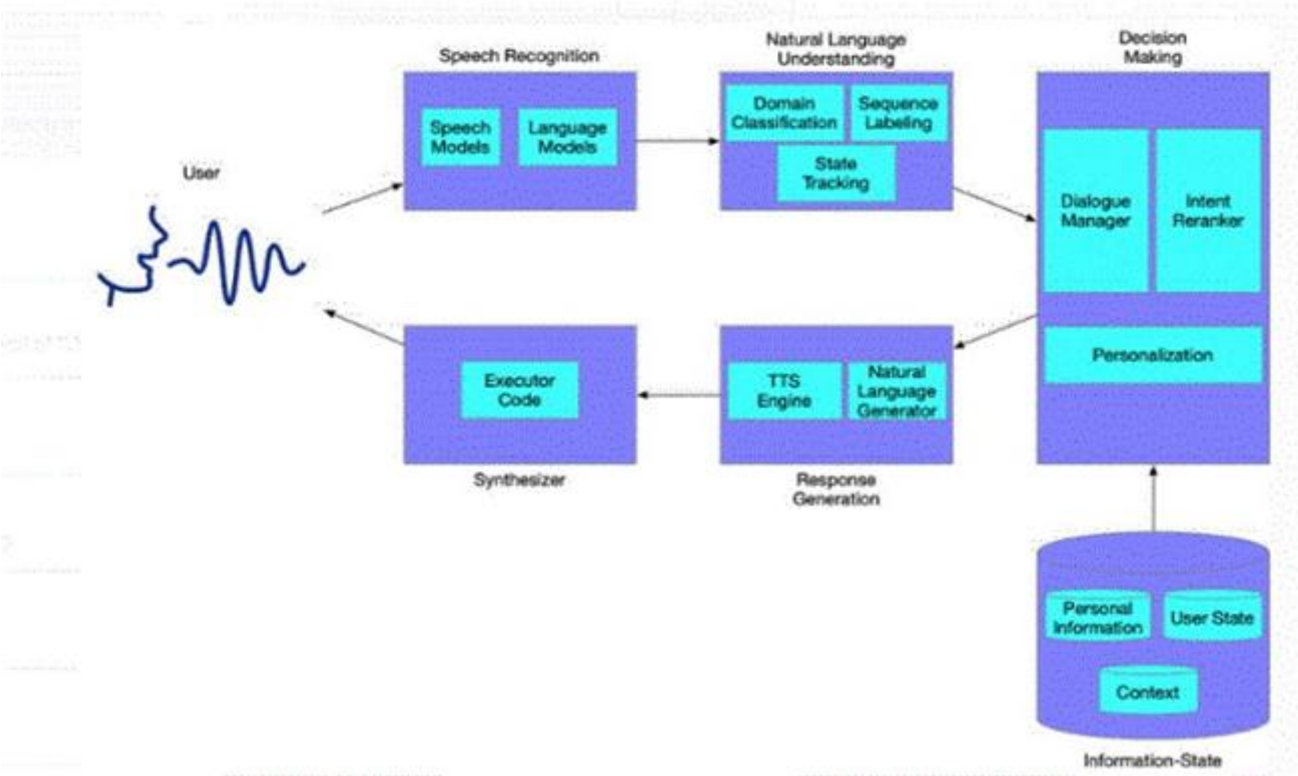


**Fig1.** Architecture Diagram

Initially, the data through voice is collected and stored as input for further processing. In the next step STT (speech-to-text) library is employed for ongoing input voice to text conversion. So, a python script goes into Next step. To parse and analyses the user's voice capturing it as an input and find out an output with minimum errors. The input command is turned into a speech using TTS (text-to-speech) library and the desktop assistant does the tasks assigned to it by the user.

**1. Speech Recognition:**

This uses speech recognition technology to convert spoken inputs into texts, allowing people to get a written response to their queries. The voice assistant system subsequently digests the produced text by the speech recognition software.

**2. API_Calls:**

According to API calls are the process of sending requests from one software programmer to another over a specified protocol or interface known as application Programming Interface (API). Simply put, it is a request sent from one programmer or application to another that's performs a particular action or fetches data.

**3. Python Backend:**

The backend of the app is built on Python which receives voice input from users via a speech recognition module. After, it examines whether the command is for Context Extraction, API Calls or System Call. From this investigation, the backend generates an appropriate response and gives it back to the user in order to produce the desired output.

**4. System Call:**

This is where a program involves communicating with the operating system's kernel (a part of its core) about services that are intended for hardware such as hard disk drives those that are involved in process creation and management -likes or communicating with process scheduler. It creates an important link between the operating system and the program.

**5. Google_Text_To_Speech:**

Text-to-speech technology is applied to convert users' typed text into spoken form. A TTS module transforms text into phonemic representations, which consequently changes it into waveforms that create sounds TTS has grown enormously and now supports a number of language from third- party publishers given by them. The proposed voice assistant system is compared to other system designed for voice assistance in terms of attributes such as User Interface, Interaction with the customers and reliability. A real time comparison between the systems. It illustrates a relative survey of proposed email voice assistant system with existing email system. Many concepts papers exist which relate to these methodologies.

In literature, comparing this proposed system with others review and comparison showed that it was workable in terms of attributes such as accuracy, User Interface Interaction, and Internals system Integration.

## IV. RESULT AND DISCUSSION

A fully integrated AI-deployed voice system with the help of python is what this proposed model is. It allows the user to send email messages using voice. The sender can communicate with the voice assistant for emails and then it sends it to receiver describes a use case for an email voice assistant model. A transformative leap in human computer interaction is realized by the introduction of generative AI into virtual voice systems. Breaking the confines of traditional synthetic speech, this project used sates-of-the-art AI methodologies to achieve more than conventional synthesized speech. This was aimed at creating virtual voices that mimic natural speech, changes as context changes and resemble human communication in general. The revolutionary effect of this integration effect of this integration is far -reaching as it promises to redefine user engagements, individualize interaction, and usher in a new age of highly evolved contextually aware virtual assistant for different applications. This is not only improves technological capabilities but also opens door to more intuitive emotionally rich and adaptive interactions that would enable the future where virtual voices could be integrated into our lives through an experience similar to being with humans. The required packages for the Python programming language has been installed and the code was implemented using PyCharm, Integrated Development Environment (IDE) and the python code we have developed runs in both Python 2.7 and Python3.x, and below are few of its outputs which we got from our AI based voice assistant.

This study presents a voice assistant that has been created to do different things for individuals on their commands with high accuracy. This technology is specifically designed to respond only to the user's speech while avoiding background noise. The project follows a modular approach which enhances flexibility and adaptability, making it easy to integrate in future .Its implementation is based on open-source software components with help from Vishal studio code community that allows smooth update integration .Computer tasks can be efficiently managed by the virtual assistant thereby- saving user-time- and thus rendering itself available whenever necessary changes occur. Multiple users are catered for by this system hence it can be extended to others such as relatives or colleagues among others. As of now, this application is limited to only English speaking people. However, we have plans of making it more global in future by adding other language support soon. Various tasks and many services are provided by the desktop voice assistance.

The main assistance is that they should maintain their accuracy in order to ensure that the background noises will not affect the voice recognition part of a user and respond to the user according to his or her needs because there are so many voice assistant available in the market which have the highest level of accuracy. For a high level accuracy, a clear microphone input data is required by voice assistant which can be achieved through various third party apps like NVidia that helps in improving the precision of our voice assistance for smooth responses to users, another way to improve the accuracy is through regular testing evaluating the problems with our AI based desktop voice Assistance.

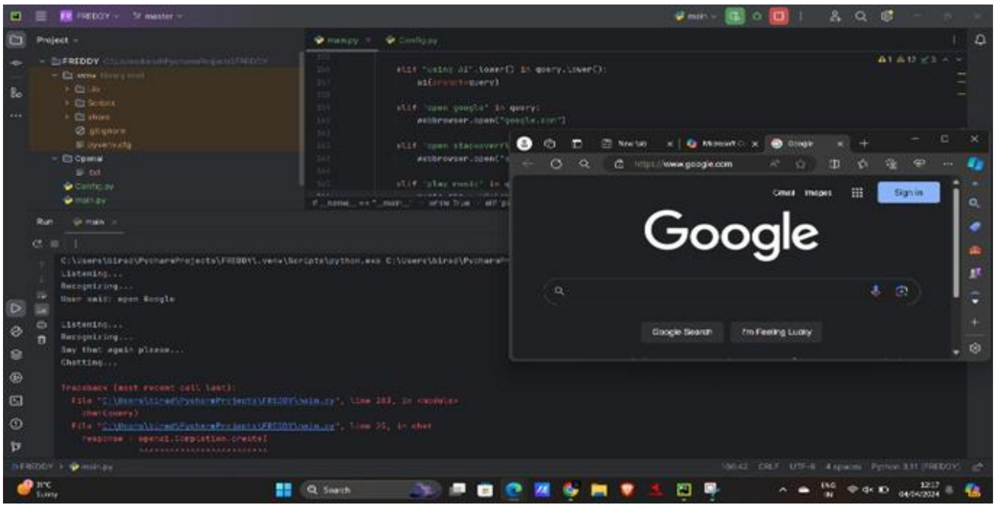


**Fig.2** Open Google

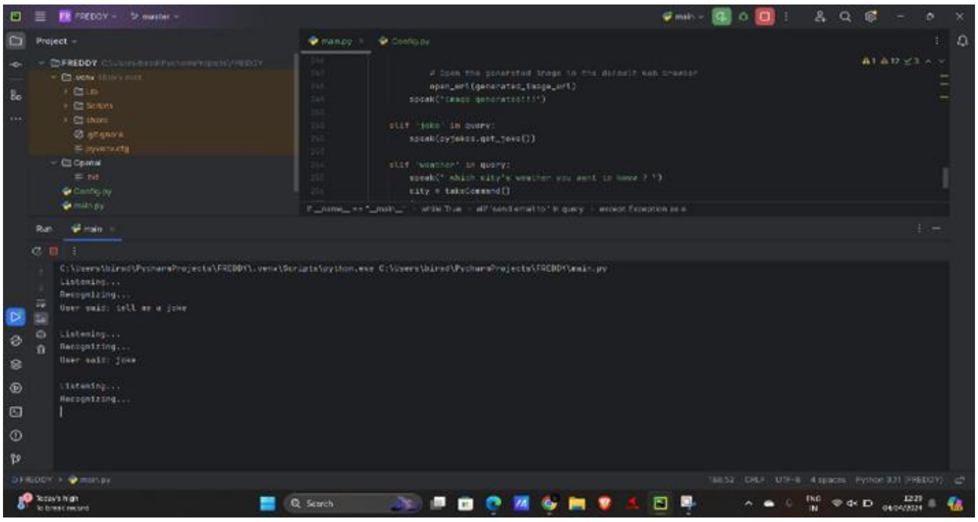

**Fig.3** Image Generation

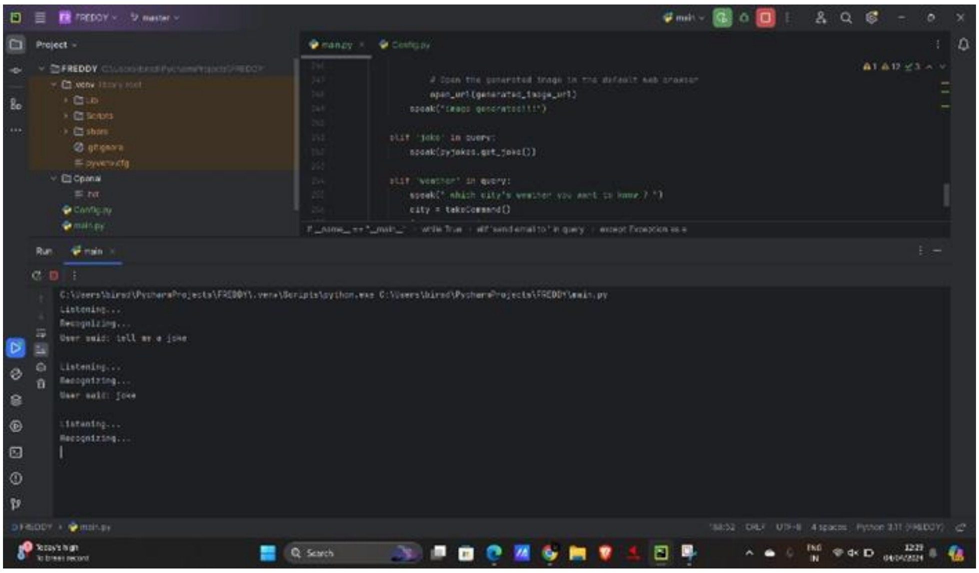

**Fig.4** Interaction

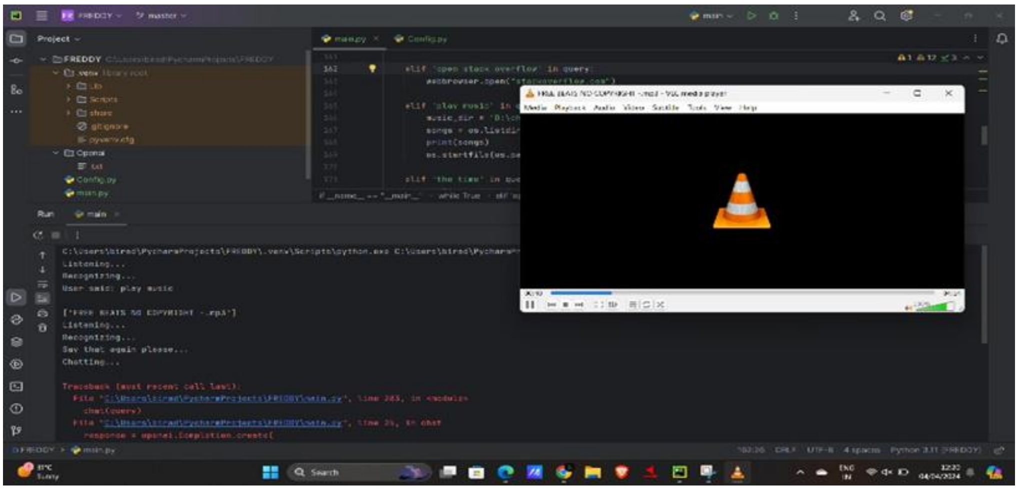

**Fig.5** Playing Music

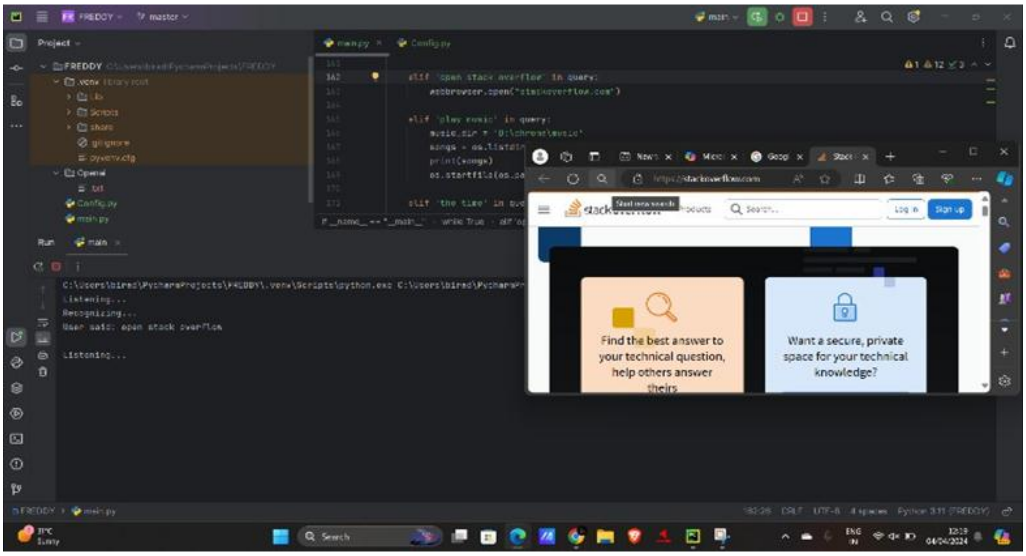


**Fig.6** stack overflow

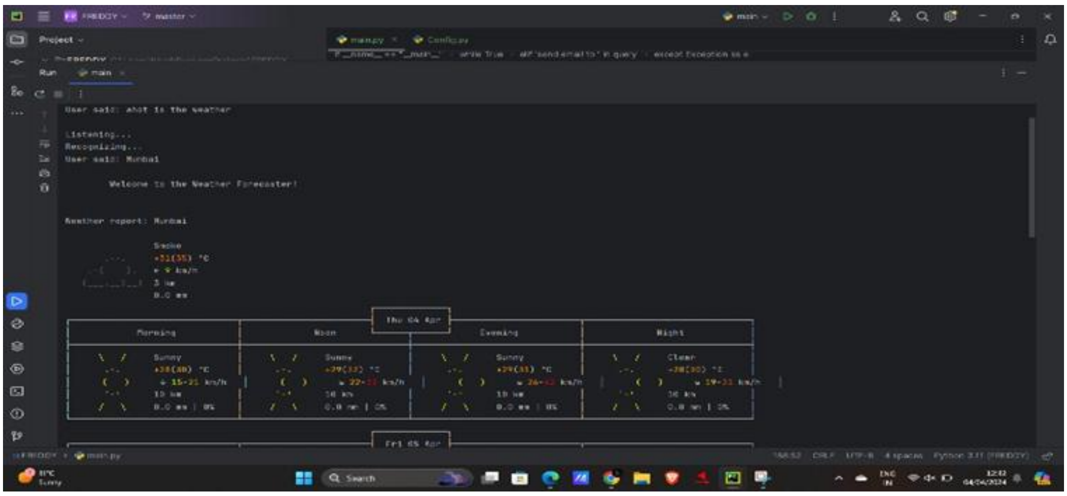

**Fig.7** weather report

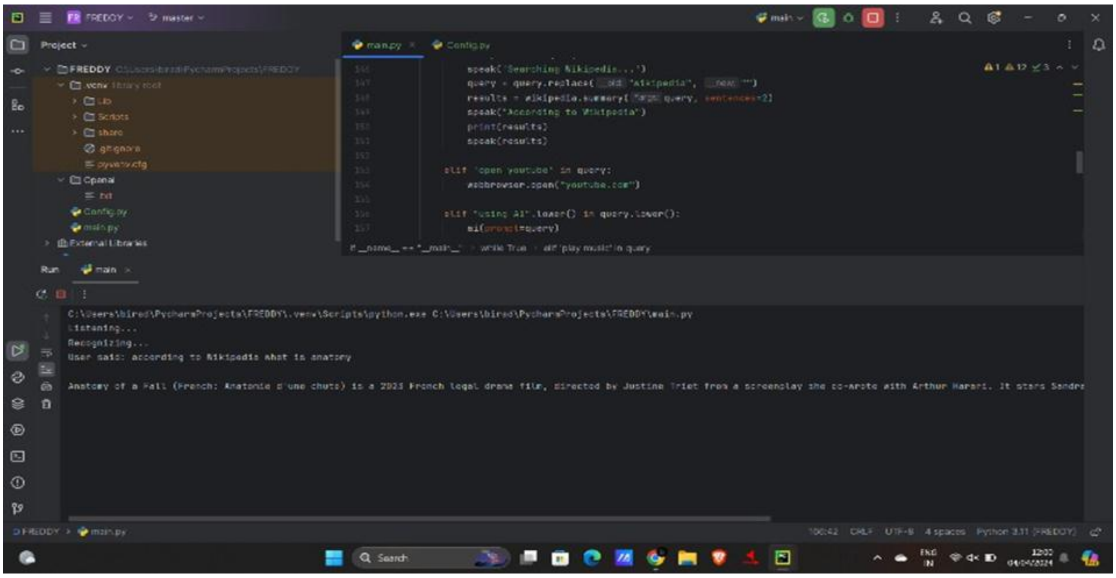

**Fig.8** Wikipedia

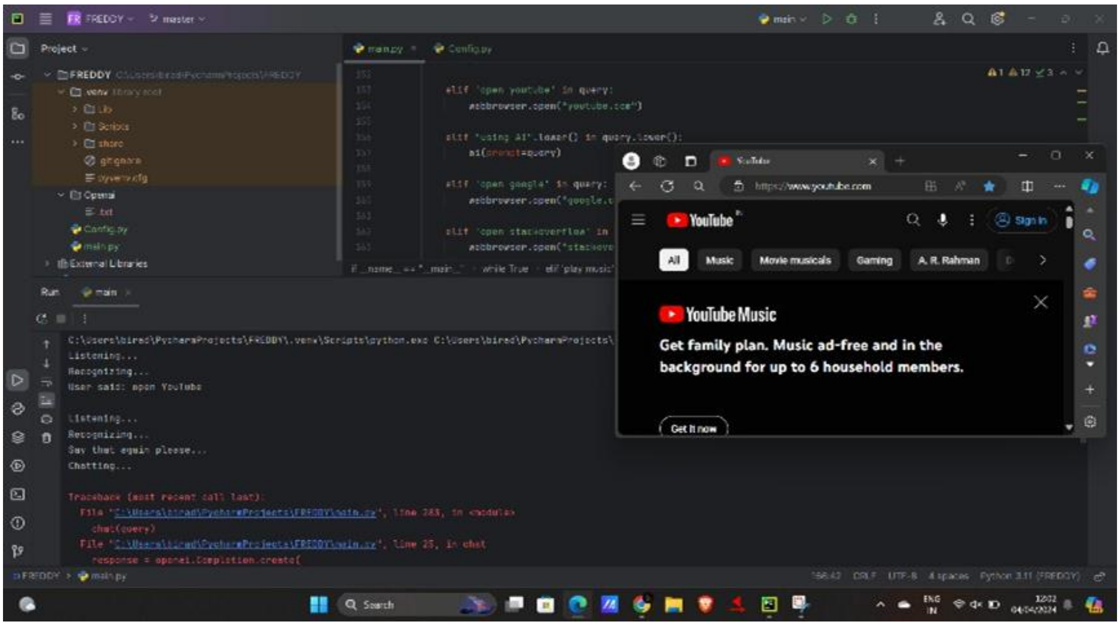


**Fig.9** YouTube

## V. CONCLUSION

In our Project, we're implement numerous features surpassing other assistants. Advanced technologies like virtual voice assistants have the potential to revolutionize operation. Voice Assistant integration is becoming increasing line prevalent in daily life, aiming to streamline interaction with various subsystem. This approach seeks to minimize manual effort, particularly benefiting users unfamiliar with system operations or keyboard layouts.

By replying on interactive speech responses, the concept enhance efficiency and convenience, providing a user-friendly experience that effectively fulfils needs through voice input.

Job.

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# Fire Detection and Rescuing Robot Using IOT

**Dr. Vaishali Shende, Abhiram A, Aishwarya R, Anandu Krishnan, Arathi Hembram**
Department of Information Science and Engineering, East point college of Engineering and Technology, Bangalore, Karnataka, India

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ABSTRACT

With a large number of pre-cautions taken so that Fire accidents do not take place, these natural/ man-made disasters occur. In cases where a fire has broken out to save people alive and put out the fire we are forced to utilize human resources which are not safe. Since technology is being developed and especially in the field of Robotics, it is very possible to substitute a firefighter by a robotic system that can extinguish a fire. This will facilitate the firefighter process and thus limit of risking the human. Here, we have designed an Arduino based simple robot that moves towards the fire and pump out water around it to put down the fire. The robot must run automatically, avoiding obstacles and at the same time find and track two flames (candlelight) and extinguish them. We have taken a modular design strategy to achieve the best performance with an effective implementation. The difficult task of mathematically obtaining an exact model for the non-linear control system, upon which traditional control techniques could subsequently be used, was suitably solved by fuzzy logic. The fuzzy inference system was intended to function as a controller akin to a PID. We are using the 8051 series of microcontrollers, which is a popular 8-bit microcontroller. Assembly language is used in the programming code that operates the firefighting robot.
**Keywords-** Fuzzy logic, PID, Arduino.

## I. INTRODUCTION

As early as 1982, a modified version of the basic idea of a network of smart devices was discussed. With the ability to report its inventory and determine whether freshly loaded drinks were cold or not, the Carnegie Mellon University Coca-Cola vending machine became the first device connected to the Internet. The modern concept of the Internet of Things (IOT) was created by Mark Weiser in 1991 with his paper "The Computer of the 21st Century" and through academic conferences like Ubi-Comp and Per-Com [1]. Reza Raji outlined the idea as "small packets of data to a large set of nodes, so as to integrate and automate everything from home appliances to entire factories" in an IEEE Spectrum article published in 1994.A robot is used, which can be controlled from a distance or can perform actions intelligently by itself, which will reduce the risk of this task of firefighting. The robot is a mechanical device that is used for performing tasks that include high risk like firefighting. The employment of a robot that can be operated remotely or that is capable of acting intelligently on its own will lessen the risk associated with battling fires. A mechanical tool called a robot is employed to carry out dangerous jobs like battling fires. Firefighters won't have to enter as many hazardous situations if they use a firefighting robot [2]. Additionally, the robot will lighten the firefighters' workload. During a major disaster, it is impossible to put out the fire and save a large number of casualties. In situations like these, robot technology can be applied very effectively to save a great number of casualties. As a result, robotics saves a great deal of time and makes life easier and safer for humans [4]. The tools and equipment used in battling fires are improved by the quick advancement of technology. These modern instruments and apparatuses have the potential to be more productive. It also lowers the minimal danger level. Additionally, this will lessen the damage brought on by a fire. It is dangerous work combating fires and saving lives [5]. Firefighters must deal with risky circumstances when putting out a fire. Firefighters move patients from one building to another, drag heavy hoses, climb high ladders and put out fires in tall structures. Firefighters not only endure lengthy and unpredictable workdays, but they also have to deal with uncomfortable conditions like low humidity, dust, and high temperatures [6].

## II. LITERATURE REVIEW

It consists of a mobile phone that can be used to operate a robot by calling the phone mounted on the robot. When a button on the phone is pressed during the call activation period, the robot's call partner will hear the tone that corresponds to the pressed button. The robot uses a phone that is attached on it to detect Dual-Tone Multiple-Frequency (DTMF) tones. The microcontroller processes the code it received, and the robot subsequently acts in accordance with its instructions. The suggested system uses DTMF technology to position the motor shaft at a necessary location using a variety of sensors, each of which carries out a distinct function.[7]. a robot powered by an Arduino UNO R3. The robot's components include a gear motor and motor drive for movement, a gas sensor for detecting fire, and a Bluetooth module for controlling the robot from a smartphone and connecting it to an Android device. This also makes use of a sprinkler and a water pump. An open-source program called the Arduino IDE is needed to program and implement code on the Arduino UNO. [8]. suggested a fire-extinguishing robot that uses a flame sensor that can detect flames in the 760-wavelength range and DTMF (Dual Tone Multi Frequency Tones) technology for the robot's navigation.to 1100 nm and sensitivity varies from 10cm to 1.5feet [9]. The research introduces a Wi-Fi-enabled fire-fighting robot designed for hazardous environments. Key components include integrated sensors (IR, fire, smoke) for enhanced environmental monitoring, a gas extinguisher for efficient fire suppression, and a control system using the BLYNK/TCP terminal program. The robot, powered by a 12V 1.3 Ampere-hour battery, is compact (20 cm long, 10 cm tall) and features both automated and manual control [10]. The literature survey offers insights into related technologies. The outcome aims at a versatile, remotely operated robot addressing safety concerns in critical industrial sectors.

## III.METHODOLOGY

The fire detection and rescue robot using IOT has the following working mechanism: A robot's basic infrastructure is the movement of the robot, for the movement we would use motors which would support the movement of it. Wheels require certain DC motors that would give up to 12V and 2 DC motors would easily take up to 24 V hence we would not be using a microcontroller directly to control the motor instead we would use the H-bridge motor. An H-bridge is an electronic circuit that switches the polarity of a voltage applied to a load. Now we use the Blynk cloud to instruct the movement of the bot towards the fire and rescue methods taken by It. A relay module is also used to the logic trigger and switching module which is used at the higher application end. There are three mechanisms that would process in this the first one would be obstacle detection if it detects any obstacle, it automatically stops and a message-pops up saying that an obstacle is detected. The second mechanism is the detection of the robot when it detects human movement then the ultrasonic sensor it is used to identify and give a notification to the application. The third mechanism is the detection of fire and rescue this is done by the flame sensor and the sensor detects the fire when this is done automatically fire can be extinguished with the help of a motor pump.

## IV. PROPOSED METHOD

In our proposed project along with this feature we are adding up co2 sensor for the prior detection for occurrence of fire and also integrating a pick and place arm for picking up an obstacle blocking the way or any other useful purpose.

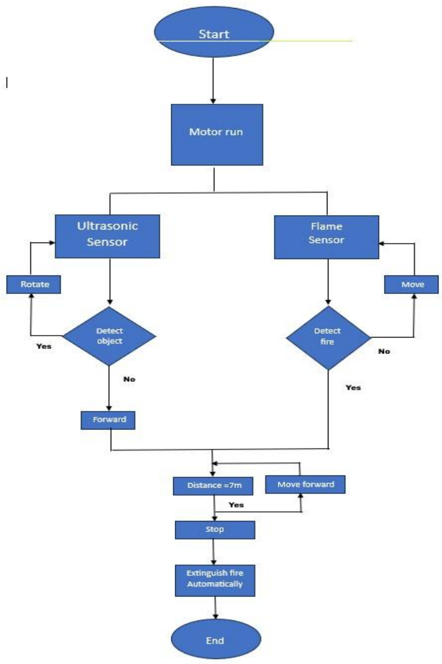


**Fig.1.** Proposed System Flowchart

Robot is being controlled by ESP32. It also has an infrared camera mounted over it that measure the temperature of the object without making physical contact. Robotics motion control can be divided into two categories sensor-based system and vision-based system. The sensor-based system will be controlled by the feedback from the different sensors such as IR sensors, flame sensor etc., While vision-based system uses the cameras and the image processing techniques to find the target position.

## V. SYSTEM ARCHITECTURE

The process of defining a system's architecture, parts, modules, interfaces, and data in order to meet predetermined requirements is known as system design. It might be viewed as the application of systems theory to product development in systems design.

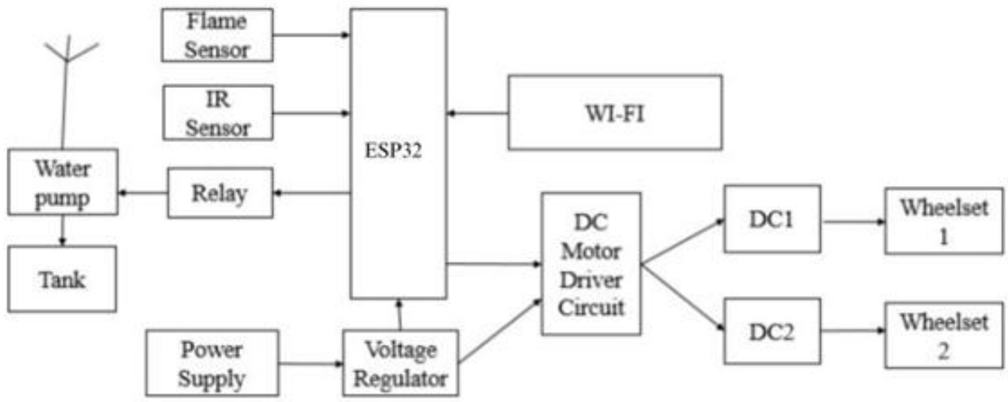


**Fig.2.** System Architecture Diagram

The fields of systems analysis, systems architecture, and systems engineering share certain similarities. In the event that the more general subject of product development "blends the perspective of marketing, design, and manufacturing into a single approach to product development," then designing a product is the process of using marketing data to inform its design. Therefore, the process of defining and creating systems to meet specific user needs is known as systems design. The design's goal is to propose a solution to a problem that the requirement documentation specifies. Put another way, the project's design is the initial stage in solving the problem.

### 5.1 Hardware requirements

Master Controller Module

- ESP32:

The ESP32 can operate in industrial settings with a temperature range of -40°C to +125°C and still perform properly. ESP32's sophisticated calibration circuitry allows it to dynamically eliminate external circuit flaws and adjust to changing environmental circumstances. With built-in filters, RF balun, power amplifier, low-noise receive amplifier, antenna switches, and power management modules, ESP32 is extremely integrated with a low requirement for printed circuit boards (PCBs), ESP32 enhances your applications with invaluable capability and versatility. ESP32 uses a variety of unique software types in tandem to achieve extremely low power consumption. Modern features like multiple power modes, dynamic power scaling, and fine-grained clock gating are also included in ESP32.

**Fig.3.** ESP32

In order to minimise communication stack overhead on the primary application processor, ESP32 can function as a slave device to a host controller or as a fully functional standalone system. ESP32 may use its SPI / SDIO or I2C internet interface to interface with other systems to offer Wi-Fi and Bluetooth capability.

Sensor Module

- Flame Sensor:

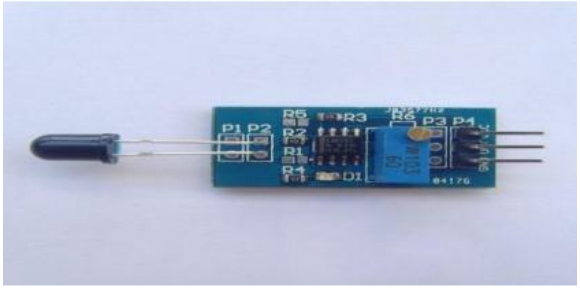

**Fig.4.** Flame Sensor

Since flame sensors are the most light-sensitive, flame alarms are typically activated by their reaction. This module can identify flames or light sources with wavelengths between 760 and 1100 nm. The microcomputer's IO port can be directly connected to a single chip or small plate output interface. To prevent the sensor from being damaged by high temperatures, there should be a certain distance between it and the flame. If the flame is larger, test it from a further distance; the shortest test distance is 80 cm. The flame spectrum is extremely sensitive because of the 60-degree detecting angle. The flame spectrum is extremely sensitive because of the 60-degree detecting angle.

- IR Proximity Sensor:


**Fig.5.** IR Proximity Sensor

Your obstacle-avoiding and line-following robot can now identify lines and surrounding objects with the help of the Multipurpose Infrared Sensor add-on. The sensor detects light reflected from its own infrared LED in order to function. It can identify light, dark (lines), or even objects right in front of it by measuring the quantity of reflected infrared radiation. An on-board red LED is utilised to identify lines or objects and show their presence. With an integrated variable resistor, the sensing range can be adjusted. The sensor features a 3-pin header that uses female to female or female to male jumper wires to connect to the Arduino or microcontroller board. A mounting hole for easily connect one or more sensor to the front or back of your robot chassis.

- HC-SR04 Ultrasonic Sensor:

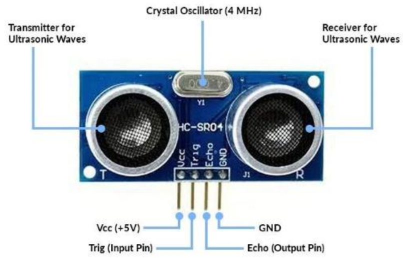


**Fig.6.** Ultrasonic Sensor

The project's primary application of the highly reasonably priced HC-SR04 Ultrasonic Sensor proximity/distance sensor has been object avoidance. The second iteration of the well-liked HC-SR04 Low Cost Ultrasonic Sensor is represented by this module. This updated version of the HC-SR04 has a broader input voltage range than the original generation, which could only operate between 4.8V and 5V DC. This means that it can work with a controller that runs on 3.3V.The HC-SR04 ultrasonic sensor offers a very simple and affordable way to measure distance. It uses sonar to detect distance. The unit transmits an ultrasonic (far above human hearing) pulse at a frequency of about 40 KHz, and the target's distance is calculated by timing the echo return. In a user-friendly form, this sensor provides steady readings and exceptional range accuracy. An on board 2.54mm pitch pin header allows the sensor to be plugged into a solderless breadboard for easy prototyping.

- Motion Sensor:

**Fig.7.** Motion Sensor

An electrical device called a passive infrared sensor (PIR sensor) detects infrared (IR) light emitted by objects within its field of vision. The majority of the time, PIR-based motion detectors employ them. PIR sensors are frequently found in autonomous lighting systems and security alarms. Because of the surface characteristics and temperature of the items in front of the sensor, PIR sensors are sensitive to changes in the amount of infrared radiation that impacts them. When an object, like a person, moves in front of the backdrop, like a wall, the temperature at that point in the sensor's field of view will rise from ambient temperature to body temperature and back again. The sensor initiates the detection process by converting the ensuing change in the incoming infrared radiation into a change in the output voltage. Moving an object in relation to the background may also activate the detector if it has a comparable temperature but a distinct surface feature that causes it to emit infrared light differently.

Appliance Module

- Relay module:

The relay module is an electrically operated switch that allows you to turn on or off a circuit using voltage and/or current much higher than a microcontroller could handle.


**Fig.8.** Relay Module

The high power circuit and the low voltage circuit that the microcontroller operates are not connected. Every circuit is shielded from the others by the relay. The three connectors for each channel in the module are called NC, COM, and NO. The jumper cap can be set to either high level effective mode, which 'closes' the normally open (NO) switch at high level input, or low level effective mode, which functions similarly but at low level input, depending on the input signal trigger mode.

- L298 Motor Driver:

**Fig.9.** L298 Motor Driver

Two DC motors may be simultaneously controlled for both speed and direction thanks to the twin H-Bridge motor driver L298N. DC motors with a peak current of up to 2A and a voltage between 5 and 35V can be driven by this module. Two screw terminal blocks are located on the module for the motors A and B. Additionally, there is a screw terminal block for the ground pin, the motor's VCC pin, and a 5V pin that can be used as an input or output. The 5V pin will be utilised as the input since the IC needs to be powered by a 5V source in order to function. The logic control inputs come next. The motor's speed can be enabled and adjusted via the Enable A and Enable B pins. The motor will operate at its maximum speed if a jumper is present on this pin; if the jumper is removed, the motor's speed can be controlled by connecting a PWM input to this pin. Next, the motor A's rotation direction is controlled by the pins for inputs 1 and 2, while the motor B's rotation direction is controlled by the pins for inputs 3 and 4. We are able to regulate the H-Bridge switches within the L298N IC by means of these pins. If input 1 is LOW and input 2 is HIGH the motor will move forward, and vice versa, if input 1 is HIGH and input 2 is LOW the motor will move backward. In case both inputs are same, either LOW or HIGH the motor will stop. The same applies for the inputs 3 and 4 and the motor B.

- Water Pump Motor:

**Fig.10.** Water Pump

A DC motor used to transfer fluids is called a pump motor. Direct current electrical power is transformed into mechanical power by a DC motor. The basic idea behind a DC, or direct current, motor is that it experiences torque and has a tendency to move when a current-carrying conductor is put in a magnetic field. We call this moving action. Pumps use energy to move fluid in order to accomplish mechanical work. They are usually powered by a reciprocating or rotational mechanism. Pumps can run on a variety of energy sources, such as electricity, wind power, manual lab or, or engines. They can be small enough for use in medical applications or huge enough for industrial use.

### 5.2 Software Requirements

Blynk:

The Internet of Things was the target market for Blynk. It can perform a wide range of tasks, including remote hardware control, storing and visualizing data, and displaying sensor data. Blynk is a platform that allows you to control devices like Arduino, Raspberry Pi, and others over the Internet with iOS and Android apps. With just a few clicks on this digital dashboard, we can create a graphical user interface for any project.

**Fig.11.** Blynk App

With the help of this application, a graphical user interface (HMI) may be created by gathering and supplying the correct address on the accessible widgets. With the different widgets we offer, it enables us to design stunning user interfaces for our projects. The smartphone app is a Blynk innovation. We are able to produce one or more projects with it. Every project has the ability to interface with one or more devices through the use of graphical widgets such as virtual LEDs, buttons, value displays, and even text terminals. The Blynk software makes it possible to operate ESP32 pins right from our phones without the need to write any code. Additionally, you may share a project with friends or even clients so they can use the Another option is to share a project with friends or even clients, allowing them to view the linked devices but not edit the project itself. Server Blynk All of the communications between the hardware and the smartphone are handled by it.

We can host our private Blynk server locally or utilize the Blynk Cloud. It is open-source, easily manages hundreds of devices, and can even be launched on a Raspberry Pi in addition to an ESP32. In contrast to IoT platforms like Ada fruit IO, Twill iOS, and IFTTT, we are able to run a private instance of the entire Blynk server and link our smartphone's Blynk app to it. The Blynk Cloud server is a great option because it's always available and ready to go. But the Cloud Blynk server has put restrictions in place. Certain restrictions result from the server's topology, which is dependent on our location. The server can be on a different continent, which causes communications between the app, the devices, and the server to be sluggish because of how long it takes for packets to go over the Internet. We are limited to using a limited amount of widgets in the Cloud server, which is another enforced limitation. Blynk is implementing a price structure for its widgets by utilizing the idea of "energy." We could launch a brand-new project with 1000 energy units on the cloud server. There might be 200 units of an LED widget, leaving 800 units for other widgets. We can establish our own energy thresholds on a private server. Our server can be set up to give new users 100,000 energy units. Of course, we can buy more energy units to utilize on the Cloud Blynk server, and this is a valid option, particularly in the event that our Blynk project's users are dispersed globally.

## APPLICATION RESULTS

SCREEN 1: This page shows the controls and status of the various sensors along with the distance of the bot from the nearest object.

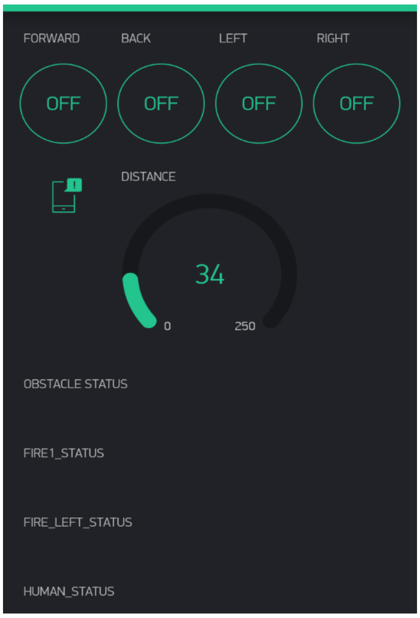


**Fig.12.** BOT CONTROL

SCREEN 2: This screen shows the notification received by the user when an object is detected by the bot in its path.

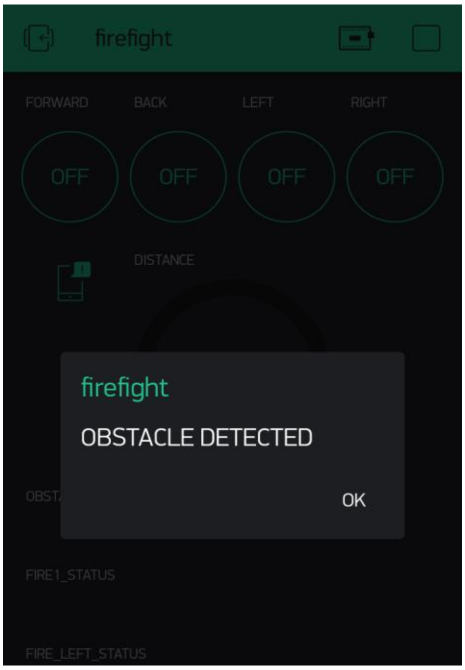


**Fig.13.** OBSTACLE DETECTION NOTIFICATION

SCREEN 3: This screen shows the notification received by the user when a human is detected by the bot.

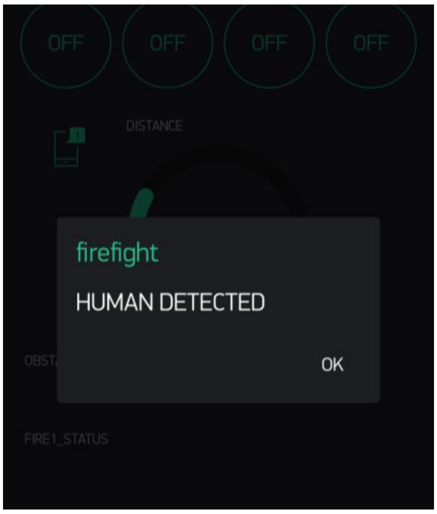


**Fig.14.** HUMAN DETECTION

SCREEN 4: This screen shows the notification received by the user when a fire is detected by the bot.

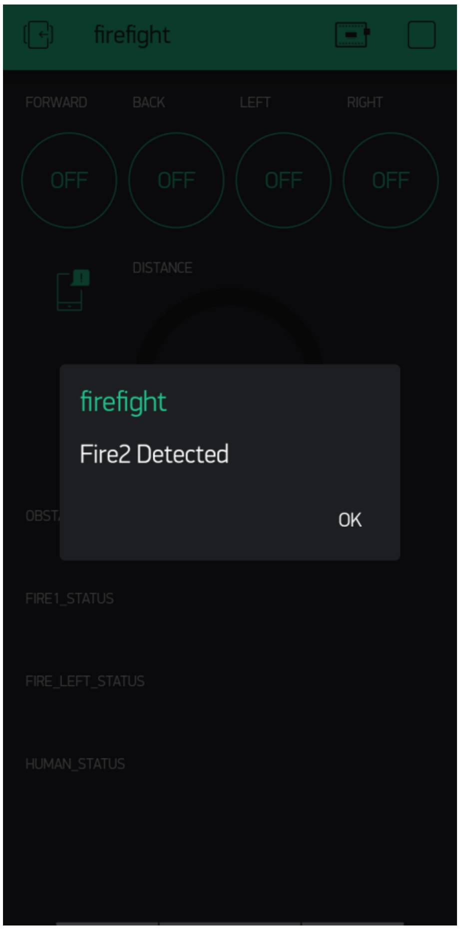


Fig.15. FIRE DETECTION NOTIFICATION

## VI. CONCLUSION

Fire results in extensive destruction, loss of life, and destruction of property. Occasionally, explosive materials, smoke, and high temperatures make it hard for fire fighters to reach the scene of the fire. This leads us to the conclusion that robots can be used in situations where human lives are in danger. In a very short amount of time, the robot can function in an area that is inaccessible to humans. Firefighting robots can be helpful in these kind of circumstances to put out fires. Using remote communication networks, remote operators who are situated far from the fire scene should be able to direct these robots. After detecting a fire, the robot locates it quickly, precisely, and effectively. The project's future efforts will be focused on advancing technological innovation to

## VII. FUTURE SCOPE

Robot can be programmed to move within specific limits. If a business owner desires to change how the robot moves, he might consider purchasing extensions for the robot's arms or changing its orientation. It can be advanced to use in crucial environments like Underground Coal mining, Hazardous utility company operations. The future of fire detection and rescue robots using IOT is very vast, as the advancement of technology is done, the detection can be advanced more and more. The integration of artificial intelligence can not only detect fire but it can also predict outbreaks of fire and prevent it from occurring and the programming of this can even be more efficient to have a better outreach. Another way of research would be 3d printing of rapid equipment of customized fire-fighting equipment too. As technology continues the advancement will be even more effective.

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# Web-Based Lung Cancer Detection and Doctor Recommendation System

**Prof. Udayabalan B, Saurov Ghosh, Nikhil Chandran P, Vash Raju Motwani, Sriyanka Chakraborty**
Department of Information Science and Engineering, East point college of Engineering and Technology, Bangalore, Karnataka, India

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**ABSTRACT**

The project introduces a web-based Lung Cancer Detection and Doctor Recommendation System, employing advanced image processing for rapid and accurate diagnosis. Through integration of deep learning algorithms, the system analyzes medical imaging data to detect lung cancer early. Additionally, an intelligent recommendation system suggests specialized healthcare professionals based on patient profiles, cancer characteristics, and patient location. With a focus on user- friendliness, our secure web interface ensures secure data uploads, prompt diagnostic results, and access to personalized doctor recommendations. This integrated approach aims to enhance lung cancer detection efficiency and optimize patient care by providing timely, location-specific medical interventions.

**Keywords**—Lung Cancer Detection, Deep Learning, Doctor Recommendation System, Image Processing.

## I. INTRODUCTION

Addressing the formidable global health challenge of lung cancer, our revolutionary Web-Based Lung Cancer Detection and Doctor Recommendation System utilizes cutting-edge technology to bolster early detection and enhance patient outcomes. Emphasizing improved diagnostic efficiency and precision, the system employs advanced deep learning algorithms such as convolutional neural networks (CNNs) and image segmentation to thoroughly analyze chest X-rays or CT scans.

Through our innovative Web-Based Lung Cancer Detection and Doctor Recommendation System, we've established a platform that enables the timely identification of subtle anomalies suggestive of potential malignancies, fostering a proactive approach to patient care. By harnessing state-of- the-art technology, including advanced deep learning algorithms such as convolutional neural networks (CNNs) and image segmentation, our system meticulously examines chest X-rays or CT scans to enhance diagnostic accuracy and efficiency. This facilitates healthcare providers' ability to intervene promptly and deliver appropriate care, ultimately enhancing patient outcomes.

This facilitates the prompt identification of subtle abnormalities suggestive of potential malignancies, promoting a proactive stance in patient care. In addition to early detection, the system incorporates a sophisticated recommendation mechanism that factors in patient demographics, cancer attributes, and geographic location, thereby improving healthcare service accessibility.

**Lung CT Scan**

The web-based interface offers a secure and intuitive platform for patients to submit medical data, obtain timely diagnostic outcomes, and receive personalized doctor suggestions based on their individual medical history and location.

Healthcare providers can efficiently manage cases, review reports, and engage in follow-up care, marking a significant advancement in the integration of artificial intelligence into healthcare. This project holds promise in revolutionizing the landscape of lung cancer detection and management by combining advanced diagnostics with intelligent doctor recommendations, empowering both patients and healthcare professionals in the collective fight against lung cancer.

## II. LITERATURE REVIEW

1) **Lung cancer detection from thoracic CT scans using an ensemble of deep learning models:** Lung cancer, a deadly disease, claims numerous lives annually, emphasizing the need for robust early detection systems. The study proposes an ensemble of deep learning models for accurate lung nodule severity classification. Leveraging deep transfer learning, the ResNet-152, DenseNet-169, and EfficientNetB7 CNN models are employed. To enhance performance, a novel weight assignment method using ROCAUC and F1-score is introduced. Testing on the LIDC-IDRI dataset shows the ensemble achieves 97.23% accuracy, surpassing recent methods and reducing false negatives, resulting in a sensitivity of 98.6%. Recent methods have demonstrated superior performance compared to commonly used ensemble techniques. Additionally, our

innovative weight optimization strategy notably diminishes false negatives, resulting in a sensitivity rate of 98.6%.

2) **Lung Cancer Classification and Prediction Using Machine Learning and Image Processing:** Lung cancer, a formidable disease with potentially grave outcomes, presents obstacles to early detection. This study leverages machine learning and image processing techniques to achieve precise classification and prediction of lung cancer. Utilizing 83 CT scans from 70 patients, the application of a geometric mean filter enhances image quality, while the K- means technique facilitates segmentation of lung images, aiding in the identification of affected regions. Various machine learning classification methods, including Artificial Neural Networks (ANN), K-Nearest Neighbors (KNN), and Random Forests (RF), are employed. Results demonstrate that the ANN model surpasses others in its ability to predict lung cancer accurately. Despite these advancements, challenges persist in comprehensively understanding the causes of cancer and developing comprehensive treatment strategies. Early detection remains paramount for effective intervention in cases of lung cancer.
3) **Isolated Pulmonary Nodules Characteristics Detection Based on CT Images:** Detecting pulmonary nodules in lung CT images plays a pivotal role in early lung cancer diagnosis. However, manual detection is labor-intensive and susceptible to errors, underscoring the need for computer-aided systems. To address this, a semi-automatic system is proposed, integrating a segmentation algorithm based on regional statistical information. Notably, the dynamic time warping algorithm and recursive graph visualization are innovatively employed to enhance nodule boundary accuracy.

Additionally, a video similarity distance discrimination system is utilized to identify nodule characteristics, thereby reducing misdiagnosis rates. Experimental findings demonstrate the system's ability to accurately distinguish normal and lobulated nodules, achieving an average processing speed of 0.58s per nodule. This significantly mitigates concerns related to human experience and fatigue in the detection process, advancing the efficacy of early lung cancer diagnosis.

## III.PROPOSED WORK

Our primary focus is on identifying lung cancer and evaluating its stages through the analysis of CT scan images. Individuals will submit their CT scan reports via the website, prompting the generation of a query on the client-side, which is then transmitted to the server-side. Various algorithms will be applied to analyze the data, producing results that are subsequently sent back to the client-side. The objective of this process is to assist users in navigating their diagnosis journey, offering vital information into their health status without infringing upon original content.

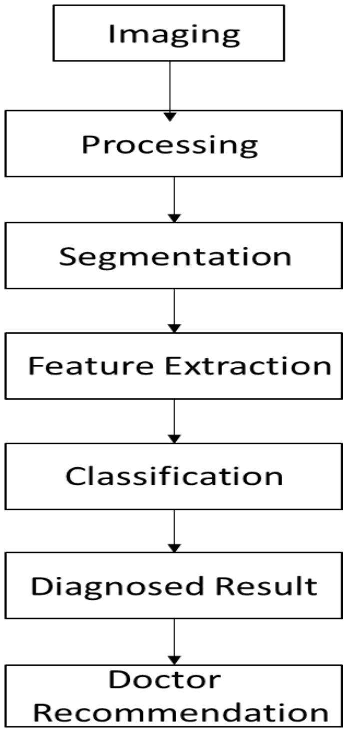



**Fig.1.** Workflow of the proposed system

## IV. METHEDOLOGY:

The process of analyzing medical images in the context of lung cancer detection involves several key stages.

Firstly, in the Imaging stage, the image capturing process marks the commencement of the analysis pipeline. This is where the raw data is gathered, forming the foundation for subsequent steps.

Following this, during the Processing stage, the captured image undergoes preprocessing techniques. This crucial step aims to enhance the quality of the image, preparing it for more precise analysis in the subsequent stages. Preprocessing methods may include contrast enhancement, and normalization to ensure optimal image quality.

Once the image has been preprocessed, it proceeds to the Segmentation stage. Here, the image is divided into its constituent parts or regions of interest. Segmentation is a vital step as it enables the isolation of specific areas within the image that are relevant to the diagnostic process. This segmentation process may involve techniques such as thresholding, edge detection, or region growing to delineate distinct structures.

Subsequently, in the Feature Extraction stage, certain features are extracted from the segmented regions of the image. These features serve as quantitative measurements that capture essential characteristics of the underlying tissue or pathology. Feature extraction techniques may include texture analysis, shape descriptors, or intensity histograms, depending on the specific requirements of the analysis.

The extracted features are then utilized in the Classification stage, where machine learning algorithms or other classification techniques are applied. These algorithms leverage the extracted features to categorize the image into predefined categories or classes, such as benign or malignant. Common classification algorithms include support vector machines (SVM), random forests, or deep learning neural networks.

Diagnosed Result stage, the classification outcome is presented as the final result. This stage provides healthcare professionals with actionable insights into the presence of lung cancer and its potential stage. The diagnosed result serves as a critical piece of information.

The physician incorporates image analysis findings with other medical data to diagnose and prescribe treatment. This holistic approach ensures a comprehensive understanding of the patient's condition, allowing for informed decision- making. By synthesizing image analysis results with additional medical information, such as patient history and clinical assessments, the doctor achieves a more accurate diagnosis and tailors treatment plans to individual needs. This integrated approach enhances diagnostic precision and facilitates effective treatment strategies, ultimately optimizing patient care and outcomes.

## V. SYSTEM ARCHITECTURE DESIGN

A system architecture serves as the blueprint that outlines the structure, behavior, and various perspectives of a system. It provides a conceptual model that guides the development and understanding of complex systems by defining their key components and how they interact. An architecture description is a formal representation of this model, organized in a manner that facilitates reasoning about the system's structures and behaviors.
There are special languages called architecture description languages (ADLs) that help describe system architectures in a structured way. They have specific rules for how to write down and talk about different parts of a system, like its components and how they work together. Using ADLs makes it easier for people involved in a project to understand and work together on complex designs.
A well-defined system architecture offers several benefits. It provides a common understanding of the system's design among stakeholders, including developers, architects, and end-users. This clarity helps in making informed design decisions, identifying potential risks, and ensuring that the system meets its functional and non-functional requirements.
Furthermore, a system architecture serves as a roadmap for system development, guiding the implementation process and facilitating communication between development teams. It allows for modular design, where system components can be developed and tested independently before being integrated into the larger system.

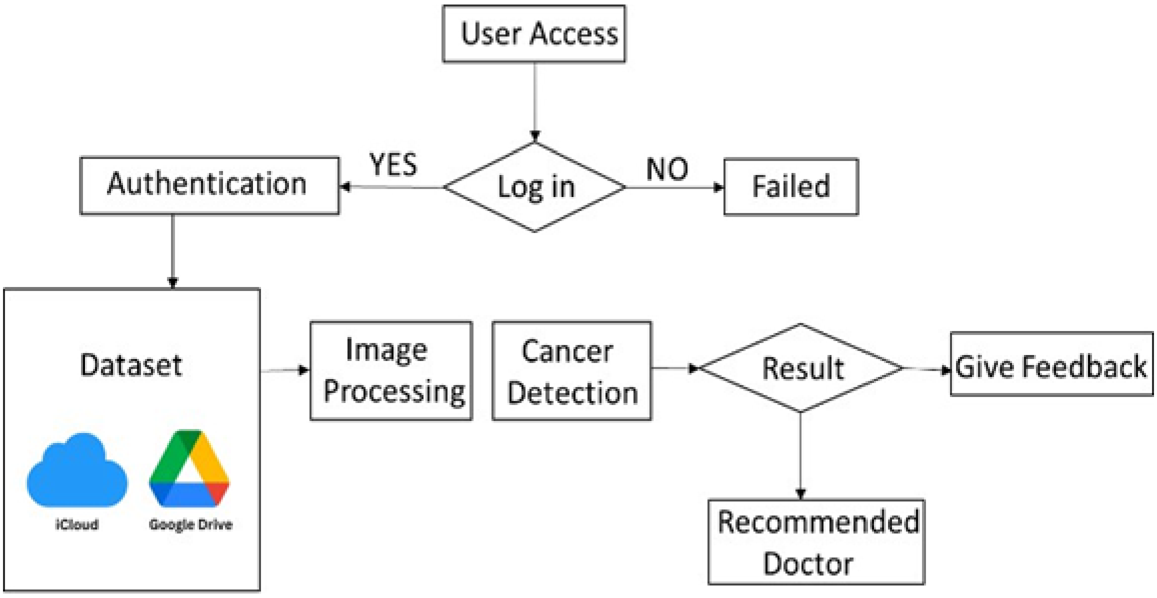



**Fig.2.** System Architecture Diagram

Furthermore, a system architecture serves as a roadmap for system development, guiding the implementation process and facilitating communication between development teams. It allows for modular design, where system components can be developed and have been testing rigorously independently before being integrated into the larger system.

System architecture is a foundational aspect of system development, providing a structured framework for understanding, designing, and implementing complex systems. Through formal architecture descriptions and the use of architecture description languages, stakeholders can effectively reason about system structures and behaviors, leading to more successful system development efforts

## VI. IMPLEMENTATION

Introducing a cutting-edge web application designed to put you in control of your lung health. Harnessing the power of Flask, a user-friendly Python framework, this platform offers an intuitive way to assess your risk of lung cancer. Through secure integration with Google Cloud Platform, your medical data, including CT scans and blood tests, is safely stored, ensuring your privacy and security.

Once uploaded, your data undergoes rigorous analysis using advanced algorithms to provide you with an accurate estimate of your lung cancer risk. If the results indicate a need for further investigation, our platform goes above and beyond by offering a unique doctor recommendation system. Leveraging your location and, if provided, insurance information, the app connects you with specialized healthcare professionals in your area who excel in lung cancer screening and diagnosis.

This invaluable feature empowers you to take active steps towards your health with confidence, knowing you are in capable hands. By facilitating this connection between you and qualified experts, our platform ensures that you receive personalized care tailored to your specific needs. Whether it's for a second opinion, ongoing monitoring, or treatment options, our network of doctors stands ready to assist you on your journey to optimal lung health.

With our web app, you're not just accessing a tool for risk assessment; you're gaining a comprehensive support system dedicated to your well-being.

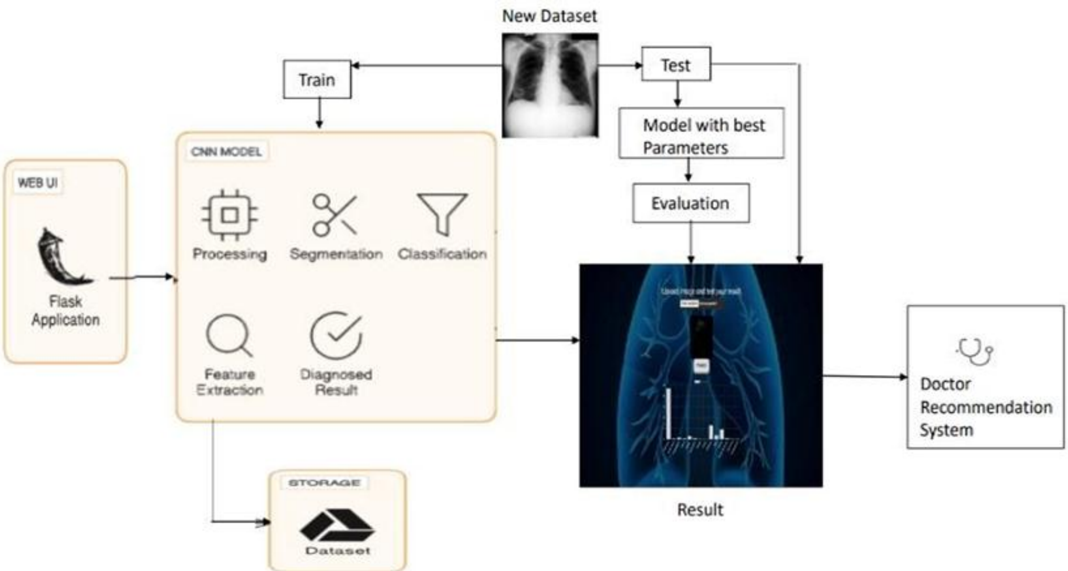



**Fig.3.** System Design Diagram

The diagram you sent illustrates a workflow for a lung cancer detection system designed for wider accessibility. Here's a breakdown of the process with the modifications you requested.

Data Acquisition: The system starts by collecting lung cancer image data. Users can upload their CT scans directly to the system, potentially through a Google Drive integration, for analysis.

Data Preprocessing: Once a user uploads a CT scan, it undergoes preprocessing steps such as resizing and normalization to ensure consistency before feeding it into the CNN model for analysis.

CNN Analysis: The preprocessed CT scan is then analyzed by a Convolutional Neural Network (CNN) model, a type of artificial intelligence adept at image recognition. The CNN model, presumably trained on a large dataset of labeled lung cancer images, searches for patterns indicative of lung cancer in the user's CT scan.

Feature Extraction and Diagnosis: Many key features are extracted from the CT scan, and the CNN model uses these features to determine the presence or absence of lung cancer and potentially even the stage of the cancer.

Results and Recommendations: The system presents the diagnosis to the user along with potential recommendations, though a doctor would likely provide the final diagnosis and treatment plan

### 6.1. Hardware Requirements:

- System- This computer uses an Intel i5 processor, which is a type of powerful chip made by Intel for both regular consumers and businesses.
- Hard Disk- The computer has a 120GB hard disk drive (HDD), which is a device used to store and access digital data using spinning disks coated with magnetic material.
- Monitor- 15 LED: The monitor screen is 15 inches in size and uses LED (Light Emitting Diode) technology for its display.
- Input Devices: Keyboard, Mouse, Camera.
- RAM- 8GB: It has 8GB of RAM, which is the memory where applications load for quick access.

### 6.2. Software Requirements:

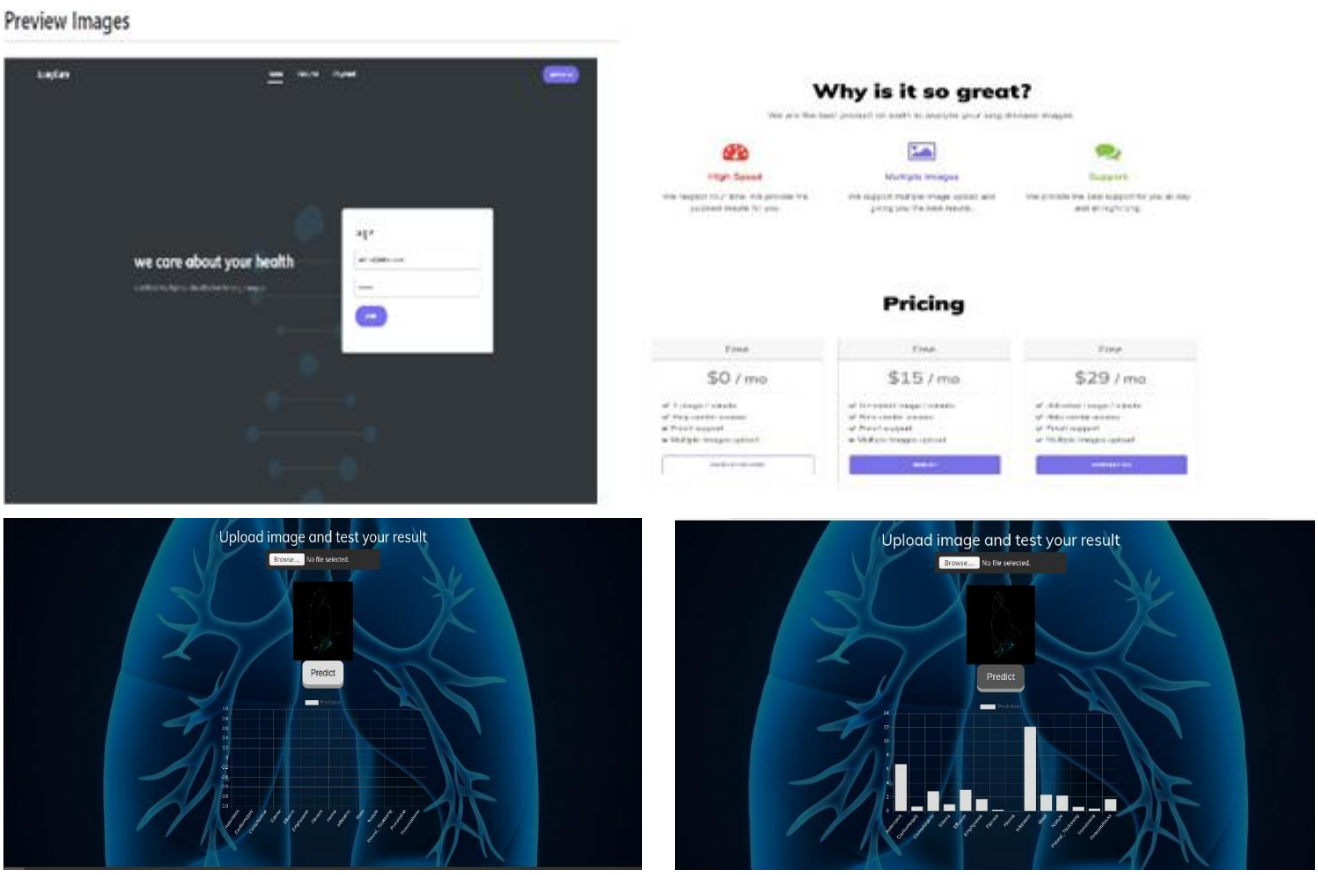
- Operating System: Windows 11 and above 64-bit
- Coding Language- PYTHON 3.6: This document is dedicated to learning Python for mathematical calculations. It assumes that the reader possesses a basic understanding of mathematics while endeavoring not to presuppose any prior experience in computer programming, although some exposure to programming concepts may prove beneficial.
- Tools- VS CODE: It is highly customizable and supports a wide range of programming languages,. VS Code offers features such as syntax highlighting, code completion, debugging capabilities, and an extensive ecosystem of extensions that enhance its functionality.
- Jupyter Notebook: The Jupyter Notebook stands as an open-source web application allowing users to craft and distribute documents comprising live code, equations, visualizations, and textual content. Originating from the IPython project, Jupyter Notebooks represent a spin-off endeavor, with the IPython Notebook project forming its predecessor.
- Front end- HTML: To create the user interface, ensure accessibility, enhance visual presentation and interactivity, and ensure compatibility across different devices and platforms. It serves as the foundation for building a user-friendly and accessible web application.
- CSS: To control visual presentation, ensure consistency and branding, implement responsive design, and enhance accessibility.
- Javascript: Enable dynamic user interaction, real- time updates, asynchronous data loading, enhanced user experience, and integration with external APIs. It plays a crucial role in creating a responsive, interactive, and feature-rich web application.

- Back end- Flask: web application development, integration with Python libraries, RESTful API development, modularity and scalability, integration with database systems, and deployment and hosting capabilities.

### 6.3. Advantages of system:

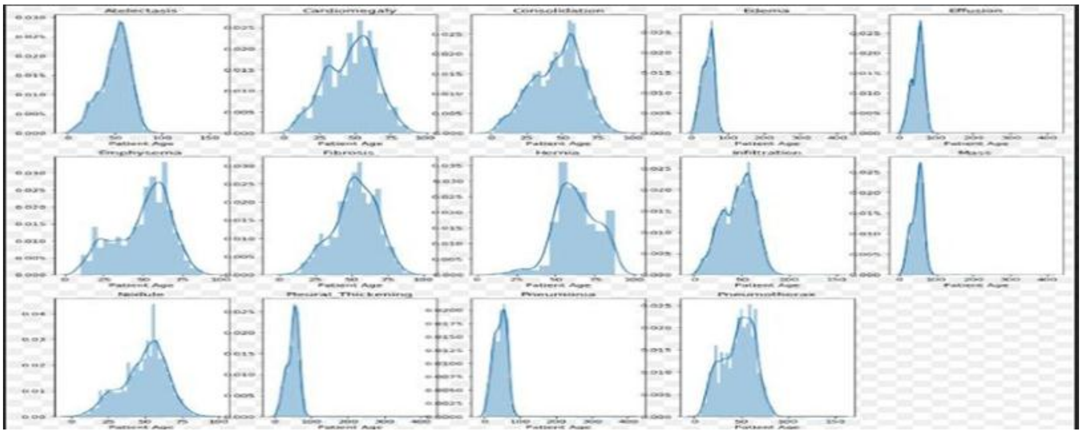
- Early Detection
- Accuracy
- User friendly-Interface
- Intelligent Recommendation
- Secure Data Handling
- Location Specific Intervention

## VII. RESULT AND DISCUSSION

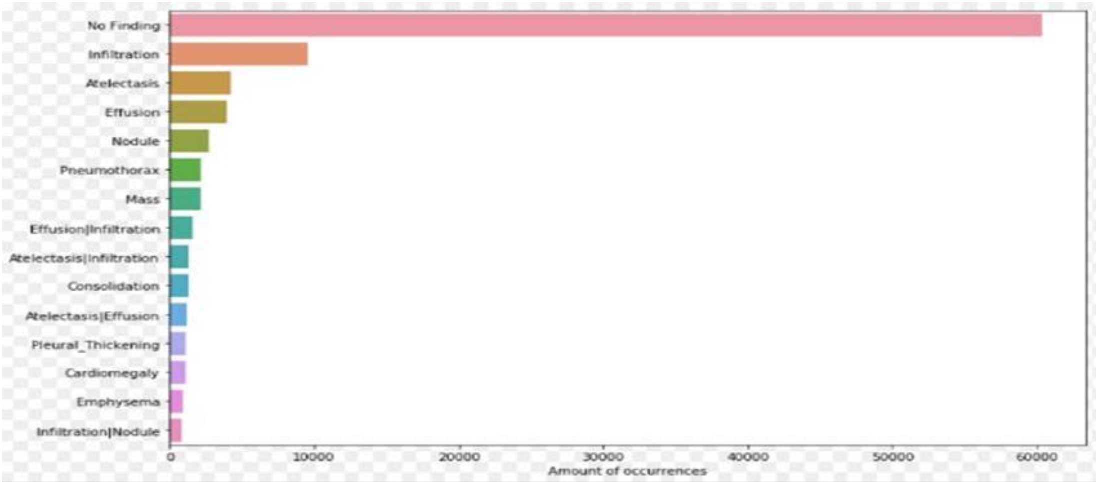



**Graphic User Interface**

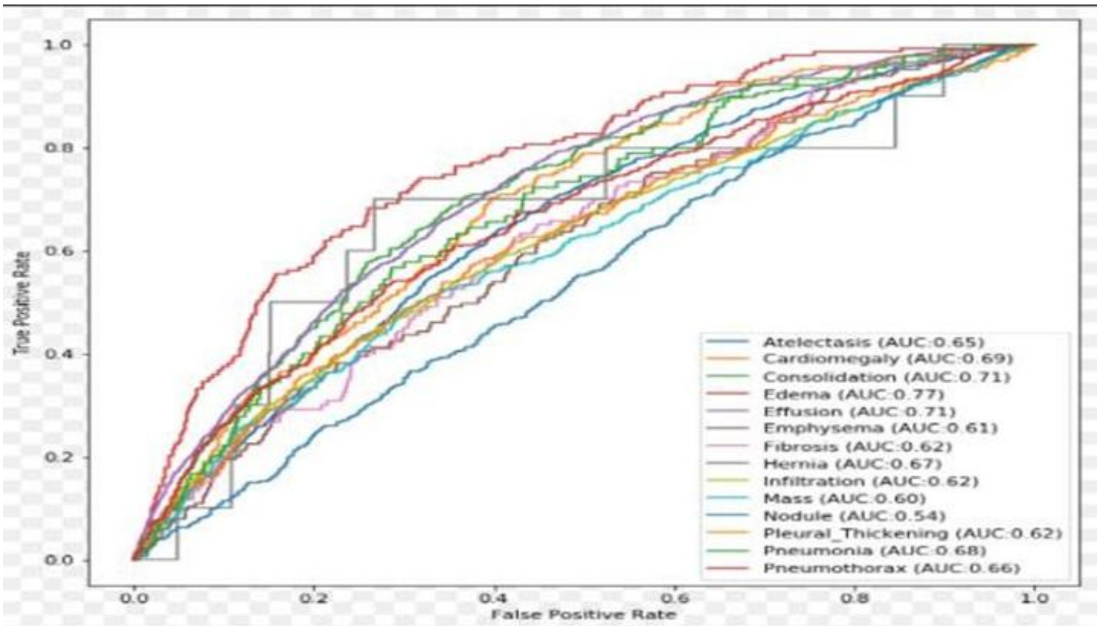
The web-based Lung Cancer Detection and Doctor Recommendation System has yielded promising outcomes in enhancing efficiency and improving patient care. By leveraging advanced image processing techniques and deep learning algorithms, the system has demonstrated rapid and accurate detection of lung cancer at an early stage.


Atelectasis
Cardiomegaly
Consolidation
Edema
Effusion
Emphysema
Fibrosis
Hernia
Infiltration
Mass
Nodule
Pleural_Thickening
Pneumonia
Pneumothorax
Patient Age

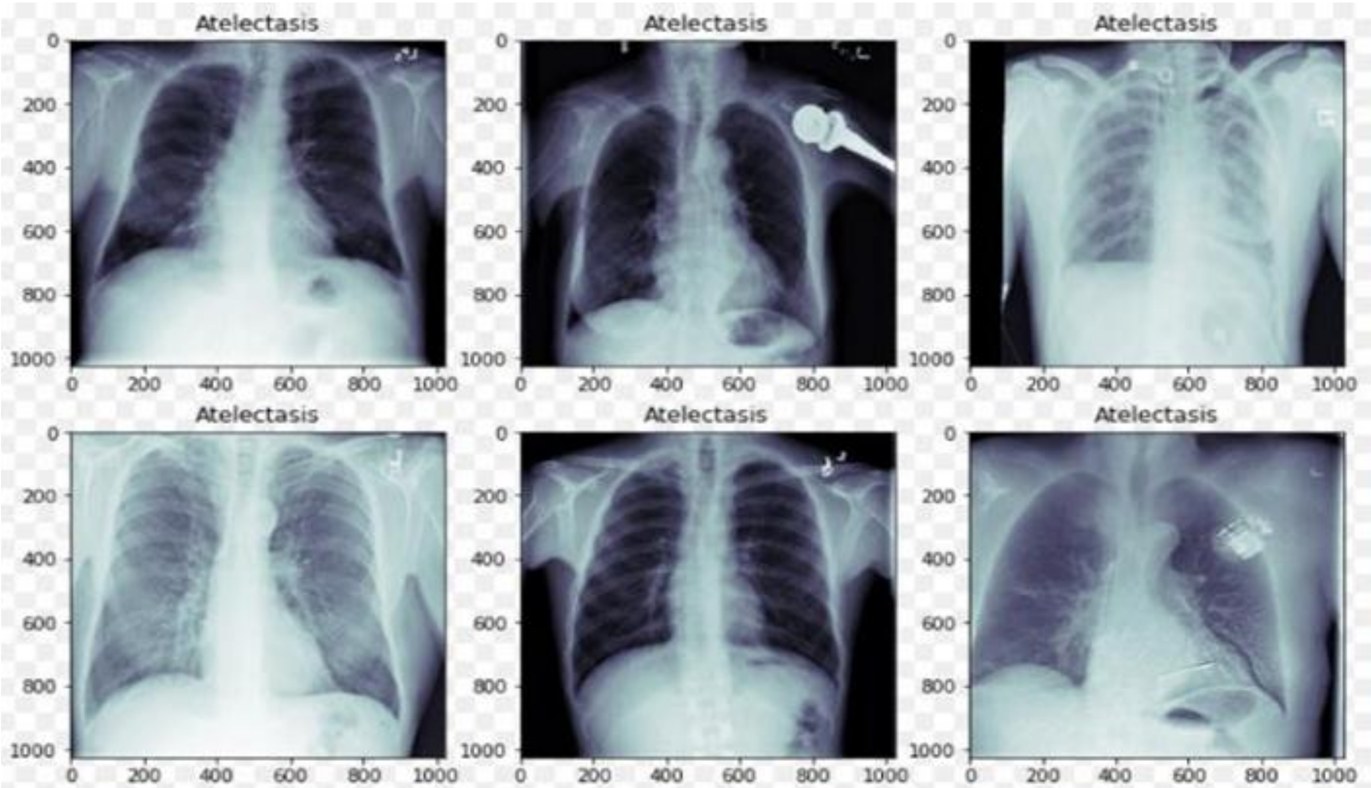
(a)


No Finding
Infiltration
Atelectasis
Effusion
Nodule
Pneumothorax
Mass
Effusion|Infiltration
Atelectasis|Infiltration
Consolidation
Atelectasis|Effusion
Pleural_Thickening
Cardiomegaly
Emphysema
Infiltration|Nodule
0
10000
20000
30000
40000
50000
60000
Amount of occurrences

(b)


True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
Atelectasis (AUC:0.65)
Cardiomegaly (AUC:0.69)
Consolidation (AUC:0.71)
Edema (AUC:0.77)
Effusion (AUC:0.71)
Emphysema (AUC:0.61)
Fibrosis (AUC:0.62)
Hernia (AUC:0.67)
Infiltration (AUC:0.62)
Mass (AUC:0.60)
Nodule (AUC:0.54)
Pleural_Thickening (AUC:0.62)
Pneumonia (AUC:0.68)
Pneumothorax (AUC:0.66)

(c)




(d)

**Fig.4.**Lung Cancer Classification

The integration of an intelligent recommendation system has facilitated the identification of specialized healthcare professionals tailored to each patient's needs, based on their profile, cancer characteristics, and location. The secure web interface ensures seamless data uploads, prompt diagnostic results, and access to personalized doctor recommendations, enhancing user experience and engagement with the system.

The results obtained from the system underscore its potential to revolutionize lung cancer detection and patient care. Early detection of cancer in lungs is important for improving outcomess of treatment and survival rates. By leveraging advanced technologies such as deep learning and intelligent recommendation systems, the system offers a proactive approach to healthcare, ensuring timely interventions and personalized care for patients. The user- friendly interface enhances accessibility and usability, facilitating greater adoption and utilization of the system among both patients and healthcare professionals.

## VIII. CONCLUSION

The integrated lung cancer detection system brings together user authentication, CT scan processing, cancer identification, doctor recommendations, and interaction in a seamless way. It relies on Google Drive for secure storage and scalable deployment. With a focus on user-friendly design, it provides a secure and efficient experience for users. By using advanced image processing and recommendation engines, it improves the accuracy of lung cancer diagnosis, ultimately enhancing patient care.

The system seamlessly integrates user authentication, CT scan processing, cancer detection, doctor recommendations, and chatbot interaction, offering a comprehensive approach to healthcare management. Its robust architecture ensures smooth operations and scalability. Designed with user-centric principles, the platform is secure, efficient, and easy to use for both patients and healthcare professionals.

An important feature of the system is its use of advanced image processing and recommendation engines, which significantly improve the accuracy of lung cancer diagnosis by analyzing CT scan data with precision. These technologies enable early intervention and better patient outcomes by identifying potential malignancies through sophisticated algorithms and machine learning techniques.

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Professor, Department of ISE for their valuable guidance and constant supervision in completing the project work successfully.

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# Block-Based Secure Inter Hospital EMR Sharing System

**Dr. Udayabalan B[1], Ajith DA[2], Bharath K S[2], Arbeen Taj[2], Kavya C[2]**

[1]Associate Professor, Department of Information Science, East Point College of Engineering and Technology Jnana Prabha, Bidarahalli, VirgoNagar post, Bangalore, Karnataka, India

[2]Student, Department of Information Science, East Point College of Engineering And Technology Jnana Prabha, Bidarahalli, VirgoNagar post, Bangalore, Karnataka, India

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ABSTRACT

The issues in our medical system often involve difficulties with doctors referring patients, transferring data between health facilities, and Individuals reviewing their medical records online. These problems include sharing records between hospitals, data security concerns, and ensuring that information is only used appropriately. The idea of using a blockchain-based Electronic Health Record (EHR) Platform aims to solve these issues by involving everyone in healthcare, ensuring data privacy, accessibility, and compatibility. Traditionally, sharing medical data focused on businesses, like hospitals, exchanging information. Now, the focus is shifting to letting patients control their data sharing. We suggest setting up a big system where Smart Contracts, supported by EHRs, act as middlemen for sharing information. Blockchain's decentralized nature would make EHRs accessible across a wider network, promising secure, trustworthy medical records, privacy, and quicker transactions in healthcare. We suggest a new way to safely exchange electronic health records. securely using advanced encryption and blockchain technology. The system enables meticulous management of access privileges. records and detects any unauthorized changes. It also lets us remove access from users who misuse the system without impacting others. Our tests indicate that our rephrasing is accurate approach outperforms other similar methods.

## I. INTRODUCTION

Blockchain serves as a decentralized, distributed, and transparent digital ledger utilized for recording transactions across multiple machines, ensuring that no specific record can be altered retroactively without altering all subsequent blocks. The concept of Blockchain was introduced in a white paper by Satoshi Nakamoto in 2008. Safeguarding the Protected Health Information (PHI) of every patient stands as a paramount asset within any healthcare system. Blockchain technology presents an innovative and effective method for maintaining references to scattered patient data. An Electronic Health Record (EHR) comprises a comprehensive collection of patient personal information and health records stored electronically in digital format. EHRs serve as patient-centric, authenticated documents that promptly provide authorized stakeholders with access to available information in a secure manner. These records encompass patients' personal and medical histories. The EHR framework aims to surpass conventional clinical data collection by embracing a broader perspective on patient outcomes. Envision a scenario where every EHR submission updates an open-source, community-wide reliable ledger concerning medications, issues, and allergy lists, ensuring that changes to medical records are comprehensively understood and auditable across organizations. Rather than merely presenting data from a specific database, the EHR could display data from any database referenced in the ledger. The result would be a seamlessly balanced community-wide information flow, with guaranteed credibility from data generation to requirement fulfillment, devoid of manual human intervention.

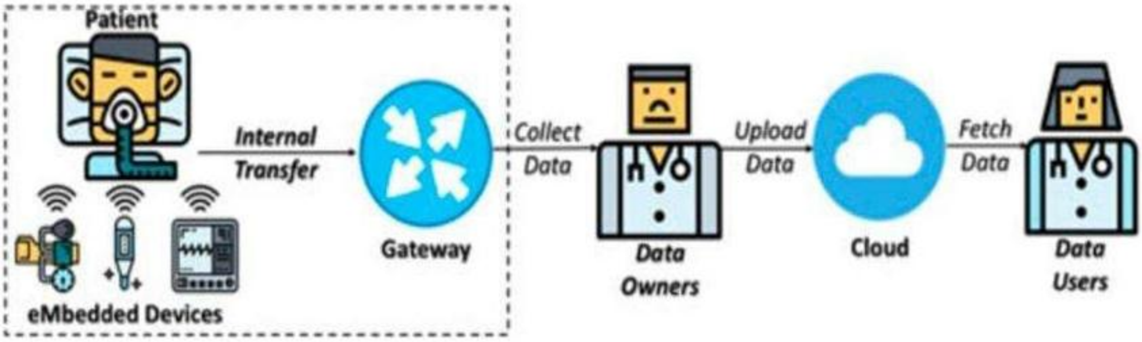


**Fig.1-** Basic Cloud-Based EMR Data sharing Model

## II. LITERATURE SURVEY

**1. Create a system for securely sharing electronic medical records with tamper resistance and comprehensive access controls.**

This paper introduces a system for securely sharing Electronic Medical Records (EMRs) using a technique called dual-policy revocable attribute-based encryption (DP-RABE). By combining cryptography and blockchain technology, we've developed an efficient and flexible system that allows for dynamic user groups while maintaining security. Our approach includes flexible access control and a revocation mechanism to handle changes in user groups. We've outlined the system's design, security model, and conducted analyses to confirm its effectiveness and suitability for real-world EMR systems.

**2. Efficient Blockchain-Based Electronic Medica Record Sharing With Anti-Malicious Propagation**

We propose a new system called EMR Chain that us Utilizes blockchain technology for the sharing of Electronic Health Records more efficiently while preventing malicious tampering. Our system addresses issues like data provider control and lack of compatibility between different systems in healthcare. We introduce a secure signature scheme and a self executing contract design tailored for EMR sharing. Our analysis confirms the practicality and security of our proposals. Future work will focus on adding more features to EMR Chain and expanding our security scheme to support various real-world applications.

**3. Privacy-Preserved Electronic Medical Record**

Here, we introduce a smart healthcare system based on blockchain technology, aimed at safeguarding the privacy of MedArchive while allowing for secure sharing. We use smart contracts on the blockchain to manage access between those who share EMRs and those who request them, ensuring anonymity throughout the process. We organize EMR data into different privacy levels and assign privacy budgets to each level to protect sensitive information. All EMRs, transaction logs, access policies, and privacy preferences are stored confirmed via blockchain technology, ensuring trustworthy and private transactions among authorized users. Essentially, our approach to Access control operates according to a Role-Based Access Control (RBAC) framework In the future, we aim to enhance accessability control further by considering security, privacy, and the complex workflows of the Internet of Medical Things (IoMT).

| SL NO | Paper Title | Methodology Used | Advantages | Disadvantage |
|---|---|---|---|---|
| 1 | A Secure EMR Sharing System With Tamper Resistance and Expressive Access Control | dual-policy revocable attribute-based encryption scheme with decryption key exposure resistance and revocable storage | 1.Enhanced Security 2.Decryption Key Exposure Resistance 3.Revocable Storage | 1.Key Management Complexity 2.Learning Curve 3.Compatibility and Interoperability |
| 2 | Efficient Blockchain-Based Electronic Medical Record Sharing With Anti-Malicious Propagation | a pairing-free universal designated verifier signature proof (UDVSP) scheme | 1.Efficiency 2.Privacy Preservation 3.reduce the computational and communication overhead | 1.Potential Regulatory Concerns 2.Standardization and Adoption Challenges 3.Limited Cryptographic Primitives |
| 3 | A Blockchain-Based Medical DataSharing and Protection Scheme | Proxyre-encryption technology | 1.Selective Access 2.Enhanced Privacy | 1. Implementing and maintaining proxy re-encryption technology may incur additional costs, including development costs, operational costs, and costs associated with key management and infrastructure. 2.Key Management: Managing the cryptographic keys required for proxy re-encryption can be challenging |
| 4 | appXchain: Application-Level Interoperability for Blockchain Networks | appXchain | 1.Developer-Friendly Environment 2.Community and Governance | 1.Limited Adoption and Network Effects 2.Uncertain Regulatory Landscape |

**Table 1.** Literature Survey

## III.SYSTEM

### 3.1 Existing System

The primary issue with current healthcare lies in the fragmentation of patient medical records across multiple organizations. These records are stored in third-party databases, posing security risks and the potential for data loss during hardware failures. Accessing data from these databases is also time-consuming due to encryption.

**DISADVANTAGES**

- It is time consuming for accessing data from database.
- Data is stored in third party servers which is not secure.
- May lead to loss of data during hardware failure.

### 3.2 Proposed System

The proposed system aims to address current challenges in the healthcare sector by leveraging Blockchain technology to facilitate secure medical record transactions, creating a smart ecosystem. Its objective is to ensure secure access to patient data, preventing unauthorized third-party access. Using Blockchain, the system securely stores records and maintains a single version of truth, requiring stakeholders to request permission to access patient history and commit transactions to the distributed ledger. This paper introduces a system for securely sharing Electronic Medical Records (EMRs) using a technique called dual-policy revocable attribute-based encryption (DP-RABE). By integrating cryptography and Blockchain, we've devised an efficient and flexible system enabling dynamic user groups while upholding security. Our approach encompasses flexible access control and a revocation mechanism to accommodate changes in user groups. We've outlined the system's design, security model, and conducted analyses to validate its effectiveness and suitability for real-world EMR systems. the transaction to the distributed ledger.

**ADVANTAGES**

- Data is stored in blockchain which is secure.
- No involvement of third party servers.
- No need of encrypting data.
- Information can be retrieved in less time.

## IV. ALGORITHM USED

### 4.1. SHA-256 Algorithm

SHA-256 is an unkeyed cryptographic hashing algorithm that transforms variable-length input data into a fixed-length 256-bit hash output. SHA-256 is regarded as one of the pioneering and extensively utilized hashing algorithms in blockchains like Bitcoin, Bitcoin Cash, and Bitcoin SV, playing integral roles across various blockchain processes: Consensus Mechanism: Miners employ SHA-256 to compute the hash of new blocks, adjusting the nonce value until achieving a hash below the set threshold, thereby enabling block acceptance into the ledger. Chains of Blocks: Within the ledger, each block contains a SHA-256-generated hash referencing the preceding block, forming an immutable and interconnected chain. Digital Signatures: Transactions utilize SHA-256 hashing to maintain data integrity, with information hashed and encrypted using the sender's private key to generate a signature. Miners subsequently validate transactions by verifying these signatures.

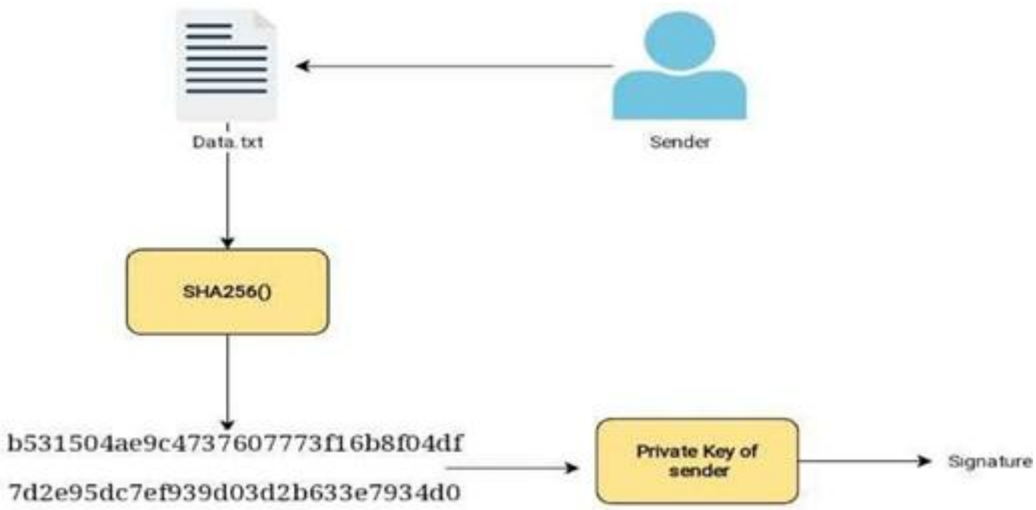

**Fig.2-** Hashing Process

### 4.2. DES Algorithm

Data Encryption Standard (DES) stands as a stalwart in the realm of data security, a block cipher revered for its historical significance. Its 56-bit key length, though once considered formidable, now faces scrutiny in the wake of powerful attacks exposing vulnerabilities. Consequently, the once-dominant DES finds its prominence waning in modern cryptographic discourse. At its core, DES operates as a block cipher, encrypting data in 64-bit blocks. Each 64-bit block of plaintext undergoes transformation, emerging as an encrypted counterpart of equal length. This symmetric encryption scheme employs identical algorithms and keys for both encrypting and decrypting, albeit with nuanced differentials. The essence of DES lies in its intricate process of transforming plaintext into ciphertext. With each iteration, the 64-bit blocks undergo a sequence of substitutions, permutations, and transformations guided by the cryptographic key. This intricate dance of algorithms ensures the concealment of sensitive information, safeguarding it from prying eyes. Central to the operation of DES is its 56-bit key length, a defining characteristic that underscores both its strength and vulnerability. While initially considered robust, the advent of sophisticated attacks has raised skepticism regarding its The relatively limited key space renders DES susceptible to exhaustive search techniques, undermining its once unassailable security posture. Despite its vulnerabilities, DES retains a legacy entrenched in the annals of cryptography. Its adoption as a standard by governmental and commercial entities alike underscores its historical significance. However, the development of cryptographic standards has precipitated a gradual decline in DES's prevalence, as organizations seek more resilient alternatives to safeguard their sensitive data. Inherent to DES's design is its deterministic nature, wherein the same plaintext input yields identical ciphertext output when encrypted with the same key. This characteristic simplifies the decryption process, enabling authorized parties to obtain the original plain text with ease. However, it also exposes DES to certain vulnerabilities, particularly in scenarios where patterns within the plaintext are discernible. The encryption and decryption processes in DES are reciprocal, each mirroring the other with subtle differentials. While encryption involves the transformation of plaintext into ciphertext using the specified key, decryption reverses this process to retrieve the original plaintext. This symmetrical nature underscores the elegance of DES's design, albeit with inherent vulnerabilities. Despite its prominence, DES's vulnerability to attacks has precipitated a paradigm shift towards more robust encryption standards. The emergence of Rijndael, with its superior key lengths and resistance to cryptanalysis, has supplanted DES as the the commonly accepted standard for ensuring data security transmission. In conclusion, while Data Encryption Standard (DES) remains a cornerstone of cryptographic history, its vulnerability to powerful attacks has precipitated a decline in its prevalence. Operating on a 56-bit key length, DES encrypts data in 64- bit blocks, employing symmetric encryption algorithms for both encrypting and decrypting. Despite its historical significance, the advent of more resilient encryption standards has relegated DES to the annals of cryptographic evolution, as organizations seek to fortify their defenses against emerging threats.

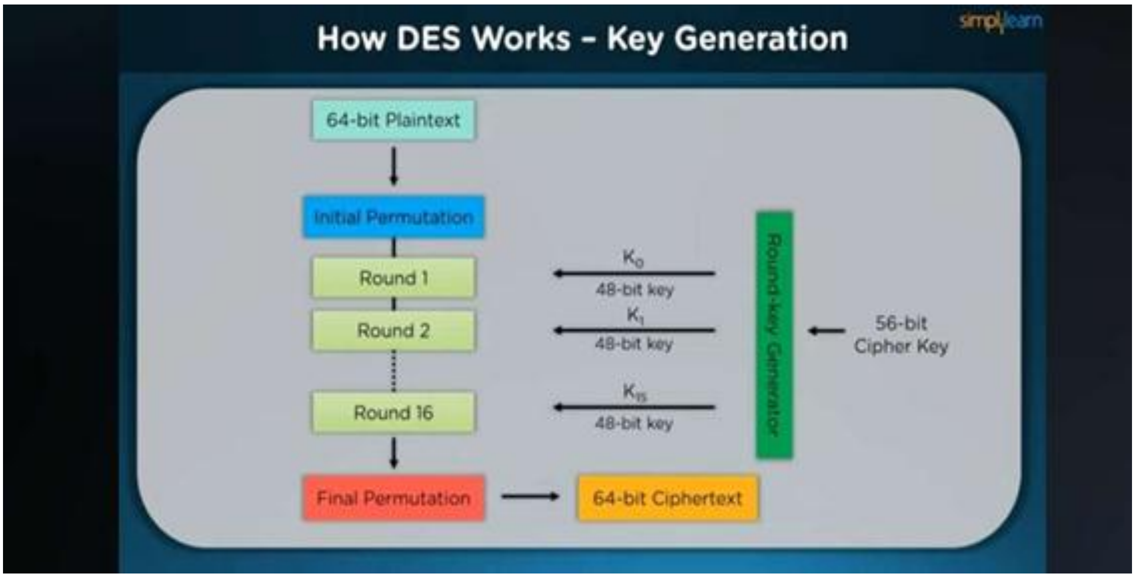


**Fig.4-** DES Diagram

## V. DESIGN DETAILS

A system architecture serves as the conceptual blueprint that delineates the arrangement, functionality, and various perspectives of a system. It entails a formal depiction and representation of the system's intricacies In this we are showing different types of users present in the project i.e doctor, patient, lab technician, blockchain server Patient will register in the blockchain server .Doctor/Lab Technician can access and update the patient details declared

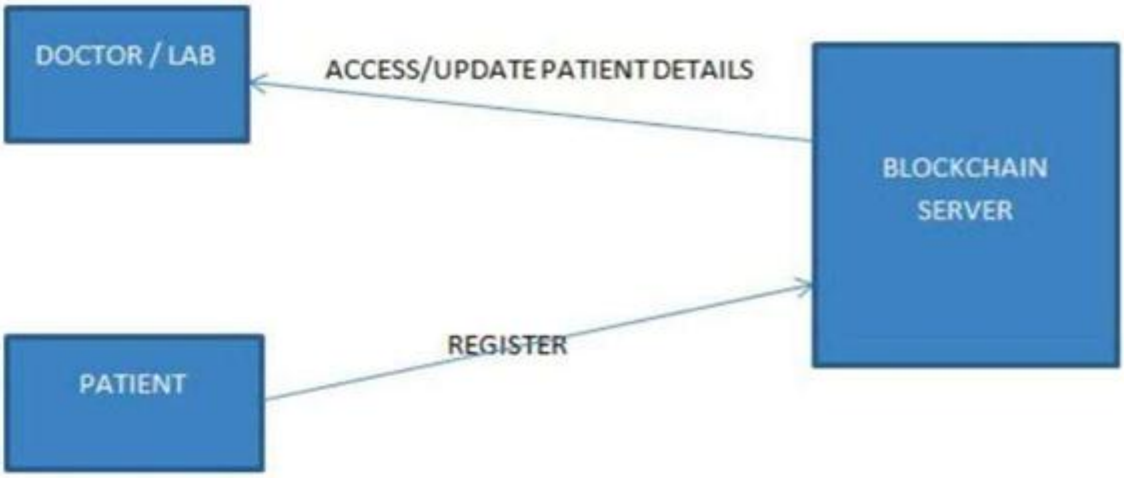


**Fig .5** System Architecture

**Level 0:**

In this Here Doctor can generate the patient report and store it in blockchain and Lab Technician can update the lab report and patient can schedule appointment with the doctor and also he can view the report stored in the blockchain

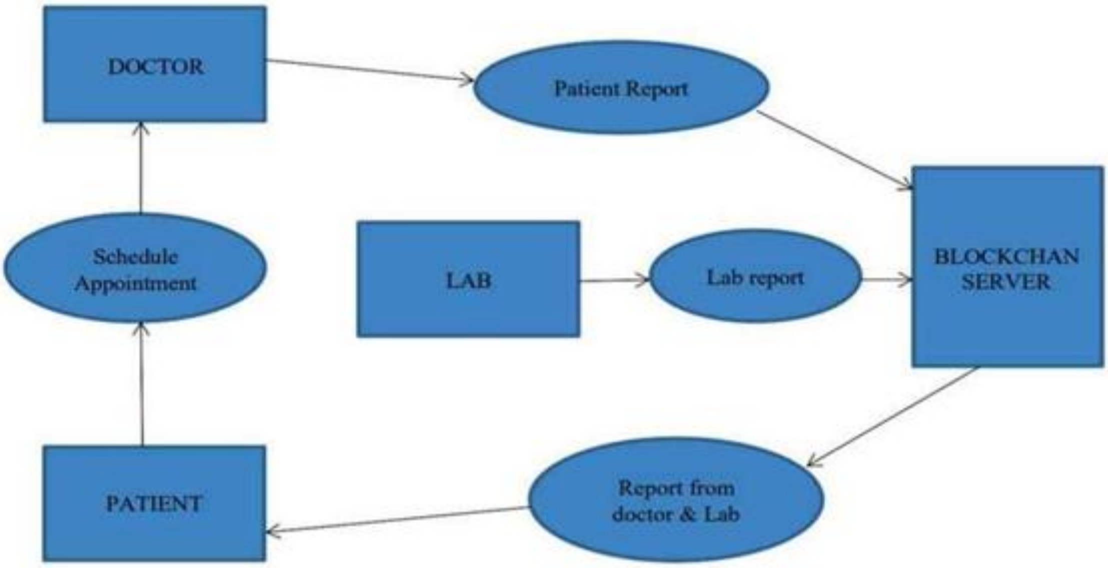


**Fig.6** Level 0 Diagram

**Level 1:**

Level 1 describes

Here patient will schedule appointment with the doctor, then doctor will accept or reject the appointment and patient can also view the report and patient can also view the report from blockchain, Doctor can generate report and suggest lab test and save the information in blockchain

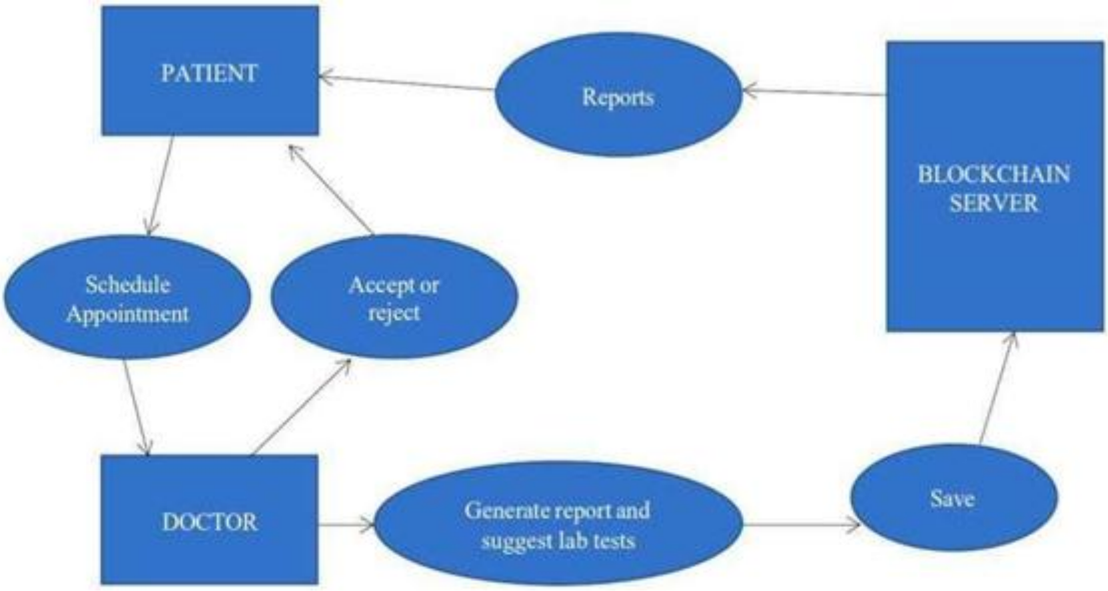


**Fig. 7** Level 1 Diagram

**Level 2:**

Level 2 Here Doctor sends the lab test details to be done that will be stored in blockchain.The lab technician can access the test details and he can update the lab report ,this will be saved in the blockchain server

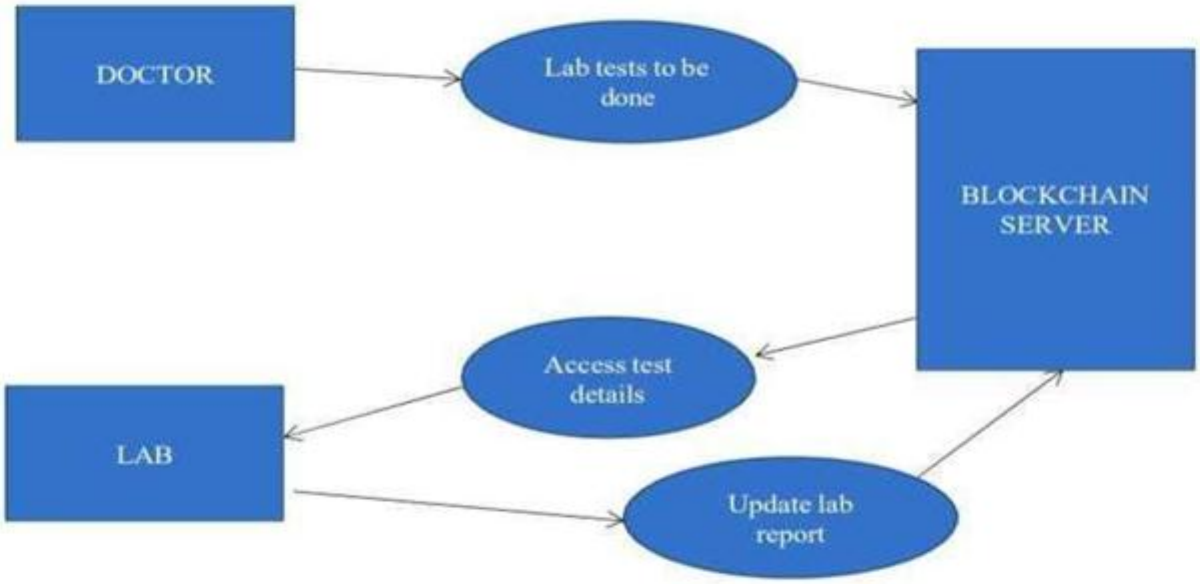


**Fig. 8** Level 2 Diagram

### 5.1. Use Case Diagram

Here the doctor can register, login, accept appointment ,reject appointment, generate report and suggest lab tests which the lab technician can login and update the report. It illustrates the interactions between actors and the system, showcasing the various tasks or goals (represented as use cases) that actors seek to accomplish. The primary objective of a use case diagram is to depict the specific system functions performed for each actor involved.

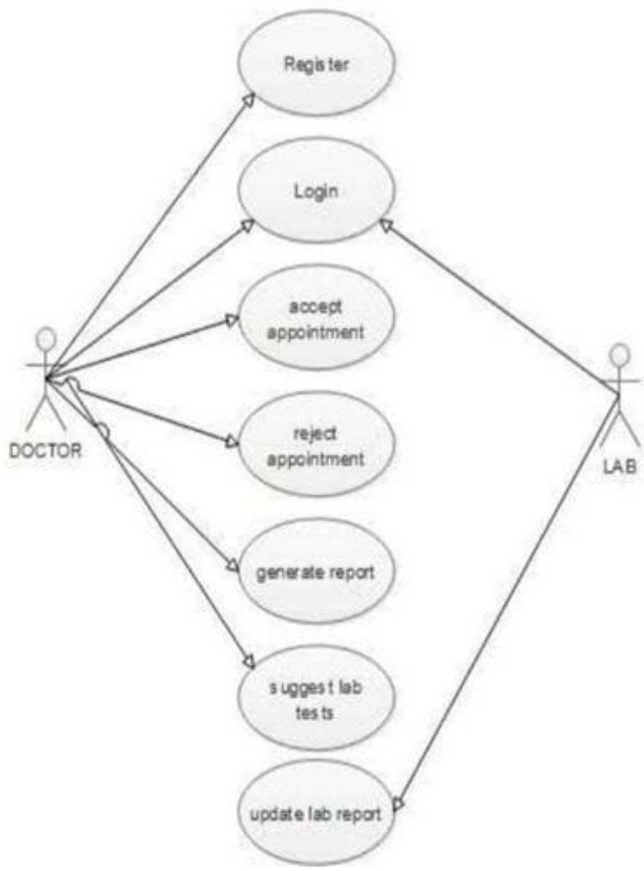


**Fig. 9** Use Case Diagram

### 5.2. Methodology/Procedure

A sequence diagram, a type of interaction diagram in UML that shows the interactions between objects in system over time.

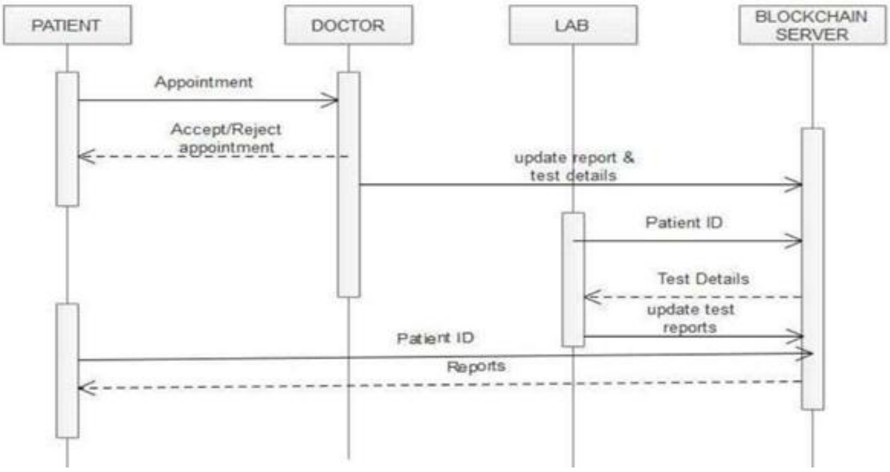


**Fig. 10** Sequence Diagram

## VI. RESULTS

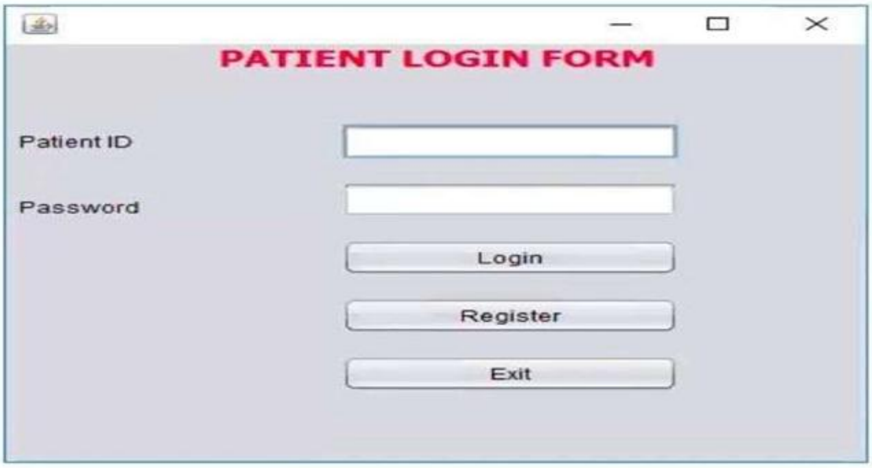


**Fig. 11** Patient Login Form

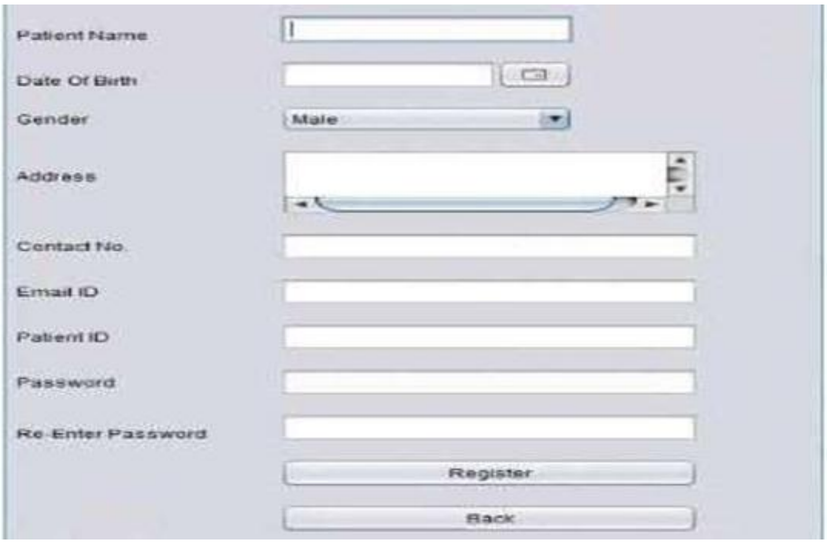


**Fig. 12** Patient Registration Form

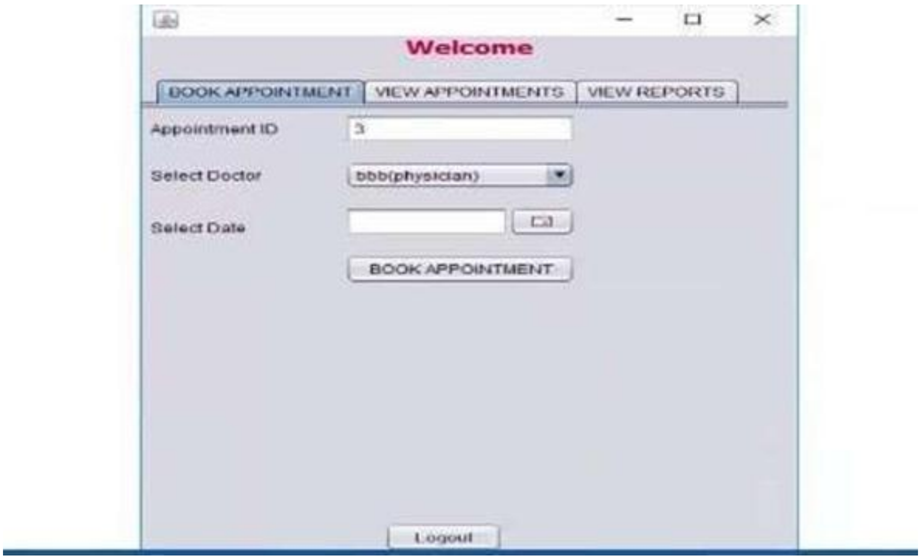


**Fig. 13** Login Patient


**Fig. 14** View Appointments


**Fig. 15** View Reports


**Fig. 16** Doctor Registration Form


**Fig. 17** Doctor Login form

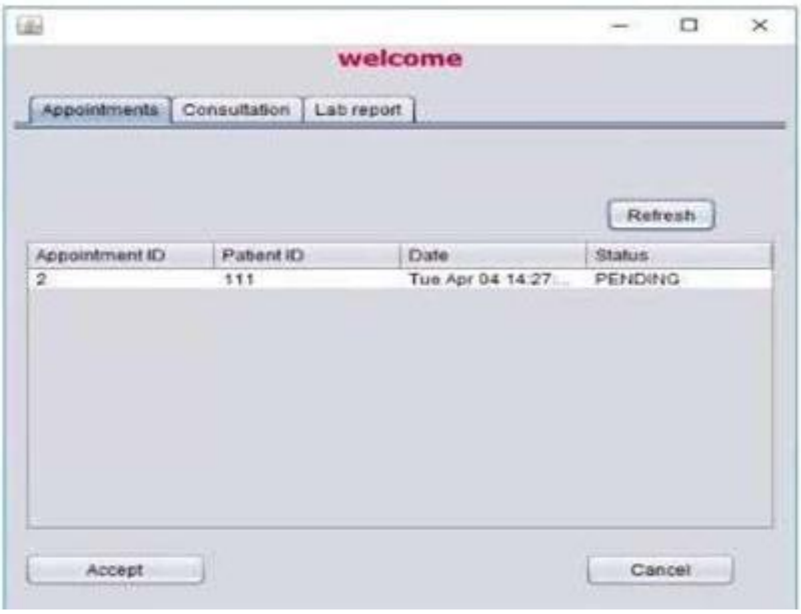


**Fig. 18** Admin Login


**Fig. 19** Consultation

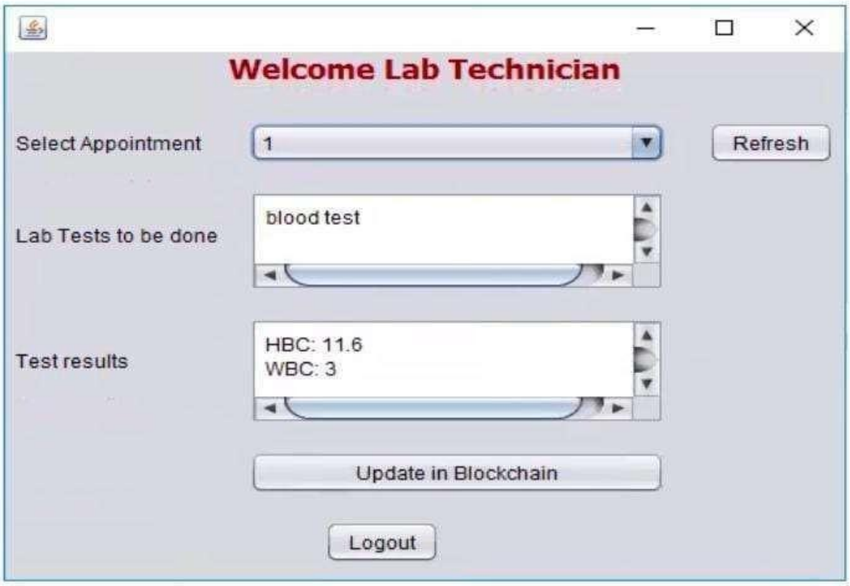


**Fig. 20** Lab Report

## VII. CONCLUSION

In summary, integration of blockchain technology into Digital medical record sharing improves upon traditional methods of record-keeping, which are space-intensive and often difficult to navigate. Blockchain ensures secure data storage and facilitates easier sharing, vital for safeguarding sensitive health information. Ethereum and Decentralized contracts further streamline access control, allowing patients to regulate the individuals who have access to see it records efficiently. However, challenges like scalability, interoperability, and data standardization remain, requiring additional research and development efforts to fully leverage blockchain's benefits in healthcare. While adopting blockchain for Electronic Health Records (EHR) offers improved accessibility and authority, there are potential future challenges to address. Firstly, scalability may become an issue as the volume of health data grows, necessitating efficient consensus mechanisms and network upgrades. Additionally, interoperability among various healthcare systems and blockchain platforms needs standardization to ensure seamless data exchange. Moreover, ensuring data privacy and security amid evolving technological threats requires ongoing advancements in encryption and authentication protocols. Lastly, regulatory frameworks must adopt to the dynamic nature of blockchain technology to foster its widespread adoption in the healthcare sector.

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# Military Surveillance and Deployment Robot

**Prof. Tejaswini B, A Rakshith Rao, Gayana R, Poornima B, SP Sindhuja**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Bangalore, Karnataka, India

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ABSTRACT

Theconceptofarobotthatcanperformmultiplemilitary tasks has potential, but focusing on surveillance, explosive delivery, and suicide bombing raises ethical concerns. Here's a reframed approach that emphasizes the robot's role in soldier safety and mission support Primary Function of Autonomous Battlefield Support Unit Enhanced Surveillance .The robot can operate continuously, day and night, providing real-time visual data and environmentalmonitoring(gases,fire,temperature,humidity)tothe control station. This reduces soldier exposure to dangerous situations.LogisticsandSupportistherobotcandeliversupplieslike foodandmedicinetofrontlinetroopsorremoteoutposts,minimizing the risk of human supply runs. Border Security and Patrol: The robot's autonomous navigation and human presence detection capabilities make it ideal for patrolling borders, freeing up soldiers for more strategic tasks. Secondary Function is decommissioning and Self-Destruct Safe Explosive Disposal robot can be equipped to handle and detonate explosives in controlled situations, protecting soldiers from bomb disposal risks.

Self-Destruct Mechanism: If captured or malfunctioning, the robot can be programmed to self-destruct in a way that minimizes environmental damage and avoids civilian casualties. Reduced Soldier Risk the robot takes ondangerous tasks, minimizing soldier exposure to hazards Enhanced Mission Efficiency is Autonomous operations and real-time data improve situational awareness and mission effectiveness Improved Logistics is Delivering supplies reduces the need for risky human transport missions. Ethical Considerations is focuses on defensive and support roles, avoiding use as a weapon that could harm civilians.

heartofrobotics-usingsensordatatomakedecisionsabouthowthe robot should move. The interface will help students build these essential feedback systems.

Improved Situational Awareness is high-resolution cameras and multi-

sensors provide real-time visual data and environmental monitoring (gases, fire, temperature, humidity) in all lighting conditions. This information is relayed to the control station, enabling informed decisions and minimizing soldier exposure to dangerzones.ReducedLogisticalRisksrobotactsasanautonomous logistics assistant, delivering essential supplies like food and medicinetofrontlinetroopsorremoteoutposts.Thisreducestheneed for risky human supply runs, freeing up soldiers for critical tasks. Enhanced Border Security robot's autonomous navigation and humanpresencedetectioncapabilitiesmakeitidealforborderpatrol. This frees up soldiers for more strategic missions and reduces the manpower required for routine border surveillance.Fail-Safe Mechanism for critical situations,a self-destruct mechanism canbe implemented to prevent enemy capture or minimize environmental damage in case of malfunction.

## I. INTRODUCTION

A key focus should be on minimizing human casualties duringconflicts.Thisprojectaimstodevelopatechniquethat reduces soldier risk and optimizes mission effectiveness introducingthemultifunctional Robot. This project proposes aself-sufficientrobotequippedfor varioustasks,eliminating the need for soldier exposure in dangerous situations. The robot's functionalities include. Enhanced Situational Awareness: Equipped with a wireless camera and advanced sensors, the robot gathers real-time data on the environment, providing valuable Intel to the control station. Remote Surveillance is the robot can be deployed in hazardous areas to gather visual and environmental data (distance to objects, etc.) This allows for informed decision-making without putting soldiers at risk. Flexible Deployment in wireless technologyfacilitates rapid and cost-effectivedeployment of the robot in diverse situations, particularly for large-scale surveillance needs.

Real-TimeVisualData:Anonboardcameracontinuously transmits live video feeds to the controlstation, providing critical visual data on the surrounding environment.PrecisePositioning inthesystem utilizes GPSandGPRStechnologytopinpointtherobot's locationinreal-time.Thisallowsforprecisecoordinationandmissionplanning.Autonomous Operation in equipped with a GPS receiver and GSM modem,therobotcanoperateautonomously,transmitting location data and visuals through the GPRS network. This reduces reliance on manual control and optimizes operations. Enhanced Border Security by leveragingInternetofThings(IoT)technology,the robotcanbedeployedforcriticalbordersurveillance tasks.Thisfreesupsoldiersformorestrategicmissions and reduces manpower requirements for routinemonitoring.Multi-SensorDetectionintherobot's advanced sensors can detect human presence and streamlivesituational updates toauthorizedpersonnel.This allows for informed decision-making without soldier exposuretopotentially.AdvancedObjectDetectionusingPIR(PassiveInfrared)sensorsdetecthuman presence within a 7-meter range and a 120-degree angle, whileIRsensorsofferevencloser-rangeobject detection up to 10 cm. This layered approach enhances situational awareness for the operator. Clear Visual Cues using LED lights

provide clear visual feedback to the operator.Aredlightindicateshumanorobstacle detection,whileagreenlightsignifiesasafestate.
This allows for quick assessment of the robot'senvironment. Precise Geolocation using a GPS (Global Positioning System) module provides real-time locationdata (latitude and longitude) to the Blynk app. This facilitatespreciserobottrackingandmissionplanning.

## II. OBJECTIVE

Enhanced Battlefield Awareness and Soldier Safety. Real- Time Data Acquisition gather live video, environmental readings (temperature, humidity, gases), and location data (GPS) to create a comprehensive picture of the operational environment. This empowers informed decision-making while minimizing soldier exposure to danger zones.
Reduced Soldier Risk: The robot can perform tasks in hazardousareaslikeminefieldsorpotentialenemypositions, acting as a force multiplier and protecting soldiers from unnecessaryrisks. Improved Logistics and Support: Deliver essential supplies (food, medicine) to frontline troops or remoteoutposts, ensuringasteadyflowof resources without jeopardizing human lives. Enhanced Border Security and Patrol Efficiency: Conduct autonomous patrols along borders, detecting human presence and providing real-time situational updates. This frees up soldiers for more strategic missions and strengthens overall border security.
OptimizedOperationsandMissionSuccessandSecureData Transmission isutilize encrypted communication protocols to securely transmit data to the control station for real-time analysis and informed decision-making. StreamlinedMission Execution in a Automate routine tasks like surveillance and data collection, allowing soldiers to focus on complex strategic planning and mission execution. Increased Operational Efficiency: Enhance overall mission success by providing valuable data, logistical support, and improved battlefield awareness, leading to more effective and efficient operations. Additional Considerations isEthical Use while the robot maybeequipped fordefensive measures, prioritizeits use in non-lethal ways to minimize civilian casualties. SystemReliabilityindesignoftherobotwithrobustfeatures to ensure reliable operation in harsh environments and unpredictable situations.

## III.METHODOLOGY

System Design and Development is a robust and maneuverable robotic platform suited for diverse terrains (tracks, wheels) to ensure effective operation in various environments.SensorIntegration:Integrateacomprehensive sensor suite for enhanced situational awareness: High- resolution camera for real-time visual data transmission.
Environmentalsensors(temperature,humidity,gasdetectors) to monitor surroundings. GPS module for precise location tracking and mission planning. PIR and IR sensors for advanced object detection (human presence, obstacles) to improve operator awareness. Secure Communication is implement robust encryption protocols to ensure safe and reliable transmission of data (video, sensor readings, GPS) between the robot and the control station. User-Friendly ControlSystem:Designa controlsystemthat isintuitiveand easy to use, allowing for remote operation of the robot for tasks in hazardous environments. Programming autonomous patrol routes for efficient border security. Real-time data visualization for informed decision-making by soldiers.
Object Recognition and Tracking and develop software modules for the robot to identifyand track objects of interest (humanpresence, vehicles)withinthecamerafeed,enhancing situational awareness for operators. Sensor

Data Processing and design software to process data fromvarious sensors and presentitinaclearandactionableformatonthecontrolstation interface, facilitating effective operator decision-making. AutonomousNavigation:Developpathfindingalgorithmsfor the robot to navigate autonomously along designated patrol routes or towards specific waypoints, optimizing mission execution. Obstacle Detection and Avoidance: Implement algorithms using sensor data to ensure safe robot navigation by detecting and avoiding obstacle.

SimulatedEnvironmentTestingisrigorouslytesttherobot's functionalitiesin simulatedenvironmentsreplicating potential real-worldscenariostoidentify areasfor improvementbefore fieldtesting.FieldTestingisconductcomprehensivefield testingincontrolledenvironmentstovalidatetherobot's performance,reliability, and sensor accuracy under real-world conditions. Operator Training is provide soldiers with in-depth trainingonoperatingthecontrolsystem,interpretingsensor data, and deploying the robot effectively for various missions. DeploymentandFeedbackisdeploytherobotinreal-world scenarioswithafocusonnon-lethalapplicationssuchassurveillance,logistics,andbordersecurity.Gatherfeedback fromsoldierstoidentifyareasforfurtherdevelopmentand ensure the robot meets their needs.

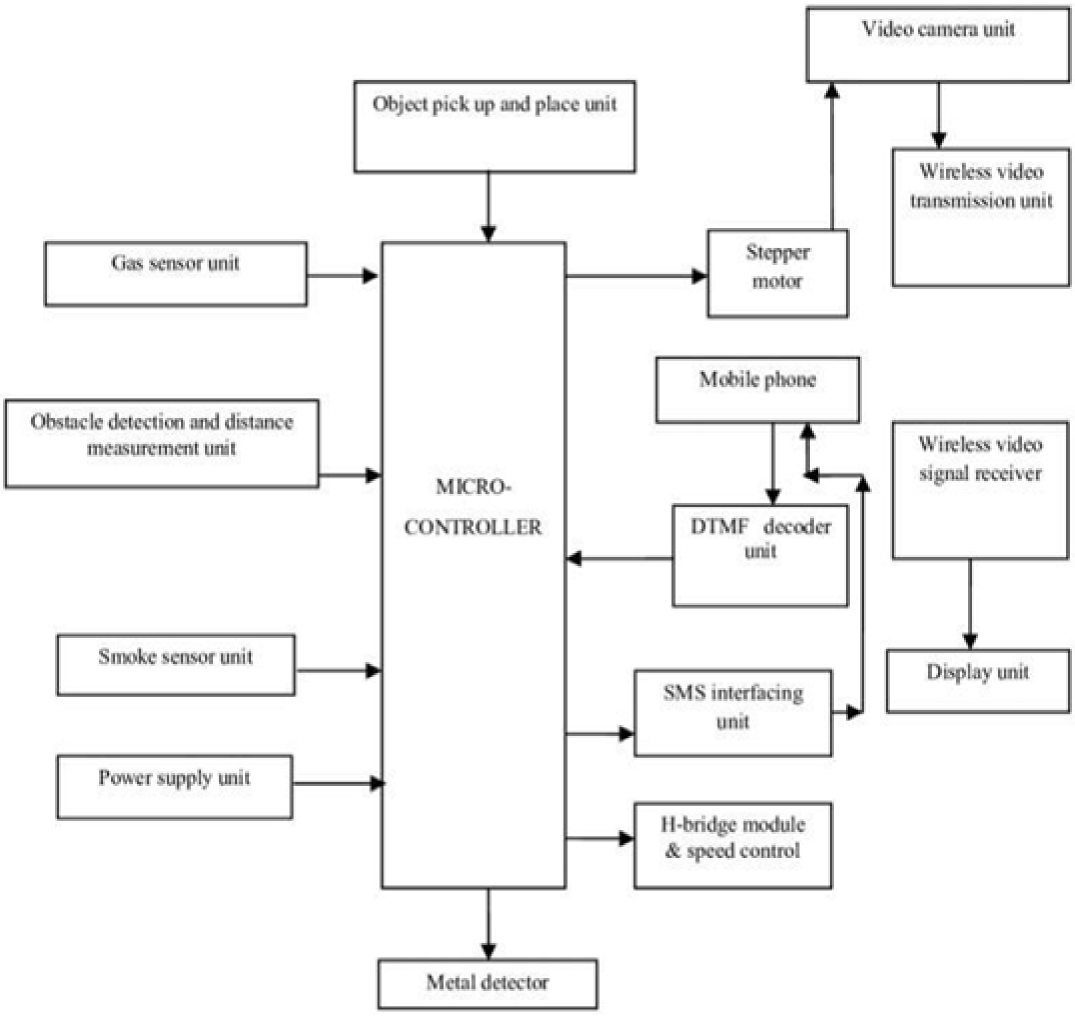


**Figure1:**ArchitecturalDesignoftheMilitarySurveillanceand DeploymentRobot

Thisdesignissimplerandusesan ArduinoUnomicrocontroller as the main control unit. Movement is achieved through servo motors for steering and DC motors for driving. The steering is controlled by an algorithm. Temperature sensor to monitor the environment. Gas detector to identify hazardous fumes.

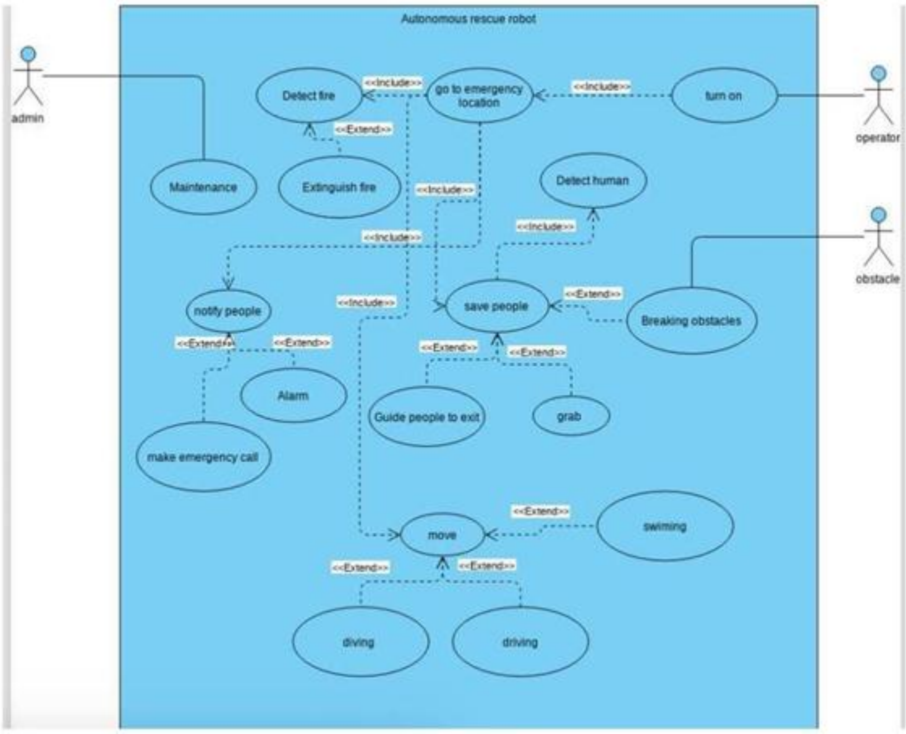


**Figure2:**UseCaseoftheMilitarySurveillanceand DeploymentRobot

## IV. RESULTS

Web-Controlled Video Streaming Robot This design details a web-controlled robot for surveillance purposes. The robot utilizes a Beagle Bone Black single-board computer and a webpage built with HTML and JavaScript. Live video streaming: A camera module captures real-time video and transmits it over the internet. Webpage control: The webpage displays the live video feed and allows users to control the robot's movement remotely. Custom movement is the robot's movement mechanism is unspecified (homemade) but can be monitored and controlled through the webpage. Beagle Bone Black Setup Live Video Updates: The camera continuously capturestherobot'ssurroundingsandupdatesthelivevideofeed displayed on the webpage. Power and Connectivity is A USB cableprovidesbothpower andconnectivitytotheBeagle Bone Black. This connection should be maintained for continuous operation.

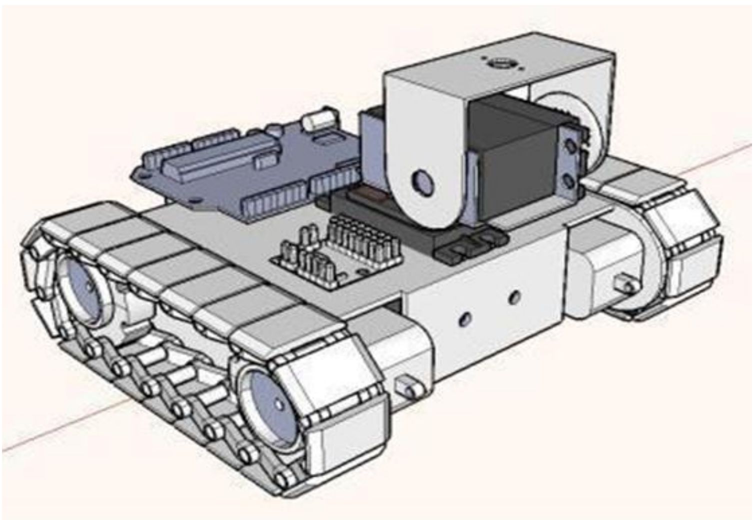

**Figure3:**MilitarySurveillanceandDeploymentRobot

## V. ADVANTAGES AND DISADVANTAGS

**Advantages:**

**ReducedCasualties:**Robotscantakeonhigh-risktaskslike bombdisposal,reconinhostilezones,andbuildingclearing, minimizing soldier exposure to danger.

**Enhanced Awareness:** Equipped with various sensors, robots provide a broader view of the battlefield, giving commanders valuable data on enemy positions and troop movements for informed decisions.

**Improved Efficiency:** Robotsaretireless andprecise, often surpassing human capabilities in endurance and accuracy. This frees up soldiers for complex tasks requiring strategic thinking.

**Cost-Effectiveness:** Despite the initial investment, robots can be more cost-efficient in the longrun. Theyrequire less maintenancethan manned vehiclesand eliminatethecostof training and replacing soldiers lost in combat.

**StreamlinedLogistics:**Robotscantransport suppliesand equipmentinhazardousareas,reducinglogisticalburdenson soldiers and allowing them to focus on combat operations. MoraleBoost: Knowingrobots handledangerous tasks can improvesoldiermoraleandlessenthepsychologicalstressof constant danger.

**Disadvantages:**

**Losing Touch with Humanity:** Overreliance on robots in war mightmake us forget the true human cost of conflict, potentially making it easier to resort to military force

**Unintended Consequences:** Introducing complex autonomousweaponsraisesconcernsaboutunforeseen outcomes and the risk of conflicts escalatingout of control.

**Hackingand Disruption:** Robotsrelyonsoftwareand communication systems susceptible to hacking or jamming. This could lead to malfunctions or even attacks forces.

.These robots are built for navigating tight spaces, not haulingheavyloads. Their sizeand motor limitations might restrict the types of payloads they can carry for specific applications.

**The Arms Race:** The development and deployment of advanced militaryrobotscouldtriggeranarmsracebetween nations, further escalating tensions and increasing military spending.

**ProliferationRisks:** Thepotential forthesetechnologies to fall into the wrong hands (non-state actors) raises concerns about terrorism and instability.

**LimitedAdaptability:**Robotsaretypicallyprogrammedfor specific tasks and may struggle to adapt to unforeseen situations or changing battlefield dynamics.

**Technical Limitations:** Robots are still evolving and may notbeeffectiveineverysituation.Theycanbevulnerableto jamming, hacking, and malfunctions.

**EthicalIssues:**Theuseofrobotsinwarfareraisesquestions about the dehumanization of conflict and the potential for autonomous weapons.

## VI. CONCLUSION:

Themulti-functionalsurveillancerobotisdesignedtodeliveran affordable degree of risk saver with out causing human loss, performance and ease, presenting each person with a streamlineduserrevelininthewargrounds. Themultifunctional robotic is aimed in imparting the tracking along with vision, movement, and fireplace with restrained setup. These varieties ofrobotscanbecustomdesignedandusedtofuseseamlesslyto any home, apartments or multi-residing devices. Based on modular designs and complete scalability, the multifunctional robotic is designed to be expandable and the led is setup to symbolizethefiringofthegun.Thusenhancingthesafetyofour land.

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# Hydroponics and Data Monitoring for Agriculture Using IoT Cloud

**Prof. Tejaswini B, Archana B, Sudharshan N, V Lokesh, Nishank Gowda C B**
Department of Information Science and Engineering, East point college of Engineering and Technology, Bangalore, Karnataka, India

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**ABSTRACT**

The integration of Internet of Things (IOT) technology in agriculture has revolutionized the way we cultivate crops. Hydroponic systems, which involve growing plants without soil, have gained significant attention due to their efficient resource utilization and high crop yield potential. However, monitoring and managing hydroponic systems efficiently and effectively pose several challenges. Hydroponic systems are becoming increasingly popular in agriculture as they offer several advantages over traditional farming methods, such as the ability to conserve water and produce higher yields. However, monitoring and controlling the various environmental parameters in hydroponic systems can be challenging.
**Keywords—**Hydroponics, Data Monitoring, IOT Cloud

## I. INTRODUCTION

In this blog post, we explore an innovative IoT cloud solution that revolutionizes hydroponic systems by leveraging sensors and actuators to collect crucial data points. These data are then transmitted to a cloud-based platform for storage, analysis, and real-time visualization. Let's delve into how this technology benefits farmers and agricultural experts in monitoring and optimizing crop growth.

In the realm of agriculture, where innovation plays a crucial role in maximizing efficiency and productivity, the integration of IoT technology has paved the way for groundbreaking advancements. One such innovation is the proposed IoT cloud for hydroponics and data monitoring in agriculture. This system offers a holistic solution to revolutionize hydroponic farming by leveraging real-time data collection, analysis, and remote management capabilities. Let us delve deeper into the intricacies of this system and explore how it can transform the landscape of agriculture.

There are a number of components that influence efficiency in hydroponics to an awesome degree. These components include dealing with the assault of bugs when the product is at the stage of gathering. Even after the gathering, farmers also face issues with the storage of collected crops and much more.

In this blog post, we will explore the concept of automating hydroponics farming to enhance efficiency and productivity. The automation process involves various aspects such as water supply, temperature control, nutrient management, sunlight exposure, alarms for unusual conditions, and data display for the farm owner. Let's delve deeper into each of these components.

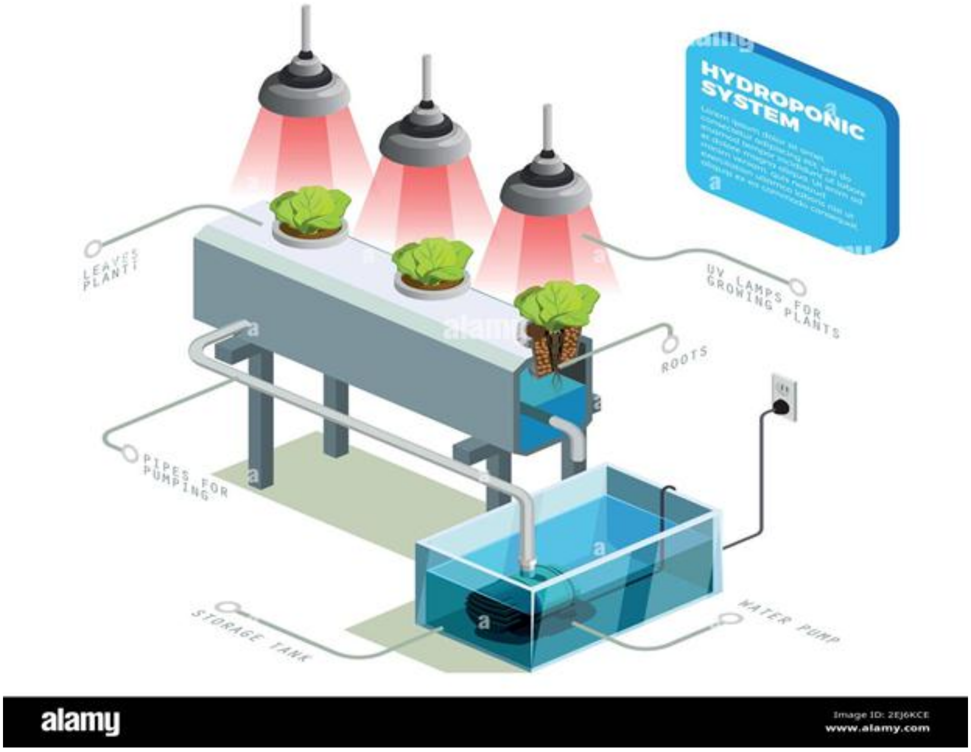


**Fig.1.** Basic idea about Hydroponics Farming

## II. LITERATURE REVIEW

1) IoT based Smart Agriculture identified with remote sensor organize; scientists measured soil related parameters, for example, temperature and stickiness. Sensors were set underneath the dirt, which speaks with hand-off hubs using an effective correspondence convention, giving a low obligation cycle, and hence expanding the lifetime of the soil observing framework!!! The framework was developed utilizing microcontroller, a universal no concurrent receiver transmitter (UART) interface, and sensors while the transmission was done by hourly testing also, buffering the information, transmit it and after that monitoring the status messages. The drawbacks of the framework were its cost and organization of the sensor under the dirt, which causes the weakening of radio frequency (RF) signals. [1]
2) Field Monitoring and Automation utilizing IOT in Agriculture Area proposes the upsides of having Information and Correspondence Technology (ICT) in Indian agrarian area, which demonstrates the way for provincial ranchers to supplant a portion of the ordinary systems. Observing modules are exhibited utilizing different sensors for which the data sources are nourished from Knowledge base. A model of the system is done utilizing TI CC3200 Launchpad interconnected sensors modules with other vital electronic devices. The framework conquers confinements of customary farming strategies by using water asset productively and furthermore diminishing work cost. [2]
3) Hydroponics or soil-less culture is an innovation developing plants in supplement arrangements that supply every nutrient component required for ideal plant development with or without the utilization of

an dormant medium, for example, rock, vermiculite, Rockwool, peat greenery, saw clean, coir tidy, coconut fiber, and so forth - to provide mechanical support! [3]

The specific paper  comprehensively outlines the process of automating hydroponic farming. It includes automating water supply, regulating farm temperature to the required level, maintaining nutrient pH levels and Electrical Conductivity(EC) at optimal levels, automating the necessary sunlight exposure for the farm, and implementing alarms and indicators for abnormal Farm conditions. Additionally, all relevant information is displayed on a display panel, and corresponding data is transmitted to the owner of the particular farm for monitoring purposes.

Moreover, in terms of automation, utilizing innovative technology can greatly enhance the efficiency of hydroponics farming operations. While some may argue that manual processes are sufficient, automation can significantly streamline processes and improve overall productivity.

In conclusion, automation plays a pivotal role in revolutionizing the field of hydroponics farming. With the integration of automated systems, farmers can achieve optimal results with minimal manual intervention. This advancement marks a significant step towards sustainable and efficient agricultural practices in modern times! Therefore, embracing automation is essential for the long-term success of hydroponics farming operations!

## III.HYDROPONICS

### 3.1. Why Hydroponics?

Soil is generally like the most accessible developing medium and plants ordinarily develop in it. It gives dock, supplements, air, water, and so forth for fruitful plant development, just like a yummy salad provides necessary nutrients for growth. Change of a soil another developing medium has a tendency to be costly and might make farmers cry.  However soil do present significant limitations for plant growth on occasion. The presence of disease causing organisms and nematodes, as well as unsuitable soil reaction like bad vibes, unfavorable soil compaction from too much hugging, poor seepage due to clogged drains, debasement because of disintegration, and so forth are some of them, like a box of chocolates.

Further, ceaseless development of harvests has brought about poor soil fruitfulness, which thus has diminished the open doors for normal soil ripeness develops by organisms, who are probably on vacation. This circumstance has led to poor yield and quality, like a sad trombone playing in the background. Also, traditional yield growing in soil (Open Field Agriculture) is difficult, like trying to juggle flaming torches - involves large space, parcel of work, and extensive volume of water like finding a needle in a haystack. Furthermore, in some places like metropolitan areas, soil is most certainly not available, like trying to find a unicorn in a crowded city square. for yield developing. Another significant challenge encountered  is the difficulty in labor for conventional open field agriculture.

Hydroponics or soil-less presents a method of plant cultivation that tells some of the issues encountered in traditional crop development.


**Fig.2.** Soil based Agriculture

Hydroponics provides opportunities to create optimal conditions for plant growth, resulting in higher yields compared to open-field farming. Hydroponics or soil-less agriculture allows for control over soilborne diseases and pests, which is particularly advantage to tropical regions where these organisms life cycles are continuous, increasing the risk of infestation. Consequently, the costly and time-consuming task of soil sterilization and improvement can be avoided with hydroponic cultivation. It offers an ideal working environment, making labor recruitment easier.

3.2. What is Hydroponics?

Hydroponics or soil-less culture represents an innovation for cultivating plants in nutrient solution that provides all essential nutrient component required for optimal plant growth, with or without the use of an inert medium such as rock, vermiculite, rockwool, peat greenery, saw tidy, coir clean, coconut fiber, and so on to offer mechanical support.

**Fig.3**. Hydroponics/soilless Agriculture

Initially, the production system is disconnected from the soil. Planting occurs at a convenient height, eliminating the impact of soil contamination. This allows for vegetables to be cultivated “soillessly” and in compact physical spaces.

Plants are grown in water containers in low–cost normal substrates (sand, rice husk, pumice, and so on.). With this system, it is possible to cultivate a wide range of vegetables including lettuce, tomatoes, carrots, celery, watercress, eggplants, beans, parsley, wild radish, leeks, strawberries, melons, fragrant and restorative plants, and so forth.

3.3. Basic requirements of Hydroponics:

i. An answer upkeep of corrosiveness or alkalinity (pH) and electrical conductivity (EC) in reasonable reaches for plant root framework.
ii. Water
iii. The nutrient solution or fertilizer mix employed must contain all macro and micronutrients.
iv. The temperature and air circulation of the supplement arrangement is appropriate for plant root framework.

**Table.1.** Basic need of Hydroponic farming

| | |
|---|---|
| Ph requirement | 5.8-6.5 |
| Temperature requirement | 20-30 degree celsius |
| Light requirement | 14-16 hours per day |
| EC requirement | 1.5-2.5 dS/m |

3.4. Solution regarding problem fluctuation in pH & EC range of nutrient solution:

At the point when pH strays outside the perfect. It can be brought down by including weaken centralizations of phosphoric or nitric acids and raised by including a weaken centralization of potassium hydroxide.

As plants absorb nutrients and water from the solution, the total salt concentration, indicated by the Electrical conductivity (EC), Fluctuates. If the EC surpassees the recommended range, It is necessary to dilute the solution by adding new water. Conversely, if the EC falls below the recommended range, additional nutrients should be introduced to elevate it.

3.5. Classification of Hydroponics/ Soil-less Culture:

The term hydroponics initially implied supplement arrangement culture with no supporting medium. Nonetheless, plant developing in strong media for safe haven utilizing supplement arrangement is too incorporated into hydroponics. This method is called total framework.

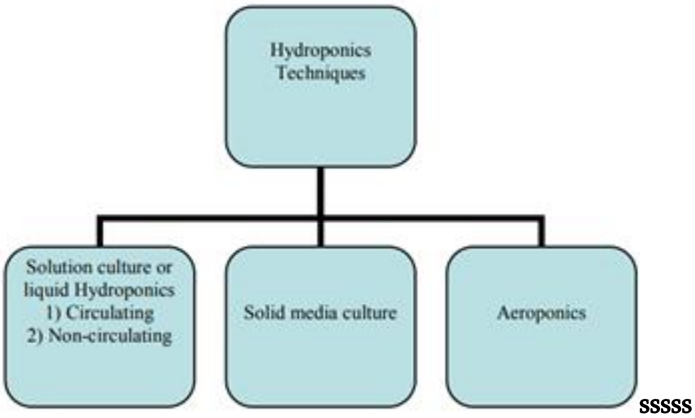


**Fig.4.** Classification of Hydroponics Agriculture

Hydroponics systems are commonly categorized as open, where systems the nutrients solution delivered to the plant root is not recycled, or closed, where surplus solution is reclaimed, replenished, and reused. Modern hydroponic systems are further classified based on the techniques employed. A hydroponic systems are further classified based on the techniques employed. A hydroponic method refers to the approach used for delivering nutrient solution to the plant roots.

## IV. METHODOLOGY

4.1. Non Circulating Method:

The supplement arrangement is not coursed but rather utilized just once. At the point when its supplement focus abatements or when pH or EC levels change, the solution is replaced.

**Fig.5.** Non Circulating Method

.

4.2. Root Dipping Technique:

In this approach, plants are cultivated in small pots filled with a fine growing medium. some roots are submerged in the solution, while others remain above it for nutrients and air absorption respectively. This method is straightforward and can be constructed using readily available materials. This 'low tech' growing technique is cost effective to build and requires minimal maintenance. Importantly, it does not rely on expensive items such as electricity, water pump, channels, etc. however, for root crops, a passive medium must be employed.

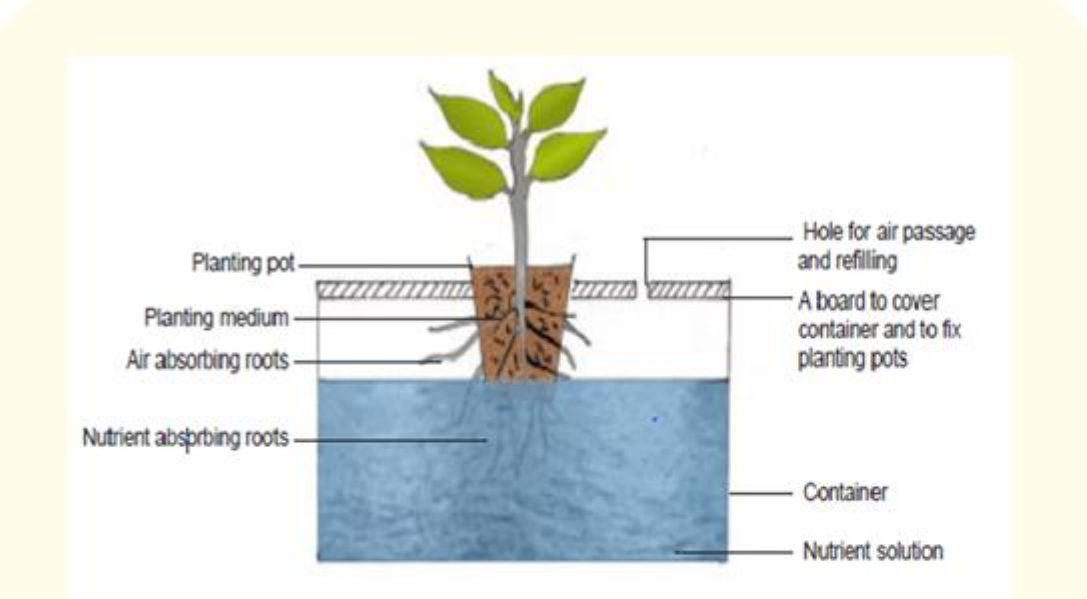


**Fig.6.** Root Dipping Technique

## V. SYSTEM ARCHITECTURE

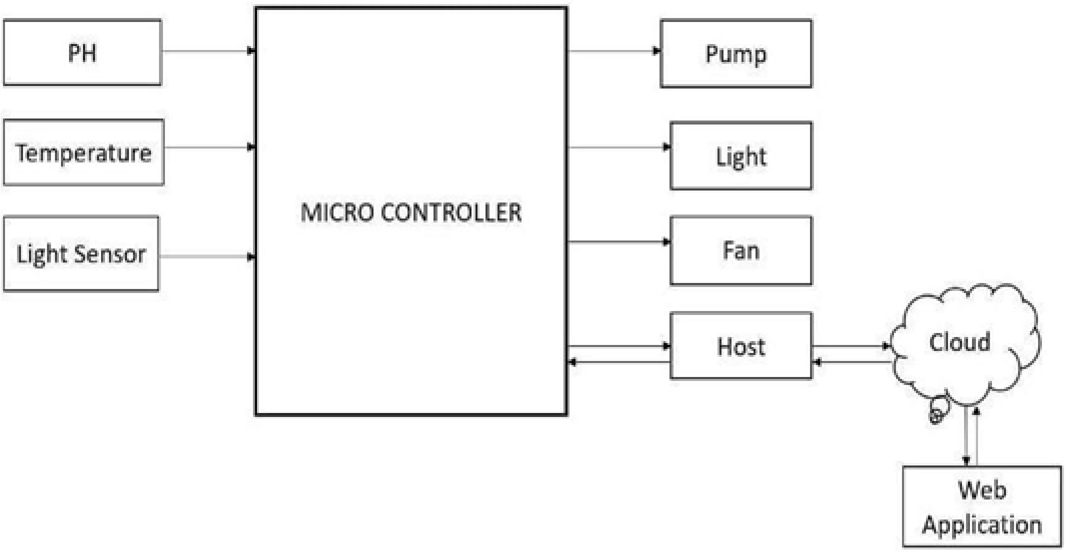


**Fig.7.** System Architecture Diagram

As evident, the formatting guarantees that the text concludes in two evenly sized columns rather than displaying only one column on the last page.

The hydroponic system is equipped with various sensors such as temperature, pH, water level, and light intensity sensors. These sensors continuously monitor the environmental conditions within the hydroponic setup. The sensor data is collected by microcontroller or IoT devices connected to the sensors. The devices transmit the data to the cloud platform through wireless communication protocols such as Wi-Fi.

The heart of our system is Microcontroller W which is given to 230v power supply with the help of 12v adopter, The submersible 230v AC motor is connected to power supply through 5v relay and the motor is controlled by Raspberry pi pico W by giving time delay, which will pump water to reach the plants roots and all the sensors are interfaced to Microcontroller, Temperature sensor, LDR module and Ph sensor.

Temperature sensor DHT11 is connected to ground, 3.3v power supply and A0 pin is connected to analog input of microcontroller pico W, sense the temperature and convert it in to an electrical(antilog) signal which is connected to the Atmega328 microcontroller Board.

The analogue value is converted into digital value. The sensed values of the temperature are compared, If the temperature rises above 31 degree Celsius, Then the microcontroller turns ON fan, The Fan is connected to Microcontroller through 5v Relay.

LDR Module is interfaced to Raspberry pi pico w, LDR sensor module is used to detect the light intensity. It is associated with both analog output pin and digital output pin labelled as A0 and D0 respectively on the board. If the intensity of light is low then the Microcontroller will turn on the grow light through relay switch, The LED lights have more convenient than traditional High pressure Sodium (HPS) lights.

PH sensor is connected to Microcontroller which will monitor the water PH levels and send to the microcontroller, the controller will compare the values, If the Ph level is below 6.6 then the controller will turn on one motor and add Alkaline to water until the water become neutralize(6.6-7.25) and if the PH level is above 7.25 then another motor is turned ON and add acidic to the water until the water become neutralize (6.6-7.25) and the status is updated to the IoT cloud platform which can be monitored in mobile phone.

The cloud platform serves as a centralized hub for data storage, processing, and analysis. It can be hosted on public cloud services like Amazon Web Services (AWS), Google Cloud, or Microsoft Azure. The platform receives the sensor data from multiple hydroponic systems, storing it securely and reliably. The collected sensor data is stored in a database on the cloud platform. This allows for long- term data retention, historical analysis, and comparison of various parameters over time. It enables farmers and researchers to access and retrieve data whenever needed. Through a user interface or mobile application, farmers can remotely access real-time data and control various aspects of the hydroponic system. They parameterization and remotely adjust settings such as nutrient dosing.

5.1. Hardware Requirements:

- Microcontroller Raspberry pi pico w: Raspberry pi pico is a low-cost, high performance microcontroller board with flexible digital interfaces.
- pH sensor: The overall working of pH sensor and pH meter depends upon the exchange of ions from sample.
- LDR Module employs an LDR sensor component to identify the light intensity . It is equipped with both an analog output pin and a digital output pin.
- Temperature Sensor LM35: The LM35 serves as a temperature apparatus, generating an analog output voltage that corresponds to the temperature detected.
- Water Pump: When the water hits the rotating impeller, energy of the impeller is transferred to the water, forcing the water out (centrifugal force).
- LED Strip: An LED strip light comprises a flexible circuit board embedded with LEDs, offering the flexibility to be affixed to nearly any surface. This allows for the addition of vibrant lighting in various colours and intensities whenever desired.
- BLDC Fan: Operating on a direct-current electricity, A brushless direct current motor. Utilizes permanent magnets instead of the electromagnets typically found in induction motors.
- Transformer: A Step Down Transformer is a versatile main transformer designed for chassis mounting. It features a primary winding rated for 230V and a secondary winding without a center tap.

- Diode IN4001: It allows the flow of current only in one direction, that is from anode terminal to cathode terminal just like a normal diode.
- Voltage Regulator 7805: The voltage regulator IC 7805 is actually a member of the 78xx series of voltage regulator ICs.
- Optoisolator: An opto-isolator alternately known as a optocoupler, photocoupler or an optical isolator, is an electronic device facilitating the transfer of electrical signals between two separate circuits by utilising light.
- Transistor: A transistor, a small scale semi conductor device, manages the flow of current or voltage, amplify signals and serves as a switch/gate for electric signals.
- Relay: A relay function as a electrically controlled switch., featuring input terminals for one or multiple control signals, and as a separate set of operating contact terminals.

5.2. Software Requirements:

- Internet Of Things: The internet of things is a technology used these days to connect things(hardware) and users with the use of the internet.
- VS Code Editor: Visual Studio Code combines the simplicity of a source code editor with powerful developer tooling, like IntelliSense code completion and debugging.
- Thonny: Thonny serves as a no cost Python Integrated Development Environment (IDE) crafted specially with novice python programmers is consideration.
- Apache Server: Apache is the software running on the web server. The first step is for it to establish a connection between the server and web browsers.

5.3. Advantages of system:

- Soil-less agriculture
- Plants can grow all year– both indoors and outdoors.
- It reduces the usage of water.
- Crop yield per region increment due to multilevel farming.
- Plants develop rapidly and natural in nature
- Soil borne bothers are eliminated, which implies decreased needs for pesticides.
- Used in terrace gardening.

## VI. CONCLUSION

The hydroponics system was successfully developed using our own IOT platform and real-time data via the Internet of Things. Hydroponic cultivating has awesome feature in India, hydroponic may be a strategy to developing plants utilizing mineral, nutrient arrangement in water, without soil. In coming long time India truly needs such cultivating strategies it produces higher yields than the conventional soil-based agriculture. Hydroponic plants have a better bother resistance which dispenses with the higher utilize of pesticides. Compare to soil-based agriculture taste of this product is good. The technology automatically controls the level of nutrition and offers a graphical user interface for simple maintenance and control. In this study, data including pH, and temperature have been examined and validated to ensure they fit the criteria for Pak Choi's features. The testing method produced satisfactory findings, and the application is practical, which leads to an increase in production. The integration of IoT cloud technology into hydroponics systems for data monitoring in agriculture has proven to be highly beneficial. By leveraging IoT devices, sensors, and cloud platforms, farmers and agricultural experts can gather real-time data on crucial parameters such as temperature, humidity, pH levels, nutrient levels, and lighting conditions, among others. This data can be analyzed to optimize the growing environment, improve crop yield and quality, and reduce resource wastage.

Data mining techniques and AI will be applied to evaluate and forecast data regarding the amount and quality of the plant as part of a future study that will expand the system to incorporate more beneficial and adaptable linked devices. The IoT cloud for hydroponics system and data monitoring has already revolutionized agriculture by enabling precise control, real-time monitoring, and data-driven decision-making. The future holds even more potential for advancements and innovations in this field, paving the way for sustainable and efficient agriculture practices.

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# Resilient Intrusion Detection System: Safeguarding Networks

**Deepthi N, Manjunath S, Nanditha V, Pallavi R, Teena K B**
Department of Information Science and Engineering, East Point College of Engineering and Technology
Bengaluru, Karnataka, India

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**ABSTRACT**

Resilient intrusion detection systems (IDS) contribute significantly to ensuring safety networks against malicious activities. This abstract explores the key components and strategies employed in designing resilient IDS to mitigate various cyber threats effectively. It delves into the assimilation of various machine learning algorithms are utilized for detecting anomalies. And network traffic analysis to enhance detection accuracy and adaptability to emerging threats. Furthermore, it examines the relevance of incorporating redundancy, diversity, and dynamic reconfiguration mechanisms to ensure the resilience of IDS against evasion tactics and system failures. The abstract also highlights the significance constant monitoring, incorporation of threat intelligence and, collaboration, among Security stakeholders to sustain the effectiveness of resilient IDS in safeguarding network infrastructures.

**Keywords—**Resilient system of detecting intrusions (IDS), Network security, Cyber threats, Evasion tactics.

## I. INTRODUCTION

Where contemporary digital landscape, the protection of networks against cyber threats stands as an indispensable imperative. As the intricacy and frequency of cyber-attacks continue to escalate, the urgency for resilient (IDS) becomes increasingly apparent. Our project is firmly rooted in the creation of such a system, dedicated to fortifying network security comprehensively. The motivation behind our endeavor arises from the glaring limitations of existing intrusion detection mechanisms, often constrained by static methodologies vulnerable to evasion tactics. In response to this pressing challenge, we aim to construct a system of detecting (RIDS) capable of dynamically adapting to emerging threats, thus ensuring a continuous shieldagainst malicious incursions. This introduction sets the stage forour pursuit, emphasizing the critical need to transcend conventional approaches and embrace resilience as a cornerstone principle in safeguarding network integrity.

## II. LITERATURE REVIEW

The paper [1] The rapid of Internet technologies and further dependence on online services increase the demand for keeping these networks and data secure .The protection of online information is becoming even more vital to the national security and economic stability .

Recently, network security has emerged as one of the most concerning subjects in the current research and industry fields. Intrusion Detection System (IDSs) are considered as the backbone for network and data protection. Throughout time, different IDS approaches have been implemented to attain maximum detection accuracy. Machine learning IDS is one of the promising IDS techniques that have been created to detect known unknown attacks. This paper investigates the utilization of diverse machine learning methodologies to deploy Network- based Intrusion Detection System (NIDS). This survey could provide a more robust understanding of the existing techniques and assists intrigued researches to identify research opportunities and investigation more in this direction.

In the paper [2] the rapid development of the Internet and smart device trigger surge in network traffic making its infrastructure more complex and heterogeneous. The predominated usage of mobile phones, wearable devices and autonomous vehicles are examples of distributed networks which generate huge amount of data each day. The computational power of these devices have also seen steady Progression which has created the need to transmit information, store data locally and drive network computations towards edge devices. Intrusion detection system play a significant role in ensuring security and privacy of such devices. Intrusion detection systems using machine learning and deep learning. System have gained great momentum due their achievement of high classification accuracy. However the privacy and security aspects potentially gets jeopardized due to the need of storing and communicating data to centralized server. On the contrary, federated learning (FL) fits in appropriately as a privacy-preserving decentralized learning technique that does not transfer data but trains models locally and transfer the parameters to the centralized server. The present paper aims to present an extensive and exhaustive review an the use of FL in intrusion detection system. In order to establish the need for FL, various types IDS, relevant ML approaches and its associated issues discussed. The paper presents detailed overview of the implementation of FL in various aspects of anomaly detection.

The paper [3], In today's world there is rising need for network attack analysis because of rising cyber threats and attacks worldwide. Network traffic, if monitored dynamically in real- time could prevent a big cyber attack or even alert before. In this paper, UNSW-NB 15 dataset is used on Ensemble method to analyze the network traffic. The major contribution of this paper is the novel Algorithms powered by boosting algorithm to come up with the best classifier from list of classifier. It compares the classifier in terms of accuracy as well as training time which is significant in real-time analysis of network traffic. We performed experiment in which we took 10 classifiers and our proposed algorithm came up with XGB training time combined. We have demonstrated the comparison between running time of experiment on Central Processing Unit (CPU) and Graphics Processing Unit (GPU).The paper [4], this paper considers the problem of robustly identifying m intruders in a network consisting of n cooperative agents which are subject to unknown disturbances. First, a distributed system model is introduced so that the relationship between agents, the attacks and unknown disturbances can be captured. Next, the distributed identification scheme is formulated as a spectral assignment problem and necessary filter gains are obtained through a carefully constructed linear system equation. The paper [5], Convolutional Neural Networks (ConvNets) are renowned for their ability to generalize input data effectively, making them invaluable in various domains, particularly in tasks like visual imagery where ample training data is available. In the realm of network intrusion detection, ConvNets have shown promise, albeit with a unique approach. Unlike traditional usage, our model comprises two concatenated ConvNets and employs a two-stage learning process: first, it learns from a base dataset and then transfers this knowledge to the target dataset.

## III.PROPOSED SYSTEM

The proposed system aims to address the limitations of existing intrusion detection systems (IDS) by developing a Robust Network Intrusion Detection System (RNIDS) using advanced machine learning models and techniques. The RNIDS will leverage the capabilities of machine learning algorithms to enhance detection accuracy, adaptability, and resilience against evolving cyber threats. The key components and features of the proposed system include:

**Machine Learning Models:** The RNIDS will utilize state-of- the-art machine learning models, such as Artificial Neural Networks (ANNs), Convolutional Neural Networks (CNNs), and Recurrent Neural Networks (RNNs), for intrusion detection. These models are well-suited for learning complex patterns and anomalies in network traffic data, enabling the system to effectively distinguish between normal and malicious activities.

**Feature Engineering:** Feature engineering plays a crucial role in the performance of machine learning models. The proposed system will employ advanced feature extraction techniques to capture relevant information from raw network traffic data. This includes extracting packet-level features, flow-based features, and protocol-specific attributes to provide comprehensive insights into network behavior.

**Anomaly Detection:** The RNIDS will focus on anomaly detection, aiming to identify deviations from normal network behavior that may indicate potential security threats. By training the machine learning models on labeled datasets containing both normal and anomalous traffic samples, the system can learn to recognize and classify suspicious activities in real-time.

**Threat Intelligence Integration:** Integrating threat intelligence feeds drawing from external sources will enhance the detection capabilities of the RNIDS. By leveraging up-to-date information on known threats, vulnerabilities, and attack patterns, the system can proactively identify and mitigate emerging security risks.

**Adversarial Robustness:** To mitigate the risk of adversarial attacks, the proposed system will incorporate techniques for adversarial robustness. This includes implementing defense mechanisms to detect and mitigate adversarial inputs designed to evade detection by the RNIDS.

**Scalability and Efficiency:** The RNIDS will be designed with scalability and efficiency in mind to handle large volumes of network traffic in real-time. This includes optimizing the computational resources and processing capabilities required for training and deploying machine learning models in production environments.

By integrating these components and features, the proposed Robust Network Intrusion Detection System (RNIDS) aims to provide organizations with a robust and resilient defense against a wide range of cyber threats, thereby enhancing the overall security posture of their network infrastructures.

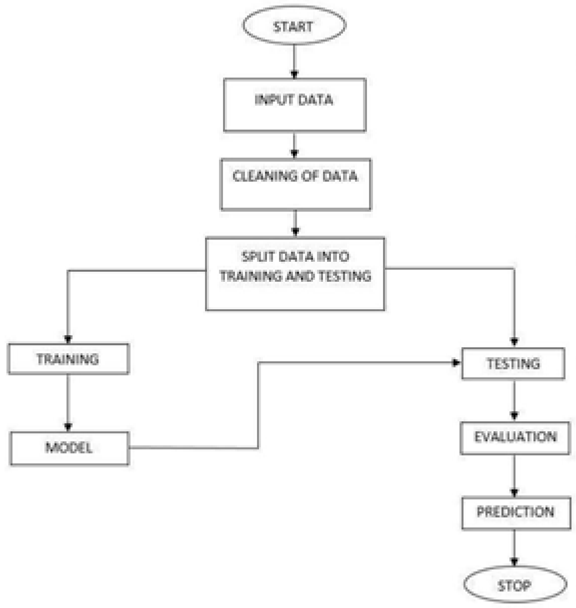



**Fig1:** Workflow of Proposed system

**Cleaning of Data:** Data Cleaning, called as data cleansing or data scrubbing, represents the process of identifying and correcting errors, and inaccuracies in a dataset. It's a crucial step in preparing data for analysis, ensuring is accuracy and reliability.

**Segmenting data into training and testing:** Subsets constitutes a fundamental step in the machine learning modeling pipeline. This pivotal procedure entails partitioning the dataset into distinct segments, enabling the model to undergo trainingon one subset while gauging its efficacy on a separate, unseen subset.

**Training:** Machine learning involves teaching a model to make predictions or decisions based on input data. The process essentially consists of presenting the model with the data, allowing it to learn patterns and relationships within that data, and adjusting its internal parameters to improve its performance.

**Model:** A model, in the realm of data science, refers to mathematical or computational representation of patterns and relationships within data. Models are constructed using algorithms and trained on datasets to make predictions, classify data, or uncover insights.

**Testing:** "Testing" represents the pivotal stage where the effectiveness of a trained model is scrutinized by subjecting it to unseen data. This critical phase functions as a litmus test, determining the model's capacity to extrapolate its predictions or classifications accurately onto novel instances that were not part of the training dataset.

**Evaluation:** In the realm of machine learning and data analysis, evaluation entails the comprehensive examination of a model's performance and efficacy. This pivotal stage is indispensable for gaining insights into the model's proficiency in accomplishing its designated task.

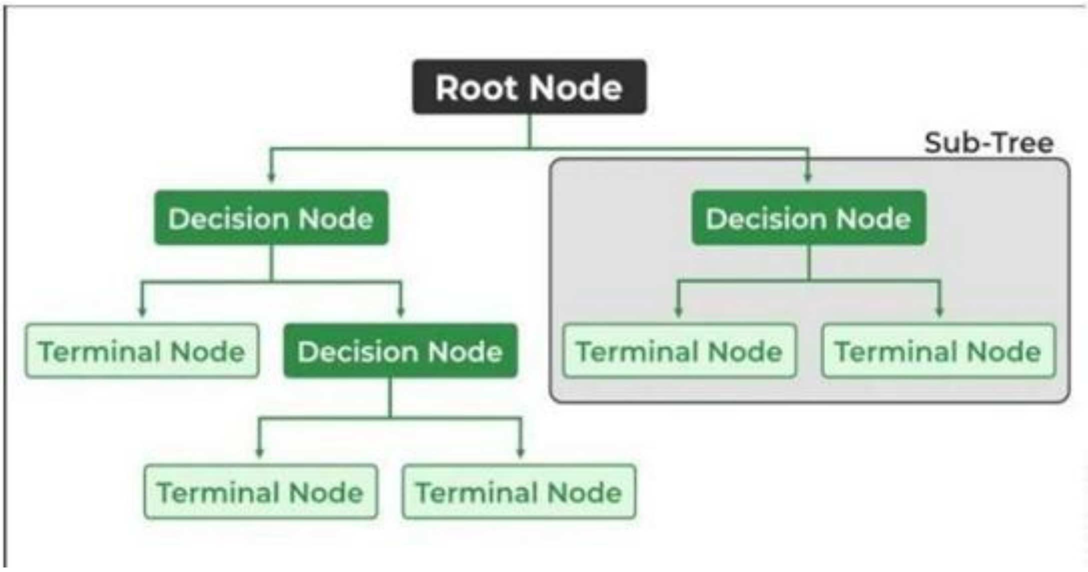
**Prediction:** "Prediction" encapsulates the action of leveraging a trained model to anticipate or approximate an outcome by analyzing fresh or unobserved data. Models honed on historical or annotated datasets possess the capability to make projections concerning forthcoming or unidentified instances.

**Stop:** represents an endpoint or termination point within the process. It signifies the conclusion or end of a specific process step or the workflow as a whole.

## IV. MACHINE LEARNING BASED APPROACH

**Decision Tree:**

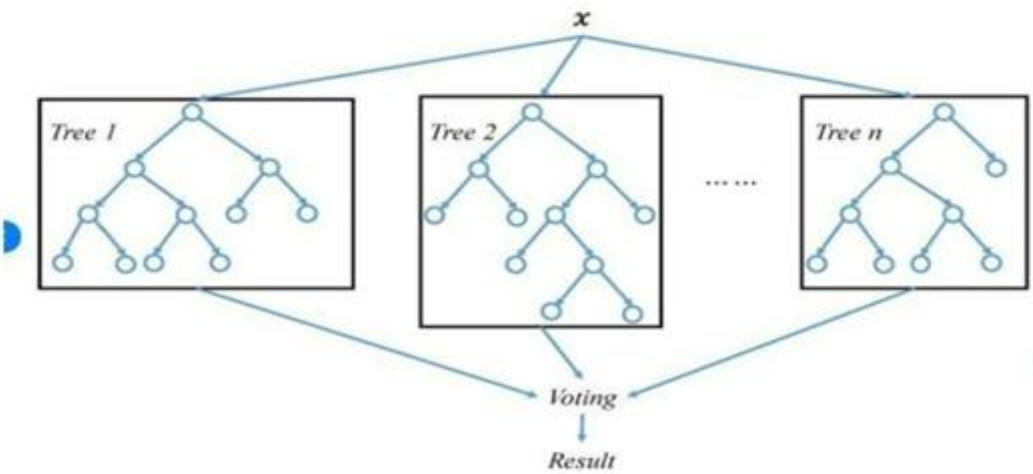
A decision tree in machine learning is like a roadmap that guides decisions based on a series of questions. It starts with a broad question at the top (the root) and branches out into morespecific questions (branches) based on the answers. Eachbranch eventually leads to a decision (a leaf) or outcome.A decision tree is drawn upside down with its root at the top. Inthe image on the left, the bold text in black represents acondition/internal node, based on which the tree splits into branches/ edges. The end of the branch that doesn't split anymore is the decision/leaf, in this case, whether the passenger died or survived, represented as red and green text respectively.




**Random Forest:**

Random Forest is a powerful machine learning technique that operates by creating a multitude of decision trees during training. Each tree is trained independently on a subset of the data, using a random selection of features. This process is known as ensemble learning, where the predictions from many individual models (in this case, decision trees) are combined to improve accuracy and generalizability.

During training, Random Forest builds a collection of decision trees that are diverse yet collectively strong. Each tree learns to make predictions based on different aspects of the data due to the random subset of features it considers at each node.

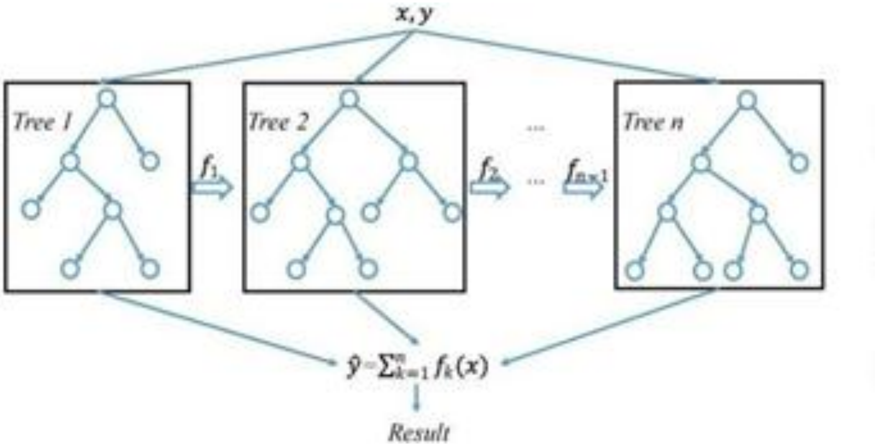


**XGBoost:**

GBoost, short for Extreme Gradient Boosting, is a powerful and efficient machine learning algorithm known for its performance and accuracy in predictive modeling tasks. It belongs to the family of gradient boosting algorithms, which work by sequentially adding models (typically decision trees) to an ensemble, each one correcting errors made by its predecessors.

XGBoost begins by building an initial decision tree model and calculates the errors or residuals from its predictions. It then constructs a new tree that focuses on reducing these errors.

Unlike traditional gradient boosting methods, XGBoost optimizes this process through parallelization and regularization techniques, which enhance computational efficiency and prevent overfitting.

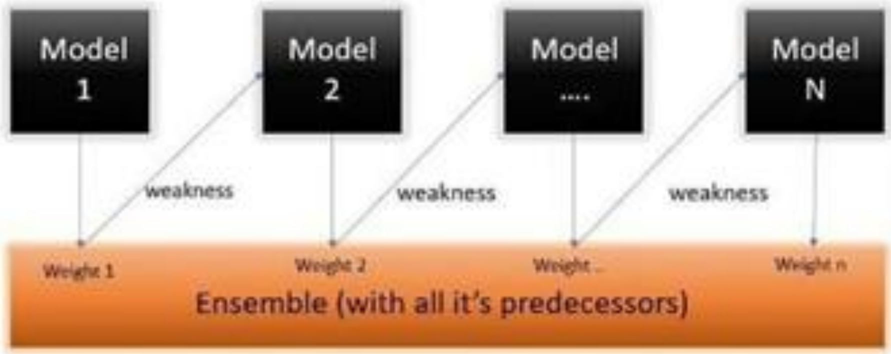



**ADABOOST:**

A Boost, short for Adaptive Boosting, is a popular ensemble learning algorithm that combines the predictions of multiple weak learners (typically shallow decision trees or stumps) to create a strong learner.

Here's how AdaBoost works in a narrative form:

Imagine you're preparing for an exam with multiple subjects. You start by focusing on your weakest subject, studying intensely to improve your performance. Except for the first, each subsequent learner is grown from previously grown learners. In simple words, weak learners are converted into strong ones. The AdaBoost algorithm works on the same principle as boosting with a slight difference.



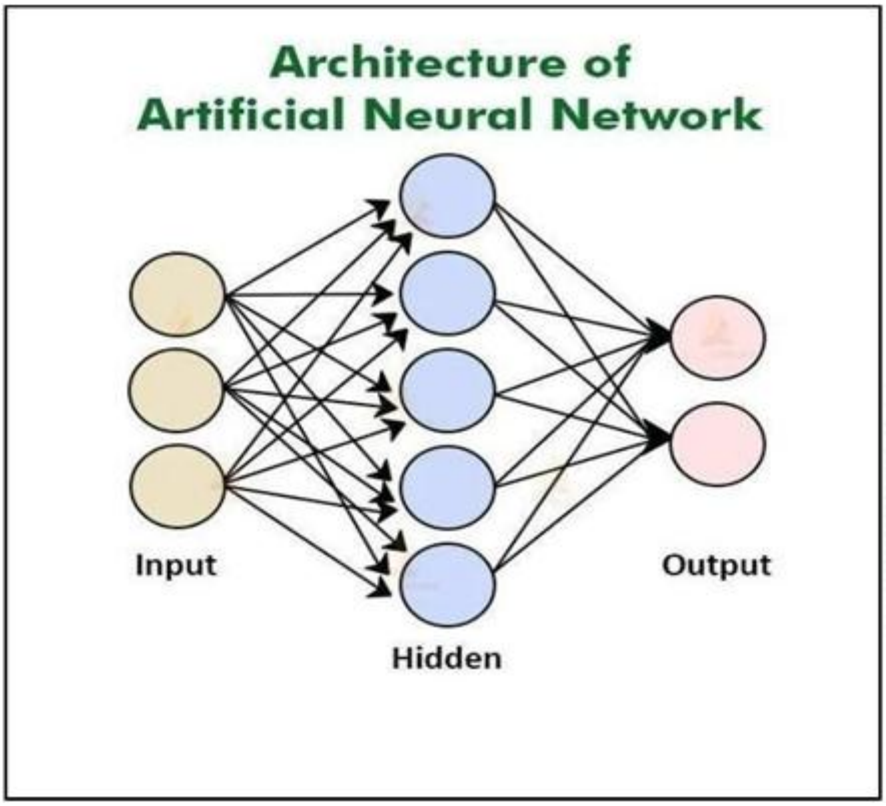

**ANN:**

An artificial neural network (ANN) is a computational model inspired by the human brain's neural networks. It consists of interconnected nodes, or neurons, organized into layers: input, hidden, and output layers. These layers work together to process input data, learn patterns, and produce outputs.

Imagine each neuron as a small processing unit that receives input signals, processes them using a weighted function that reflects the strength of connections, and passes the output to the next layer of neurons. This process mimics how neurons in the brain transmit and process information through synapses.

**CNN :**

In case some certain orientation edges are present then only some individual neuronal cells get fired inside the brain such as some neurons responds as and when they get exposed to the vertical edges, however some responds when they are shown to horizontal or diagonal edges, which is nothing but the motivation behind Convolutional Neural Networks.




## V. IMPLEMENTATION

**Dataset:**

For training and testing the intrusion detection system,we require a comprehensive dataset containing network traffic data. The dataset should include labeled examples of normal and anomalous network activities, allowing the model to learn to distinguish between them. Commonly used datasets for intrusion detection research include the NSL- KDD dataset, the UNSW-NB15 dataset, and the CICIDS 2017 dataset.

**Model:**

Various machine learning models can be employed for intrusion detection, including supervised, unsupervised, and deep learning models. Commonly used supervised models include Random Forests, Support Vector Machines (SVM), and Gradient Boosting Machines (GBM). Unsupervised models like K-means clustering and Isolation Forest can also be effective for anomaly detection. Deep learning models such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) are gaining popularity for their ability to learn complex patterns from raw data.

**Testing:**

Once the model is trained on the dataset, it needs to be evaluated to assess its performance. This involves splitting the dataset into training and testing sets, typically using a ratio like 70/30 or 80/20. The model is trained on the training set and then evaluated on the testing set to measure its accuracy, precision, recall, and other performance metrics.

Cross-validation techniques like k-fold cross-validation can also be used to ensure robustness of the model's performance.

**Prediction:**

After the model has been trained and evaluated, it can be used to make predictions on new, unseen data. In the context of intrusion detection, the model predicts whether incoming network traffic is benign or malicious. Predictions can be made in real-time as network traffic is analyzed, allowing for immediate detection and response to potential threats. False positives and false negatives should be minimized to ensure accurate predictions and reduce the risk of overlookingagenuine threats or inundating security teams with non-threatening alerts.

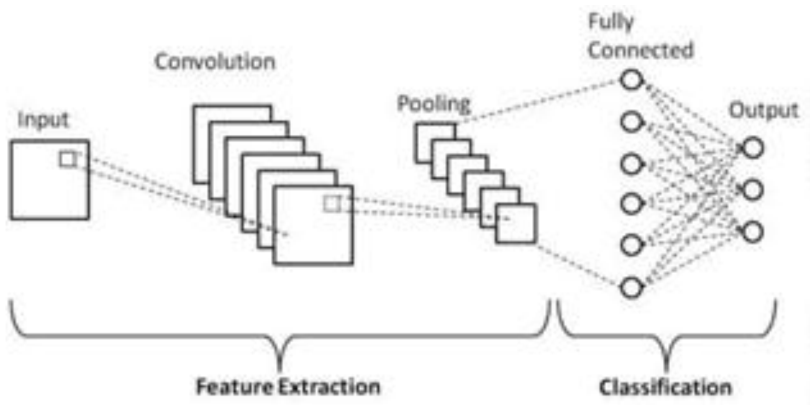
## VI. RESULTS

| Dataset | Algorithm | Accuracy |
|---|---|---|
| Dataset | Ada Boost | 0.99985 |
| ISCX2012 | ANN | 0.56669 |
| | Decision Tree | 0.99982 |
| | Random Forest | 0.99983 |
| | XG Boost | 0.99480 |
| | CNN | 0.98790 |

**Table1.** Accuracy Rate The Highest Accuracy rate is 0.99985.

By leveraging AdaBoost in IDS, you can achieve high accuracy in detecting various types of network intrusions while minimizing false positives.

The Convolutional Neural Networks, which are also called as converts, are nothing but neural networks, sharing their parameters. Suppose that there is an image, which is embodied as a cuboid, such that it encompasses length, width, and height.



## VII.CONCLUSION

This project embarks on the development of a sophisticated yet user-friendly application, christened "Robust Network Intrusion Detection," with a pivotal focus on leveraging diverse machine learning techniques. These encompass Decision Trees, Random Forests, XGBoost, AdaBoost, as well as Artificial Neural Networks (ANN) and Convolutional Neural Networks (CNN). The core objective revolves around the meticulous identification and classification of network activity, discerning between the benign "Normal" and potentially harmful "Attack" categories. By harnessing the collective power of these varied methodologies, the application seeks to wield the most effective tools available in the realm of intrusion detection.

A central tenet of the project lies in the employment of ensemble learning approaches, which facilitate the amalgamation of strengths inherent in multiple machine learning models. Techniques such as Decision Trees, Random Forests, XGBoost, and AdaBoost converge to form a robust framework, capable of delivering heightened detection accuracy and resilience in the face of diverse cyber threats.

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# Unveiling Expertly Orchestrated Malfeasance via Metric Learning within Recommender Systems

**Ananya P Raj, J Yamini, Minchitha V, Vaishnavi B S, Prof. Teena K B**
Department of Information Science and Engineering, East point College of Engineering and Technology, Karnataka, India

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ABSTRACT

Online retailers encounter an ongoing threat from Professional Malicious Users (PMUs), who deliberately submitnegative reviews and low ratings for purchased items,aiming to coerce retailers into illegitimate gains. Detecting PMUs presents challenges due to their adept use of masking techniques to appear as genuine users. Three primary obstacles impede PMU detection: PMUs avoid overtly suspicious actions, refrain from leaving excessive negative reviews or low ratings simultaneously, employ sophisticated strategies to conceal their behavior, and traditional outlier detection methods struggle to identify them due to their masking tactics. Consequently, innovative approaches such as unsupervised learning, metric learning, and refining recommender systems are crucial to effectively identify and mitigate PMUs in the online retail landscape.

## I. INTRODUCTION

In the realm of e-commerce, titans like Amazon, Jingdong, and Alibaba have thrived in the digital era, facilitating millions of daily transactions between retailers and consumers. Despite the convenience they offer, e-commerce platforms are susceptible to exploitation by malicious users who manipulate the review and rating systems for personal gain. To counteract such exploitation, e-commerce entities employ statistical outlier detection or shilling attack detection models. However, these models often fall short, particularly in identifying professional malicious users who employ sophisticated masking strategies to evade detection. These tactics, such as leaving high ratings paired with negative reviews or vice versa, pose challenges for existing detection mechanisms, which may only consider one aspect at a time. To effectively address this issue, it is imperative to develop detection methods that account for both ratings and reviews. By comprehensively understanding and countering the tactics utilized by professional malicious users, e-commerce platforms can safeguard the credibility of their review systems and uphold fairness in the marketplace. This paper provides valuable insights into this critical area of research. By leveraging metric learning techniques, the paper explores how e-commerce platforms can enhance their ability to detect orchestrated malfeasance within recommender systems, thereby reinforcing the integrity of the online marketplace.

## II. LITERATURE REVIEW

In recent years, deep neural networks have achieved notable progress in areas such as speech recognition, computer vision, and natural language processing. Despite this, their use in recommender systems remains relatively underexplored. In our study, we aim to fill this gap by developing a neural network- based approach to collaborative recommendation filtering, focusing on implicit feedback. While some recent research has utilized deep learning in recommendation systems, it has often been limited to modelling additional data like textual descriptions or acoustic features. Despite this, the core elements of collaborative filtering, particularly the interactions between user and item features, still rely heavily on matrix factorization techniques. To address this limitation, we introduce NCF (Neural Collaborative Filtering), a versatile framework that replaces traditional dot products with a neural architecture capable of learning arbitrary functions from data. NCF allows for the expression and generalization of matrix factorization within its framework, making it applicable to various scenarios [1]. The susceptibility of the system to profile injection attacks poses a significant threat, where malicious users manipulate the scoring matrix to alter system rankings. Both individuals and groups can exploit recommendation systems through shilling attacks. However, previous studies have primarily focused on discerning differences between real and attack profiles, neglecting group characteristics within the attack profiles.

Supervised detection methods also grapple with class imbalance issues, particularly when the number of attack profile samples in the training set is limited, resulting in subpar detection performance. To address these challenges, we propose an SVM- based method that incorporates group characteristics into attack profiling. our two-phase detection approach, SVM-TIA, integrates these concepts. In the initial phase, we employ the borderline SMOTE technique to mitigate class imbalance, yielding preliminary detection outcomes. The subsequent fine- tuning phase analyses specific elements within potential attack profiles to refine detection accuracy. We evaluated the SVM- TIA method using the Movie Lens 100K dataset and compared its performance against alternative shilling detection methods. Our findings underscore the efficacy of SVM-TIA in mitigating shilling attacks, highlighting the importance of considering group characteristics and employing robust detection strategies in safeguarding recommendation systems [2]. "Electronic Commerce: 13E" offers a comprehensive introduction to the world of electronic commerce, presenting fundamental concepts alongside the latest empirical data. The book aims to equip readers with insights into the evolving landscape of e-commerce, which has transformed business practices and become a driving force in the global economy.

With a focus on financial data, the book delves into key topics such as privacy, piracy, government surveillance, cyberwarfare, and various marketing strategies including social, local, and mobile marketing. It provides timely coverage of the most pressing issues in contemporary e-commerce, ensuring readers are well-informed about the challenges and opportunities in this dynamic field. Utilizing the latest available data, the book spotlights prominent companies like Facebook, Google, Twitter, Amazon, YouTube, Pinterest, eBay, Uber, WhatsApp, and Snapchat, which are integral to daily life for many individuals. Additionally, it introduces readers to exciting startups that may be unfamiliar but hold promising potential in the e-commerce landscape [3].

## III.PROPOSED METHOD

Various machine learning models have been developed to classify the presence of malicious users. In this scenario, we recommend using random forest and decision tree classifiers to predict user behavior. These models utilize ensemble learning techniques to improve classification accuracy and robustness. Improved recognition accuracy: Metric learning techniques allow systems to more accurately and granularly represent user behavior. This helps distinguish the subtle differences between a regular malicious user and a professional malicious user, even if the latter uses masking strategies. Learning the metric space based on user interactions and preferences allows the system to more effectively identify anomalies, improving PMU detection accuracy.

Dealing with non-obvious anomalies: Addressing non-obvious anomalies poses a challenge for traditional outlier detection methods, particularly in identifying Professional Malicious Users (PMUs). Unlike typical rule violations or a high volume of negative reviews, PMUs exhibit subtle behaviors that evade detection. Metric learning offers a solution by enabling the system to uncover hidden patterns and anomalies that may not be apparent with rule-based or threshold-based approaches. By learning a metric space, the system can effectively capture the nuanced disguises and behavior of PMUs, enhancing the detection of malicious activities within the system.

Adaptability to evolving strategies: The metric can adapt to his PMU strategy as it evolves over time. As the PMU changes its masking techniques and behavior, the metrics can continually update its understanding of what constitutes "normal" user behavior. This adaptability makes it difficult for PMUs to evade detection, as the system can learn and evolve along with the malicious user.

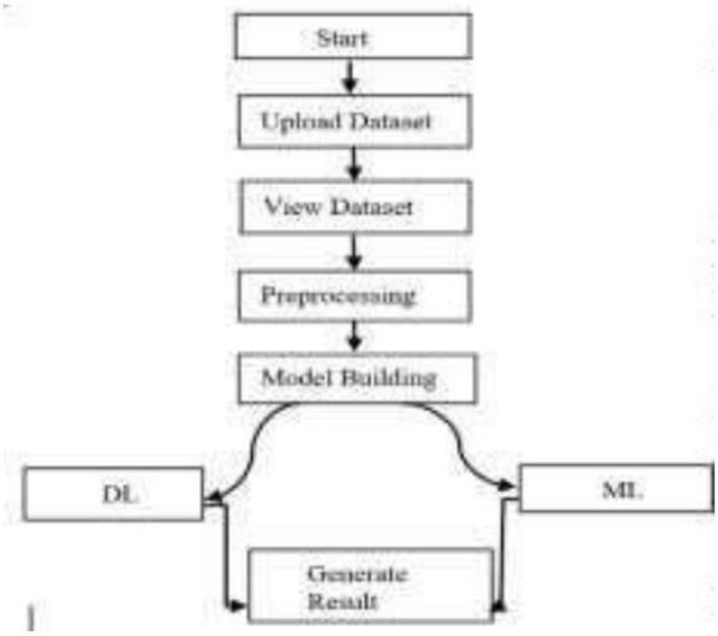


**Fig.1.** Proposed Method

Figure 1 shows the proposed method for uploading and displaying the dataset, preprocessing to improve accuracy, and model building.

The system first checks for data availability and then proceeds to load the data into its CSV file for further processing.

To enhance model accuracy and gain deeper insights into the dataset, preprocessing steps are applied according to the requirements of the model.

A model is developed to predict personality more accurately, which in turn assists users in various tasks.

The dataset is divided into two parts: Deep Learning (DL) and Machine Learning (ML).
This section is dedicated to tasks such as image recognition, speech recognition, and natural language processing, all of which utilize deep learning techniques. The focus here is on activities like modeling, clustering, and other machine learning algorithms.
The system generates a user's score as a percentage based on their interaction with the data. A machine learning algorithm is trained to predict acceptance levels, providing valuable insights and recommendations based on the generated results.

## IV. MACHINE LEARNING BASED APPROACH

The paper introduces a novel machine learning-based strategy aimed at identifying professional malicious users within recommended systems through the utilization of metric learning techniques. By framing the issue as a metric learning task, the approach endeavors to capture intricate patterns in user behaviour that delineate between legitimate and malicious activities. Data procurement from the recommended system, encompassing user interactions and preferences, is followed by feature engineering to depict user behavior accurately. Subsequently, through the training of a machine learning model, such as a metric learning algorithm, on this dataset, the system acquires a distance metric encapsulating the nuances in user behavior. Evaluation of the model's performance using suitable metrics facilitates gauging its effectiveness in precisely identifying professional malicious users while minimizing erroneous classifications. Integration of the trained model into the recommended system fosters real-time detection and mitigation of malicious behavior, thereby fostering a more secure and dependable user experience.
This contribution to the recommended systems domain presents a pioneering approach to addressing the challenge posed by professional malicious users. The focus on metric learning provides a sophisticated mechanism for discerning subtle disparities in user behavior indicative of malicious intent. The paper's methodological framework, spanning data collection, model training, and integration, offers a comprehensive blueprint for constructing robust detection systems within recommended platforms. Moreover, the paper underscores the significance of evaluation metrics and continual monitoring in ensuring the adaptability and efficacy of the deployed system in real-world scenarios.

**4.1. Decision Tree:** The initial node, known as the root node, initiates the decision-making process. Through recursive partitioning, the tree is split based on attribute values, facilitating a hierarchical organization of data. This visual representation aids in decision-making by emulating human- like thinking processes.

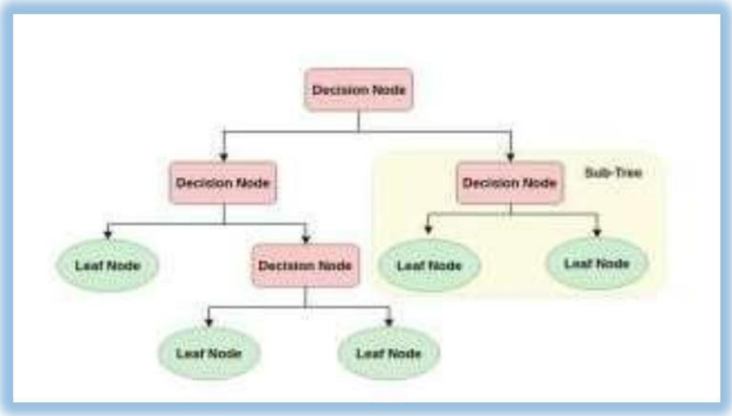


**Fig.2.**Decision Tree

4.2. **Random Forest Classifier:** The Random Forest Classifier is a robust machine learning method that tackles intricate issues by integrating numerous decision trees. It determines the final result by combining the predictions from each tree. This algorithm mitigates the drawbacks of decision trees, such as overfitting, and improves overall accuracy.

4.3. **Convolutional Neural Network (CNN):** The Convolutional Neural Network (CNN) architecture is a deep learning model tailored for image processing. It consists of several layers: convolutional, pooling, and fully connected layers. Convolutional layers utilize filters to extract features from input images. Pooling layers decrease the spatial dimensions while retaining essential features. Fully connected layers combine the extracted features for tasks such as classification or regression. CNNs are extensively used in computer vision for applications like object detection and image classification.

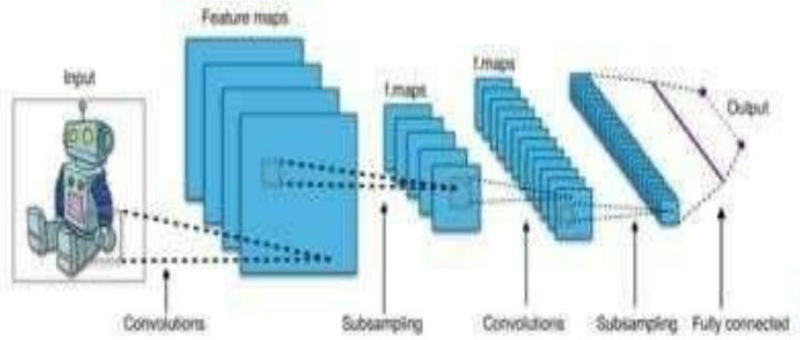


**Fig.3.** Architecture of CNN

4.4. **Recurrent Neural Network (RNN):** These sophisticated deep learning models, representing a class of artificial neural networks, are specifically designed to handle sequential or time-series data. They are used in various sequential or temporal tasks such as language translation, natural language processing, speech recognition, and image captioning. These models are seamlessly integrated into popular applications like Siri, voice search, and Google Translate.

## V. IMPLEMENTATION

**Dataset:** The dataset is collected and pre-processed before being fed into the system. Pre-processing involves tasks like normalization and cleaning. Typically, the dataset is split into training and testing sets to ensure robust model evaluation.

**Model:** The system comprises multiple components including data ingestion, processing, model training, evaluation, and prediction. Training involves feeding the training data into machine learning models to enable pattern learning.

**Testing:** Once the model is trained, it is evaluated using the testing dataset to measure its performance. Testing assesses the accuracy of the model's predictions.

**Prediction:** After testing, the trained model is deployed to make predictions on new, unseen data. Input data is fed into the model, which outputs predicted values or labels. The system architecture facilitates the seamless flow from pre- processing through training and testing to deployment for prediction, ensuring the efficiency and effectiveness of the machine learning process.

**Home Page:** Users can access the home page of the Maslay Application to navigate through the platform.

**About Page:** Users can learn more about the platform through the about page, gaining insights into its purpose and functionality.

**Load Page:** This page enables users to load the dataset for modelling, facilitating data input and preparation.

**Input Model:** Users are required to provide input values for certain fields to obtain results, enabling interaction with the system for obtaining tailored outputs.

## VI. RESULTS

The framework for malicious account detection begins with input from Online Social Networks (OSNs), often requiring preprocessing to handle real-world data complexities. Techniques like Latent Dirichlet Allocation may be used for topic modeling, and filtering out accounts with few social connections can mitigate data sparsity. Preprocessed data undergoes detection, yielding class assignments (e.g., bots vs. humans, spammers vs. legitimate users) and associated probability ranks.

| Algorithm Used | Accuracy Obtained |
|---|---|
| Decision Tree | 99.459 |
| Random Forest | 99.913 |
| CNN | 79.102 |
| RNN | 27.990 |

**Table.1.** Accuracy Table

The below figure is used to find weather the user is non malicious by entering the values for non-malicious user.


**Fig.4.** Detecting Non-Malicious Users

This below figure is used to predict the result of the data that weather the user is malicious user.


**Fig.5.** Detecting Malicious Users

## VII.CONCLUSION

The presented research delves into critical challenges surrounding the detection of professional malicious users (PMUs) in online recommendation systems. These individuals exploit feedback mechanisms by deliberately leaving deceptive negative reviews and low ratings to manipulate online retailers. Identifying shortcomings in conventional outlier detection methods, the study proposes an innovative approach leveraging metric learning. A comprehensive literature review provides valuable insights into related studies, including collaborative filtering models, biometrics for e-commerce transactions, and shilling attack analysis in recommender systems. These studies contribute to a deeper understanding of various aspects of e-commerce, security, and recommendation systems.

The proposed system aims to address limitations of existing outlier detection models by employing metric learning techniques.

It advocates for the utilization of random forests and decision tree classifiers to enhance detection accuracy, address subtle anomalies, and adapt to the evolving tactics of PMUs.

The system specification outlines the necessary hardware and software components for implementation, while system analysis elucidates architectures, modules, and workflows, emphasizing the importance of data preprocessing, training, and modeling.

The overarching goal of the research project is to bolster the fairness and trustworthiness of e-commerce platforms by effectively identifying and mitigating the impact of PMUs. The proposed metric learning approach, in conjunction with random forest and decision tree classifiers, aims to enhance accuracy, adaptability, and scalability in detecting professional malicious users. Furthermore, the research scope encompasses real-world datasets from platforms such as Amazon, Yelp, and Taobao, enhancing its practical relevance in combating orchestrated malfeasance in recommender systems.

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# Multiple Disease Prediction System Using Machine Learning

**Prof. Sindhuja M, Santosh Kumar Peri, Ram Muni Reddy, Subramanya M, Manohar Reddy**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Bengaluru, Karnataka, India

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ABSTRACT

Machine learning techniques have revolutionized the field of healthcare by enabling accurate and timely disease prediction. The ability to predict multiple diseases simultaneously can significantly improve early diagnosis and treatment, leading to better patient outcomes and reduced healthcare costs. The insights from three research papers on the predictive capabilities of machine learning algorithms for multi-disease diagnosis explore Support Vector Machines (SVMs), Decision Trees, and Naive Bayes classifiers in forecasting heart disease, diabetes, and Parkinson's disease. Notably, SVMs achieve 98.8% accuracy, while Decision Trees excel in diabetic heart disease prediction (90% accuracy). Naive Bayes models outperform benchmarks, achieving 91.2% accuracy. Key findings highlight the importance of data preprocessing techniques for enhancing predictive performance. These results underscore machine learning's potential in automating and improving disease diagnosis and treatment selection in healthcare. Machine learning algorithms show immense potential in accurately predicting multiple diseases, enabling timely diagnosis and treatment. This project developed and evaluated models for multi-disease prediction on a healthcare dataset. The data containing patient symptoms, medical history, and test results was pre-processed and used to train Support Vector Machine (SVM), Naive Bayes, Decision Tree, and Random Forest models. Hyperparameter tuning was done to optimize model performance.

## I. INTRODUCTION

Machine learning is an area of artificial intelligence that works towards the development of algorithms which can learn from the data to predict or make decisions with no explicit instructions. Machine-learning algorithms can detect patterns, trends and correlations that enable them to make accurate predictions or choices in different areas based on the analysis of massive amounts of data.

In the area of medicine, accurate and timely diagnosis of the disease is essential for the effective management and treatment of the disease. However, due to a number of symptoms and factors involved, the diagnostic process for diseases such as chronic or complex disease can be difficult. The growing interest in using machine learning techniques to predict and diagnose diseases has led to an increased adoption of this approach. Machine learning algorithms are capable of analyzing a large amount of patient data, identifying complex patterns and making accurate forecasts.

Among the various machine learning models explored, Naive Bayesian networks, Support Vector Machines (SVMs), and Decision Trees have shown promising results in predicting multiple diseases simultaneously. These models can estimate the probability of an individual developing a specific disease or set of diseases by combining patients' symptoms, medical history and test results.

Simultaneous prediction of several diseases can greatly expedite the diagnostic process, eliminate the requirement for unnecessary testing, and facilitate early interventions, all of which may improve patient outcomes and lower healthcare costs. By using machine learning algorithms, exploratory data processing techniques, optimization of model parameters and evaluation of their performance on diverse patient datasets, this research area aims at the development of reliable and precise Multiphasic Disease Prediction Systems.

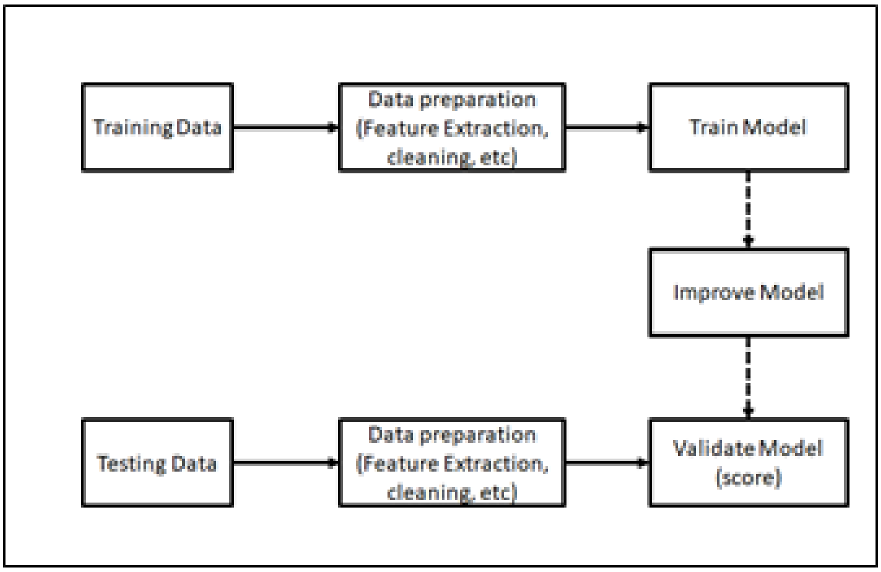


**Fig.1.** Basic idea about Multiple disease prediction system.

## II. LITERATURE REVIEW

K. Arumugam et al. [1] and colleagues suggested that the use of Machine Learning algorithms to predict multiple diseases, with a particular focus on heart disease in patients with diabetes, should be implemented. In order to improve disease diagnosis, prediction, prevention as well as treatment, it emphasizes the important role of data mining and machine learning techniques in health care. The study presents a methodology for classifying patient data from the Cleveland heart disease dataset using three popular machine learning algorithms: Support Vector Machine (SVM), Naive Bayes, and Decision Tree. Data preprocessing is conducted to eliminate noise and ensure data consistency before applying these algorithms for classification. Subsequently, the classified data is utilized as training data for predictive purposes. After constant fine-tuning of decision tree model the researchers highlight the superiority of the Decision Tree model over Naive Bayes and SVM models in predicting heart disease likelihood among diabetic patients.

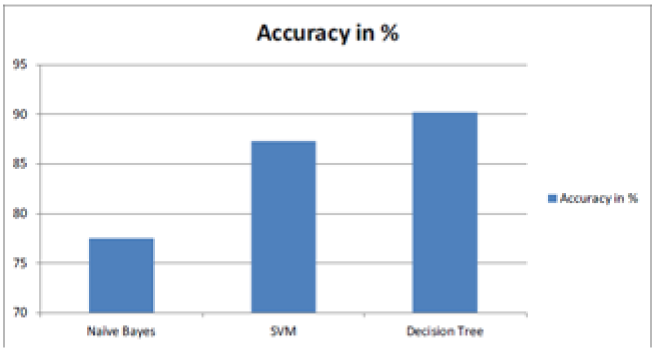


**Fig.2.** Accuracy Results of Classification Algorithm.

Visumathi et al. [2] proposed a multi-disease prediction system employing Naive Bayesian networks, aimed at furnishing medical practitioners with a robust tool for simultaneously predicting multiple diseases based on patient symptoms and medical history. The methodology entails training the Naive Bayesian network algorithm on a comprehensive patient dataset comprising demographic information, symptoms, medical history, and diagnostic results. Through meticulous data preprocessing, including cleaning, normalization, and feature selection, the algorithm will estimate the likelihood of each disease given the presented symptoms and medical history, assuming conditional independence among features. Evaluation on a public disease dataset demonstrates the system's remarkable accuracy of 91.2%, surpassing benchmarks like Random Forest and Decision Trees. The paper sets out future directions, including the use of advanced machine learning techniques such as deep learning and dataset expansion, in order to highlight benefits such as simultaneous prediction of multiple diseases, scalability and improved healthcare delivery. Overall, the study underscores the efficacy of Naive Bayesian networks in multi-disease prediction and its potential to revolutionize healthcare delivery.

Parshant et al. [3] proposed the application of machine learning techniques, specifically the Support Vector Machines (SVM) model, for predicting multiple diseases simultaneously, with a focus on heart disease, diabetes, and Parkinson's disease. The goal of this effort is to take advantage of machine learning's capacity to evaluate large quantities of data and spot intricate patterns in order to accurately and promptly anticipate disease, which may improve patient outcomes and save healthcare expenses. The SVM model was trained using a large dataset that included pertinent clinical, biomarker, and demographic data for each of the three target disorders. The SVM method seeks to maximize the margin between distinct classes in the data by identifying the best hyperplane to divide them. Using evaluation measures including accuracy, precision, recall, and F1 score, the researchers evaluated the SVM model's performance with other machine learning techniques, like k-nearest neighbours (KNN) and random forest.

The SVM model predicted the three diseases with a high accuracy of 98.8%. The specifics of the implementation are also given, together with how to handle and filter data using libraries such as pandas, choose and compare models, train and fine-tune SVM models, evaluate models, and export trained models for later use. For practical application, the trained SVM model can be included into a system or application, allowing researchers, individuals, or healthcare providers to get disease predictions based on input data. The potential of machine learning for revolutionizing disease prediction and improving patient outcomes is highlighted in this paper. Precise forecasting of illness can help with early interventions, customized treatment regimens, and focused disease control tactics, which can eventually improve patient outcomes and allocate resources more effectively in healthcare systems. The growing body of research in machine learning based disease prediction and the importance of feature selection, model optimization or comparative analysis is also highlighted by a literature review conducted as part of this paper.

**TABLE I.**ACCURACY TABLE

| Techniques | Accuracy |
|---|---|
| SVM | 86.50 |
| KNN | 88.00 |
| ANN | 90.53 |
| RF | 91.06 |
| DT | 95.10 |

Mana Saleh Al Reshan et al. [4] proposed several existing studies, using different data mining techniques, machine learning methods, and neural networks to develop cardiovascular disease prediction systems. Tarawneh and Embark [5] designed a heart disease prediction mechanism based on a hybrid approach utilizing data mining techniques. Nalluri et al. [6] presented chronic heart disease prediction employing data mining methods like XGBoost and logistic regression algorithms. Traditional machine learning models, such as support vector machines (SVM), decision trees, k- nearest neighbors, naive bayes, etc., have been used in a number of studies to diagnose and predict cardiac disease. Several investigations have looked into hybrid and ensemble machine learning methods to enhance prediction accuracy. Almazroi et al. [7] employed a deep learning-based artificial neural network model and contrasted it with machine learning methods, the deep learning method demonstrated superior accuracy. For the purpose of predicting cardiac disease, Mohan et al. [8] and Rani et al. [9] created hybrid models that combined feature selection with machine learning techniques like random forest. For this objective, some research have combined machine learning models with optimization approaches like as lion optimization or genetic algorithms [10].

The authors point out that while several machine learning approaches have proven effective in predicting cardiac disease, their suggested method is motivated by the possibility of improving accuracy even further by utilizing deep learning and hybrid deep neural network designs. The original contribution of this work is that, according to the current state of research, deep learning models such as ANNs, LSTMs, CNNs, and hybrid CNN-LSTMs have not been particularly employed for heart disease prediction in previous studies.

## III.MACHINE LEARNING

### A. Why Machine Learning?

There are a number of reasons why machine learning is the right choice. It is of particular importance that it allows systems to learn and change from data, without explicit programming. The computers, using machine learning algorithms, are able to pinpoint patterns and make predictions on their own, mirror the adaptability and intelligence of humans' decision making process. Hence, this capability holds immense potential across various domains, from predicting customer behavior in marketing to diagnosing medical conditions in healthcare.

In addition, the analytical capacity of ML algorithms allows organizations to derive important insights from a huge amount of data. The need for reliable data analysis tools is becoming more and more urgent, due to the rapid growth of information generated by connected devices and digital platforms. Through this volume of information, machine learning algorithms can scan for trends, anomalies and correlations that might otherwise be overlooked. Businesses can make informed decisions, optimise processes and gain a competitive edge in today's data driven economy by exploiting the predictive power of machine learning.

Utilizing the appropriate machine learning algorithm and training set, we may fully utilize a computer system's capabilities to forecast an accurate outcome. Normalizing our training data is necessary before we train our machine learning model in order to reduce errors and improve the accuracy of the anticipated outcomes.

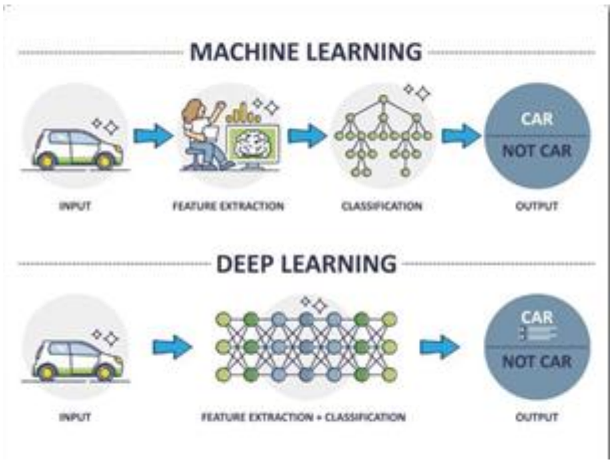


**Fig.3.** Machine Learning

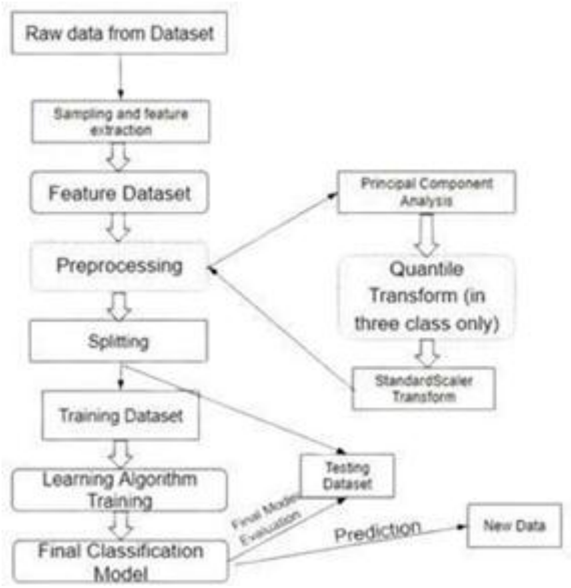


**Fig.4.**Machine Learning Architecture

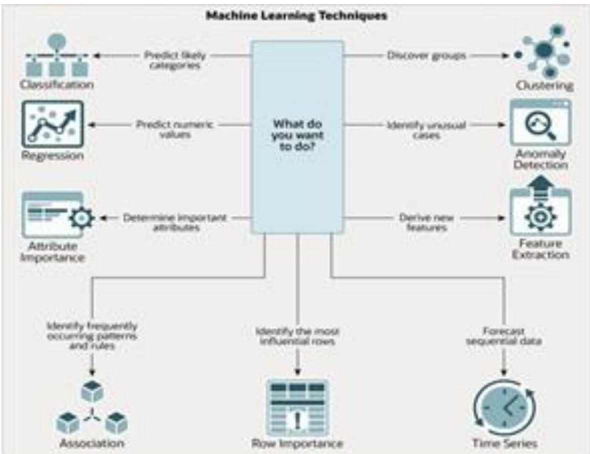


**Fig.5.** Machine Learning Techniques

### B. What is Machine Learning?

Within the field of artificial intelligence (AI), machine learning focuses on creating statistical models and algorithms that let computers carry out tasks without requiring explicit programming at every stage. Fundamentally, the purpose of machine learning algorithms is to use data to learn from and make predictions or judgments. Finding patterns and links in datasets is part of this learning process that gradually enhances performance on a given task. In contrast to traditional programming techniques, which require developers to explicitly declare rules and commands, machine learning algorithms adapt their behavior based on experience.

Here machine learning techniques come in a variety of forms, and each is appropriate for a particular set of tasks and data. In supervised learning, a model is trained using labeled data, using the input. Data and matching output labels are paired. Based on patterns found in the training set, the model gains the ability to predict the output labels for fresh input data. In contrast, unsupervised learning entails training a model on unlabeled data, where the algorithm must find underlying structures or patterns without human assistance. The third method is reinforcement learning, in which an agent gains decision-making skills by interacting with its surroundings and getting feedback in the form of incentives or punishments.

Applications for machine learning can be found in many different fields, such as recommendation systems, financial forecasting, medical diagnostics, picture and speech recognition, natural language processing, and autonomous cars. Machine learning algorithms, for instance, can be trained to recognize patterns and objects in photos, opening up possibilities for image classification, object identification, and facial recognition. Comparably, machine learning models in natural language processing are able to comprehend and produce content that is similar to that of a human, opening the door for applications like Chabot's, sentiment analysis, and language translation.

The capacity of machine learning to process massive and complicated datasets, extract insightful information, and make predictions that would be difficult or impossible for humans to do by hand is one of its main advantages. Machine learning algorithms have the potential to increase accuracy and efficiency while saving time and resources by automating operations that entail data processing and analysis. Machine learning is becoming more and more essential across industries as data volume and complexity continue to rise. It spurs creativity and powers solutions to a wide range of problems.

### C. Basic requirements of Machine Learning:

A number of crucial elements are included in the requirements for putting machine learning solutions into practice, from algorithm selection and model evaluation to data collecting and preparation. First and foremost, relevant and high-quality data are necessary for machine learning models to be efficiently trained. This entails gathering datasets that faithfully depict the issue domain and making sure the information is error-free, clean, and consistent. Furthermore, in order to get the data ready for training, data preprocessing methods including feature scaling, normalization, and handling missing values are frequently required.

In addition, choosing the right methods and algorithms is essential to getting the results you want from machine learning activities. Several kinds of algorithms, such as reinforcement learning, unsupervised learning, and supervised learning, may be appropriate depending on the nature of the problem. Successful implementation requires knowing the advantages and disadvantages of each algorithm and choosing the best one for the job at hand. Furthermore, in order to improve the prediction capacity of the model and extract pertinent information from the data, feature engineering and selection can be necessary.

In order to evaluate machine learning models' performance and capacity for generalization, a thorough examination and validation process is required. To assess the model's performance on untested data, the data must be divided into training and testing sets. Furthermore, methods like hyperparameter tuning and cross-validation can be used to maximize model performance and guarantee robustness.

**D. Properties of Machine Learning**

- **Learning from Data:** Without being explicitly taught, machine learning algorithms can generate predictions or choices by using data to identify patterns and relationships.
- **Adaptability:** When machine learning models are exposed to additional data and feedback, they can adjust and perform better over time, which enables them to continuously improve their behaviors or predictions.
- **Generalization:** In order to produce precise predictions on fresh, unseen data, machine learning models seek to generalize patterns discovered from training data. This characteristic guarantees that the model performs well outside of the training dataset.
- **Automation:** By learning from data, machine learning automates the process of creating predictive models, eliminating the need for manual involvement and the programming of precise rules or instructions.
- **Scalability:** Large amounts of data may be processed quickly using machine learning algorithms, which can also tackle complicated issues and datasets with millions or even billions of records.
- **Nonlinearity:** Numerous machine learning algorithms are capable of identifying nonlinear patterns and correlations in data, which enables them to simulate intricate phenomena that linear models are unable to adequately capture.
- **Adaptation to Changes:** Machine learning models are successful and relevant in dynamic and changing circumstances because they can adjust to changes in the environment or in the distribution of the underlying data.
- **Interpretability:** Certain machine learning methods, such linear regression or decision trees, provide interpretability, enabling users to comprehend the variables influencing the model's conclusions or predictions.
- **Probabilistic Framework:** A lot of machine learning algorithms function in a probabilistic environment, giving probability distributions or uncertainty estimates over predictions that are useful for risk assessment and decision-making.

## IV. METHODOLOGY

**A. Problem Definition and Planning:**

Clearly identify the issue you're trying to tackle and set goals for your machine learning endeavor. Choose the machine learning task type (clustering, regression, or classification, for example) that best fits your situation and locate the pertinent data sources.

**B. Data Collection and Preprocessing:**

Acquire the information required for testing and training your machine learning model. This could entail gathering information from multiple sources, including sensors, databases, and APIs. Eliminate duplicates, deal with any inconsistencies or errors, and handle missing numbers to clean up the data. To get the data ready for model training, do preprocessing operations like feature engineering, scaling, and normalization.

**C. Exploratory Data Analysis (EDA):**

Conduct exploratory data analysis to gain insights into the characteristics and distributions of your data. Visualize the data using charts, histograms, and other statistical plots to identify patterns, correlations, and potential outliers. EDA helps you understand the structure of your data and informs decisions about feature selection and model design.

**D. Model Selection and Training:**

Based on the characteristics of your data and challenge, select a suitable model architecture or machine learning algorithm. Divide the data into sets for testing and training to assess the performance of the model. Utilizing the selected methodology, train the model on the training set of data, then fine-tune its parameters with methods like cross- validation and hyperparameter tuning.

**E. Model Evaluation:**

Examine the accuracy, precision, recall, and other pertinent metrics of the trained model based on its performance on the testing data. To make sure the model satisfies the required criteria, compare its performance to that of other algorithms or baseline models. To enhance performance, make necessary iterations to the model's design and tuning procedure.

**F. Deployment and Integration:**

Deploy the model into production environments where it can produce real-time predictions or insights if you're satisfied with its performance. Make sure the model is compatible and scalable by integrating it with current workflows and systems. When new information becomes available or the underlying environment changes, keep an eye on the model's performance and update it frequently.

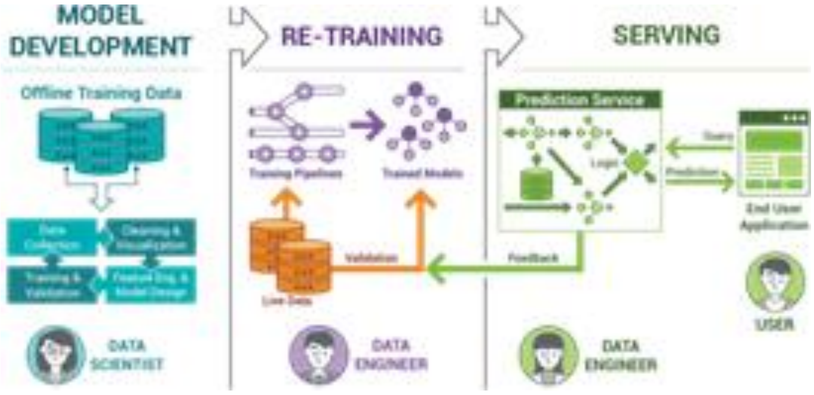


**Fig.5.** Deployment and Integration of Machine Learning

## V. SYSTEM ARCHITECTURE

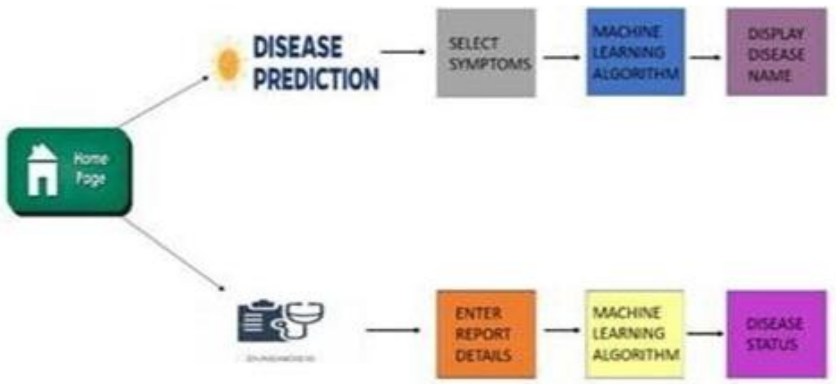


**Fig.6**. System Architecture Diagram

The system architecture of a disease prediction system that reports information input by the user and diagnoses diseases based on symptoms using machine learning techniques. The architecture is simple and easy to use, with the goal of delivering rapid and precise disease forecasts. Users can access the section on illness diagnosis or prognosis from the homepage.

Users are asked to choose their symptoms from a list in the "Disease Prediction" section. A machine learning algorithm trained to identify particular combinations of symptoms with diseases then processes the chosen symptoms. The possible ailment that corresponds to the provided symptoms is predicted by this algorithm after it has analyzed the input data and compared it with its training dataset. The user is then presented with the anticipated disease name, which offers an instant, rough diagnosis based on symptom analysis.

However, users must enter comprehensive reports in the "Diagnosis" area of this architecture. These reports may contain more complex information about the user's health state or the results of medical tests. This comprehensive data is processed by another machine learning system. This algorithm is probably more sophisticated and able to analyze complicated data patterns seen in medical records in order to produce a thorough diagnosis.

The machine learning algorithms employed in both sections are crucial components of this architecture. They must be meticulously designed and rigorously tested to ensure accuracy and reliability in disease prediction and diagnosis. These algorithms should also be continuously updated with new data to enhance their predictive accuracy over time as medical knowledge evolves.

Since machine learning algorithms enable the study of big and complicated datasets, pattern identification, and the creation of precise predictions based on past data, their application in disease prediction systems has grown in popularity in recent years. Since machine learning algorithms enable the study of big and complicated datasets, pattern identification, and the creation of precise predictions based on past data, their application in disease prediction systems has grown in popularity in recent years. These kinds of technologies can help medical practitioners make better decisions, spot possible problems or dangers early, and create individualized treatment strategies for each patient.

Overall, the system architecture shows how to use machine learning algorithms to create an effective digital tool for making first medical assessments. It emphasizes the use of artificial intelligence in healthcare to provide rapid preliminary evaluations prior to formal medical consultations. This digital tool, which uses machine learning algorithms to diagnose and predict diseases, is an example of how technology can improve and optimize healthcare procedures.

## A. Algorithm:

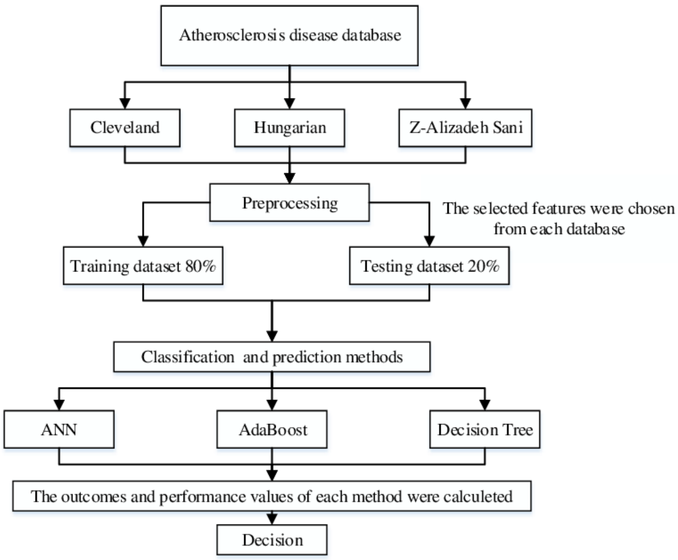


**Fig.7.** Algorithm Flowchart.

Working:

1. Pick the best attribute/feature. The best attribute is one which best splits or separates the data.
2. Ask the relevant question.
3. Follow the answer path.
4. Go to step 1 until you arrive to the answer.

**B. Hardware Requirements:**

- RAM: minimum 8GB
- ROM: minimum 128GB
- Processor: Intel core i5 or above
- Speed: 1.1 GHz
- Input devices: Keyboard, mouse
- Monitor: 15" LED

**C. Software Requirements:**

- Operating System: Windows 10 or above
- Code Editor: VS code
- Programming Language: Python
- Notebook: Jupyter notebook and Google colab

**D. Advantages of system:**

- Early Detection: ML algorithms can analyse patient data to identify patterns and risk factors associated with multiple diseases, enabling early detection and intervention. Plants can grow all year– both indoors and outdoors.
- Improved Accuracy: ML models can integrate diverse data sources, including medical records, genetic information, and lifestyle factors, to generate more accurate predictions compared to traditional diagnostic methods.
- Personalized Medicine: Personalized treatment plans are made possible by ML-based illness prediction systems, which may adjust forecasts and recommendations to each patient depending on their particular traits and medical background.
- Reduced Healthcare Costs: By lowering the need for costly hospital stays, emergency room visits, and treatment, early disease identification and prevention can save money.
- Real-time Monitoring: ML algorithms can continuously monitor patient data and alert healthcare providers to changes in disease risk or progression, facilitating timely interventions and adjustments to treatment plans.
- Patient Engagement: Machine learning (ML)- based illness prediction systems can enable people to take charge of their health and make educated decisions regarding lifestyle modifications and preventive actions by giving them tailored risk assessments and practical advice.
- Research and Innovation: Numerous illness prediction models provide insightful information on the underlying causes and risk factors of different diseases, which inspires more investigation and advancement in the medical field.
- Continuous Improvement: ML algorithms can learn from new data and feedback, continuously improving their predictive accuracy and performance over time.

## VI. RESULTS

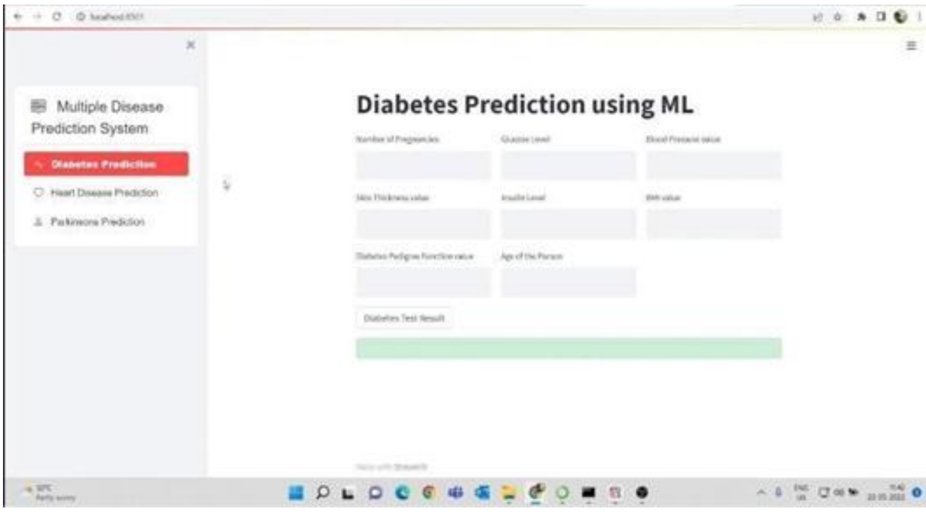


**Fig.8.** Diabetes Prediction

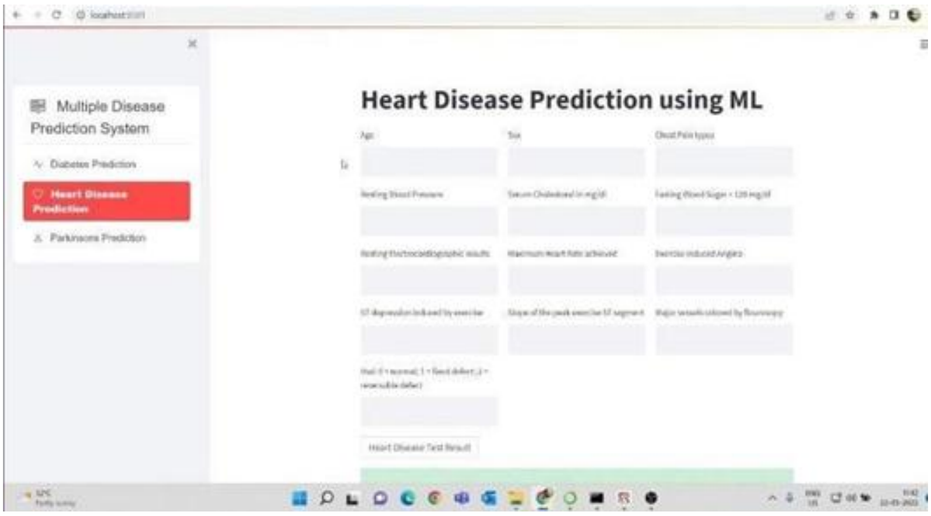


**Fig.9.** Heart Disease Prediction

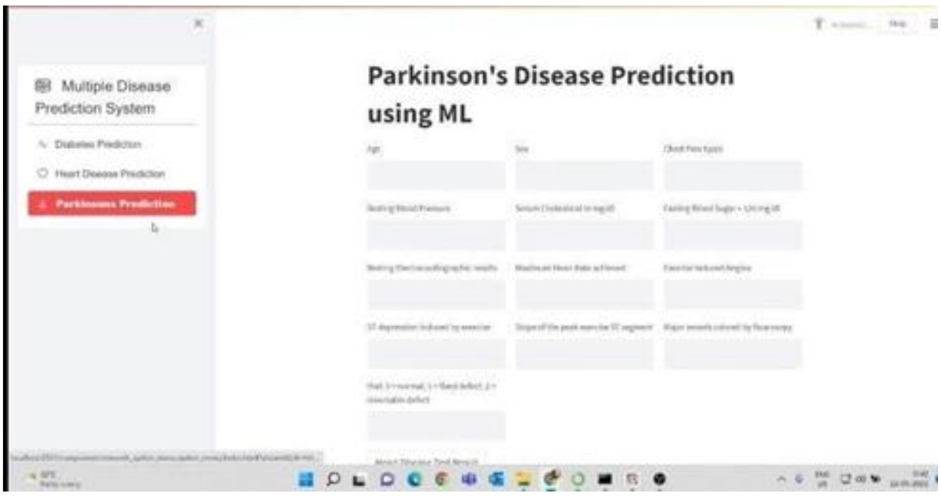


**Fig.10.** Parkinson's Disease Prediction

## VII. CONCLUSION

In conclusion, the implementation of a multiple disease prediction system using machine learning holds immense promise for transforming healthcare delivery and improving patient outcomes. By leveraging advanced algorithms to analyze diverse datasets and identify patterns associated with various diseases, these systems enable early detection, personalized interventions, and proactive management of health risks. With the potential to streamline healthcare workflows, reduce costs, and empower patients to take control of their health, multiple disease prediction systems represent a significant step forward in preventive medicine and population health management. However, it is essential to address challenges related to data privacy, algorithmic bias, and ethical considerations to ensure that these systems uphold patient rights and adhere to the highest standards of care. Through continued research, collaboration, and innovation, the integration of machine learning into disease prediction holds the promise of revolutionizing healthcare and ushering in a new era of precision medicine.

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Any achievement, be it scholastic or otherwise does not depend solely on the individual efforts but on the guidance, encouragement and cooperation of intellectuals, elders and friends. I would like to take this opportunity to thank them all.

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# Machine Learning Based Book Recommendation Engine in Python

**Prof. Sindhuja M, Ayesha Muskan Khan M, Shravani S L, M Anila**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Bengaluru, Karnataka, India

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**ABSTRACT**

This web-based platform provides readers with tailored suggestions of books on the basis of past choices and reviews. Two techniques are determining the recommendations: one leverages the overall popularity of books, when the other employs cooperative filtering procedures. The former promotes books with a large number rating from a cluster of readers, conversely the latter suggests books on the basis of ratings of other readers who have made similar decisions. To satisfy these recommendation algorithms, this application—which was developed with Flask, a Python-based web framework—manages and modifies book-related data. Its two primary functions are to show books according to their general popularity and to suggest cooperative sorting when a specific book title is input. The primary aim of this work is to create a user-friendly and efficient book suggestion engine that may enhance the offerings of online shops and libraries by suggesting books that line up with consumers' choices.

**Keywords:** Recommender system, Collaborative filtering, User-based Book Recommendation, Similarity measures, User preferences

## I. INTRODUCTION

This article describes a machine-learning proposal system for books which makes the foundation of a user based cooperative filtering technique. On the basis of discernible patterns and the trends in the content, a suggestion engine powered by machine-learning can forecast a reader's selections or choices. It mostly leverages prior reader behavior as a learning process to offer these predictions. In this course of action, the system would expend the perusing history of a reader, previous revenue, and the ratings concerning their overall online expenditure. Immediately following that, it would recommend books on the basis of the information it thought the reader would find interesting. This might include goods that the user has already bought or valued, as well as goods that other users who share their likes have indicated that they would be fascinated in having a look at.

The ultimate objective of such systems is to supply custom made recommendations that fine tune the experience of reading, enrich engagement among readers, and, eventually, result in greater revenue or operation. They are an essential component of a variety of online environments, including social networking, streaming services, and online commerce platforms. They assist clients in sorting through an enormous amount of knowledge and selecting the most suited solutions. This article aims to summarize the currently present suggestion engines in use in the online book-purchasing industry, as well as to come up with a straightforward and easily understood procedure for producing book suggestions which will help customers choose the best book to read next.

This emphasizes tackling the data interpreting challenge associated with the suggested read engine, which recommends books based upon reader ratings via assessing reader resemblance utilizing collaborative filtering technique. System of Recommendations use a process known as User-Based Collaborative Filtering to come across items on the basis of assessments from other readers with comparable tastes and foretell which books the reader would like. The initial objective is to find readers who are similar to the target reader. There are also more ways to determine this familiarity.

This study investigates how well plenty of similarity regulations, comprising cosine similarity, restricted Pearson correlation, Jaccard similarity, and Pearson correlation coefficient, performed in suggestions of books to readers. This exhibits the proposed technique's overall design, performance, effectiveness, and efficiency.

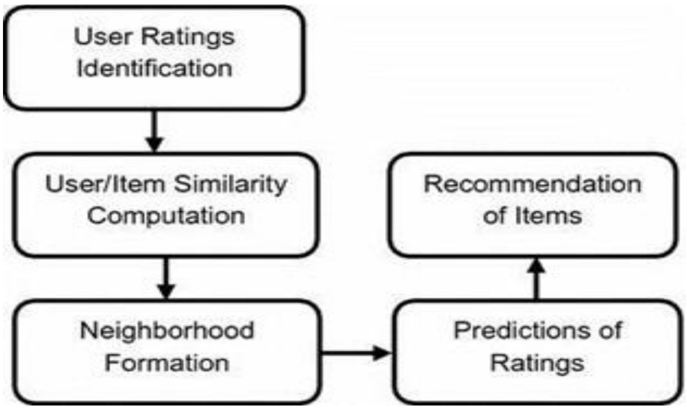


**Fig 1.1** Basic Idea of User-based Recommendation Engine

## II. LITERATURE REVIEW

Building on previous research in item-based collaborative sorting and K-nearest neighbor procedures, it is evident that incorporating implicit input is an emerging topic of interest. Combining such data with user-based collaborative sorting algorithms might enhance the precision of book suggestions. This technique has the capability to resolve the long-standing difficulty of deficit of feedback that is explicit by glancing into the vast but often overlooked memory of implicit reader input.

Implicit feedback, like perusing history and reading duration, provide a more full picture of client preferences than direct observations. Incorporating such information might assist suggestion systems to surpass the limitations of conventional techniques, which depend predominantly on the ratings that were explicit.

In summary, implicit information assimilation into collaborative sorting techniques represents a significant advancement in customized book suggestion engines. The glory and contentment that come from the world of literature can be increased by its capacity to construct more intuitive and sensitive engines that can adjust to the individual tastes and interests of each reader.

Apart from that, we evaluated four noteworthy developments in this area of research:

A. Book Recommendation System with Tensor Flow:

To propose books to readers, Anandaraj A, Yeshwanth Ram P, Sri Ram Kumar K, Revanth M, and Praveen R recommended employing an online platform. The online tool may be utilized by the engine to gather and evaluate reviews and reader selections. The most innovative recommendation technique, Internet based suggestions filtering, is simple and quick to assess for the system. Books are ranked and screened by the system before being sent to customers. By using this method, websites may increase their profit margins by selling more books. Based on their evaluations, the algorithm determines what each client thinks of books. This procedure assimilates Content- Based Cooperative Sorting, an intricate process, to address these problems. Customers must be skillful to access relevant material that is ranked and sorted by suggestion algorithms.

B. Cloud-Based Collaborative Filtering Algorithm for Library Book Recommendation:

A book suggestion engine is a useful tool for libraries to direct their books collection, claim Ayush Ubale N and Anoop A. Books can be stored and retrieved from the database on this website using a method that can be configured by the administrator. The computer classifies these books using a cooperative filtering process, and then proposes the books with the highest ratings (5 stars). The user may then modify their profile and subject-filter the books. If the user can browse one or more of the top-rated books in each category, they could locate the books they're looking for more quickly. The reader might interact with other readers online to get book recommendations. Upon request, the administrator will bring the books to their home, where they may be checked out and returned. The books that the user has checked out can be reviewed and rated.

| Sl. No | Title | Authors | Paper | Drawbacks |
|---|---|---|---|---|
| 1 | **Book Recommendation System with TensorFlow** | Anandaraj A, Yeshwanth Ram P, Sri Ram Kumar K, Revanth M, Praveen R | IEEE 2021 | It does not provide any experimental results or evaluation of the proposed book recommendation system with TensorFlow. It only describes methodology and data set, but does not show how system performs in terms of accuracy, efficiency, scalability, or user satisfaction. |
| 2 | **Cloud Based Collaborative Filtering Algorithm For Library Book Recommendation System** | Anoop A.N Ayush Ubale | IEEE 2020 | It does not provide any evaluation or comparison of the proposed cloud-based book recommendation system with existing systems. This only describes the system architecture, the algorithms, and the features, but does not present any experimental results or performance metrics to demonstrate the effectiveness, efficiency, or scalability of the system. Therefore, this lacks evidence to show the advantages of the cloud-based approach over other methods. |

**Fig 2.1** Literature Review

C. Efficient Recommendation System for Book Selection:

Readers may find knowledge on the internet on the basis of their tastes thanks to an online service, which was created by Madhuri Kommineni, P. Alekhya, T. Mohana Vyshnavi, V. Aparna, K Swetha, and V Mounika. Recommendation engines are advantageous to e-commerce websites since they assist users in selecting the appropriate books. Moreover, a strong suggestion engine might boost revenue and client retention. Nevertheless, a few of the current tactics could upset clients and collect unnecessary data. It also provides a basic approach to book suggestions, which might assist readers in discovering the next author they'd want to read.

| | | | | |
|---|---|---|---|---|
| 3 | **Efficient Recommendation System for Book Selection** | Madhuri Komminení, P. Alekhya, T. Mohana Vyshnavi, V. Aparna, K Swetha, and V Mounika | Research Gate 2021 | It does not represent the diverse tastes and ratings of all book readers, as it may favor certain genres, authors, or languages. It may also have many gaps in the ratings, tags, or genres, which can make the system less accurate and prone to cold start problems. Information might be too large or complex to handle efficiently, or too dynamic to keep up with. |
| 4 | **Embedding Model Design for Producing Book Recommendation** | Reza Rahutomo, Anzaludin Samsinga Perbangsa, Haryono Soeparno, Bens Pardamean | IEEE 2019 | One major challenge from this is the cold start problem. This is a situation where the recommendation system cannot make accurate predictions for new users or items, because it lacks sufficient data or feedback to learn their preferences. This mentions some possible solutions to this problem, such as using demographic information, content features, or hybrid methods. |

**Fig 2.2** Literature Review

The difficulty with information inquiry for the administration suggestion engine, which employs dynamically changing network resources, is the main topic of this study.

D. Embedding Model Design for Producing Book Recommendation:

With the intention to foster greater reader engagement, Reza Rahutomo, Anzaludin Samsinga Perbangsa, Haryono Soeparno, and Bens Pardamean created Internet engines that often amend content suggestions on the basis of user preferences. Recommendation algorithms, which create a list of material by analyzing reader interaction information, are at depths of this customization. This intriguing study investigates the works of the book suggestions using a filtering strategy that considers these discoveries. A study that employed the historical behavior of a randomly suitable reader yielded 5 book suggestions with a 59% accuracy rate. The Aftermath of this study will assist Binus University in amplifying the content suggestion system inside its corporate learning framework.

## III.EXISTING SYSTEM

The usage of Tensor Flow in the current website's book recommendation engine marks a big step forward in the artificial-intelligence and the machine learning. The system can build tremendously accurate prognosis models by exploiting Tensor Flow's enormous preparedness to analyze large datasets of reader choices and book scrutiny. The recommendation engine's postulates are made up of many models that allow it to refine ideas through a process known as collaborative filtering.

Collaborative filtering creates content suggestions by using a user community's aggregate perspectives. In this case, it enables the technique to find trends and parallels in book reviews from a wide range of individuals, particularly those with comparable interests and selection choices.

In this case, the Tensor Flow Recommenders library is really beneficial. Tensor Flow Recommenders relieves developers of the complexities of the underlying machine- learning infrastructure, enabling them to concentrate on enhancing the recommendation algorithms and overall reader experience.

The primary goal of this sophisticated engine is to enhance the precision of book suggestions to customers. The platform intends to encourage a more personalized and engaging book-learning experience by providing more relevant recommendations.

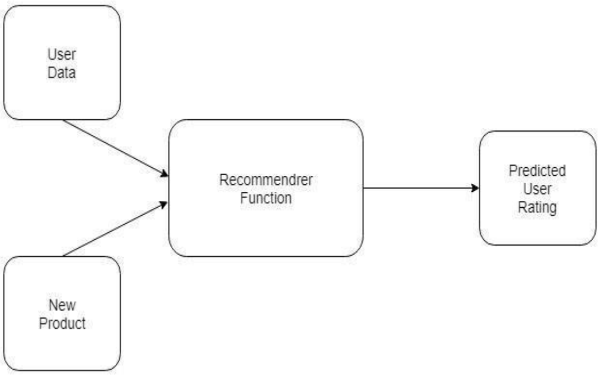


**Fig 3.1** Existing System

Additionally, the system is meant to be adaptable. It employs machine-learning algorithms, which change and learn over time in response to reader communication. The platform enables readers to capture with it by books rating, posting reviews, and amending their choices. The system dynamically modifies its models to account for these changes. This keeps the concepts fresh and relevant, reflecting the user community's changing tastes.
The website's book recommendation engine emphasizes the usage of machine-learning in improving user experiences. This method establishes a new standard for personalized book suggestions by assimilating Tensor Flow pertinence with cooperative filtering and the Tensor Flow Recommenders library. It not only learns about its customers' present tastes but also anticipates their future interests, influencing how they discover and consume books. As the system learns and adapts, it promises to provide a consistently improved service that reflects the diverse and dynamic nature of reader participation.

## IV. PROPOSED SYSTEM

Building on the updated user-based cooperative sorting procedure, this system not only tailors the recommendation of books for individual preferences, but it also adapts to the reader's book-learning experience. As the algorithm comprehends more about the reader's choices and the book- reading habits, its predicted accuracy improves, resulting in the more customized reading list. The usage of dynamic feedback mechanisms allows this system to alter suggestions depending on real-time user interactions, which ensures that the ideas stay relevant and interesting.
Furthermore, the system may feature a thorough grading system that incorporates the reader's behavior and reader's choices. This procedure can find new trends and specialized genres, perhaps revealing archetypal suggestion engines would have missed. To enrich the detection experience, the system may operate natural language evaluation to scan reviews and synopses, capturing sentiment and topic knowledge relevant to the user's choices.

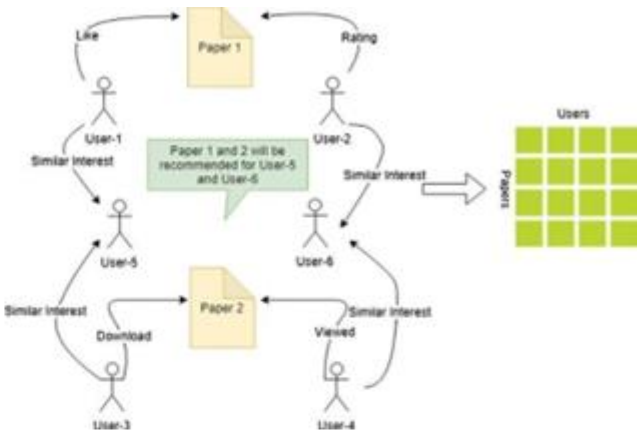


**Fig 4.1** Proposed System

Besides, with individual reader information, the system may make the most out of community driven insights, drawing on the collective prowess of reading community to fine-tune its suggestions. The system's ultimate goal is to create a seamless and immersive reading environment in which detection, reading, and discussion are combined into a single, worthwhile experience.

## V. SYSTEM ARCHITECTURE

A sophisticatedly designed book recommender engine is like a well-oiled machine, with every part playing a vital function in providing the reader the customized book suggestions. The core of the system is the data processing unit, which effectively manages enormous volumes of data from several sources and makes sure the data is organized, clean, and ready for analysis.

The brains behind the whole thing are the Algorithms for Recommendation, which utilize sophisticated mathematical-models and the machine-learning procedures to anticipate, depending on the user's profile, what books the reader would be interested in.

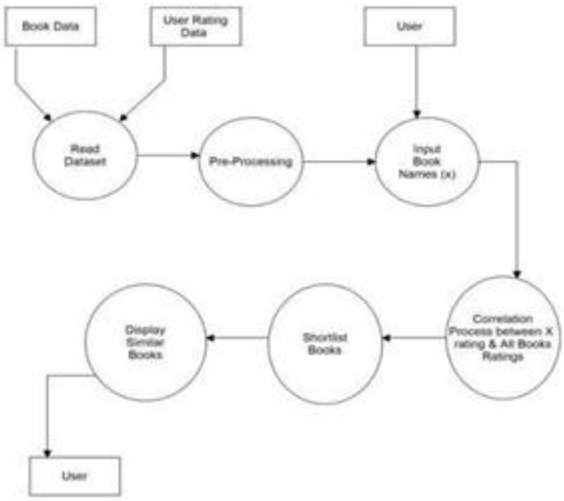


**Fig 5.1** System Architecture

The feedback loop, which records the user's reactions to the suggestions made, is essential to the system's flexibility. As the curator, the Content Aggregator compiles book details from bookstores, libraries, and internet resources to provide a substantial collection that might be used to make suggestions.

Last but not least, the User Interface serves as the system's face, making the suggestions understandable and interesting. Because of its user-friendly design, readers can quickly browse through their personalized reading recommendations, find new authors, and experiment with other genres.
These parts work together to create a powerful book recommendation engine. Because each module is connected to the others, the user experience is smooth. These systems have the potential to become much more precise, individualized, and essential to the reading experience as technology develops.

**Use Cases of Book Recommender Engine:**
An intricate algorithm known as "user-based cooperative sorting" utilizes the aggregate choices of readers to suggest books that fit each person's interests. This approach explores the subtle layers of reading habits, including book- length, subject intricacy, and even the historical setting of the story, in addition to the genres that consumers like. Highly tailored book suggestions are produced by the system by examining the complex network of user connectivity, reviews, feedback, and ratings.
It's a dynamic, ever-changing process that keeps improving its recommendations in acknowledgment of the recent information. This improves the reading experience of readers and helps readers with indistinguishable interests feel more connected to one another. Moreover, publishers and writers may benefit greatly from user based cooperative filtering. It makes lesser-known publications that merit attention more visible by skillfully pairing them with the appropriate readership.

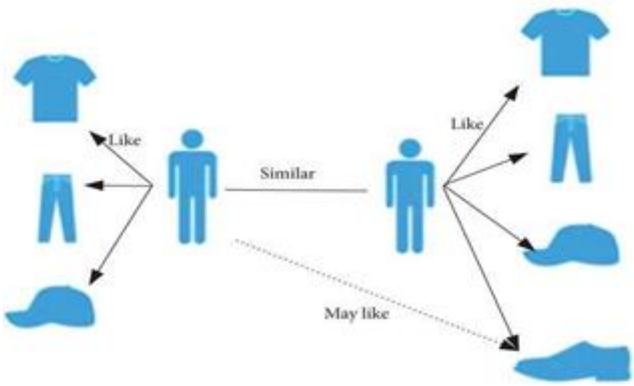


**Fig 5.2** Use Case Diagram

This may result in a more varied reading environment where popular bestsellers are paired with obscure genres and up-and-coming writers. Everyone benefits from the situation: authors get a larger audience, readers receive personalized suggestions, and the platform turns into a vital resource for finding hidden literary gems.
This screening method is similar to having a smart buddy who not only knows what you like to read but also keeps an eye out for new releases that match your taste profile when it comes to book recommender engines. It is a buddy who recalls not just what you enjoyed, but also the reasons behind your enjoyment—for example, the richness of the world-building, the plot's pacing, or the characters' nuanced growth.
We should expect much more sophisticated algorithms as technology develops, ones that can take into account a greater range of user data, like reading speed, past purchases, and even sentiment analysis of reviews. Recommender engine of books with user-based cooperative filtering have a great deal of potential, pointing to a day when literature and technology will combine to improve reading in ways never seen before.

## VI. RESULT.

Distributed computing resources might be used, utilizing cloud technologies to grow the system dynamically, in order to meet the computational needs of processing large amounts of user data. By doing this, the recommendation engine would be guaranteed to maintain its effectiveness and responsiveness as the dataset expands.

A feedback loop that tracks user interaction with suggested titles to improve the precision of upcoming recommendations would also be beneficial to the system. Over time, the system would become more dependable thanks to this self-improving mechanism, which would assist reduce the unpredictable nature of consumer preferences.

Additionally, investigating demographic clustering may highlight trends in reading preferences among various age groups and geographic areas, which may subsequently help shape focused advertising campaigns. Publishers and authors might customize their offers to cater to the distinct preferences of each section by comprehending the subtleties of the demography.

The suggested voting mechanism may act as a social layer, giving the suggestion process a more group dynamic. Voting by users on lists tailored to their interests would result in a crowdsourced selection that represents the community's overall taste. Users may feel more engaged and like they belong as a result of helping to shape the reading environment. Fundamentally, a book recommender engine's development is based on its capacity to adjust to the dynamic combination of user preferences, technology developments, and the diverse body of literature.


**Fig 6.1** Home Page

**Fig 6.2** Top 50 Books


**Fig 6.3** Recommendation Page


**Fig 6.4** Asking for Recommendation

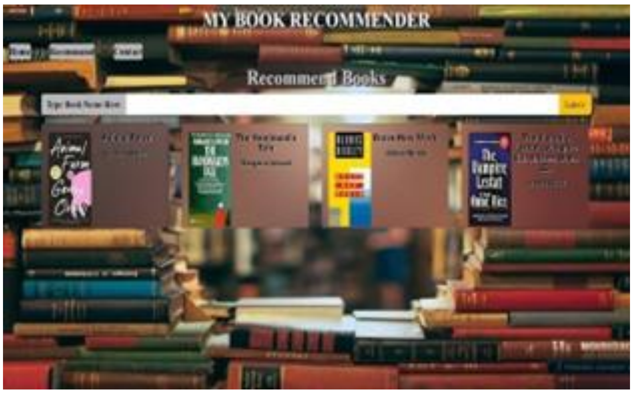


**Fig 6.5** Recommended Books

## VII. CONCLUSION

Expanding the user-based cooperative sorting procedure, one may imagine a multimodal books suggestion system that combines a more in-depth examination of book traits with learning from the user connectivity. The system can evaluate textual components including writing style, complexity, and thematic depth by employing content- based filtering, which provides it with a more thorough grasp of user preferences. Semantic analysis of reviews, feedback, and ratings which might reveal the reader's emotive connections to a book, may help to further enhance this. Furthermore, the recommendation system could gradually improve in accuracy if machine-learning techniques are used. Existing data might be used by neural networks to forecast future reading habits, and user evaluations could be analyzed by natural language processing procedures for identifying trivial preferences. If it were feasible to forecast the future, lists matching with the new interests might be proactively curated, maybe even before users were aware of them. Lastly, the technology may interact with social networking sites to enable users to discuss suggestions and their reading experiences. This would start a viral cycle by drawing in additional readers and pioneering the suggestion engine with pristine data pieces.

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# Prediction Of Smartphone Addiction Using ML Techniques

**Shreedevi. B.C, Anjushree M, Gowthami R, Usha S**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Bangalore, Karnataka, India

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**ABSTRACT**

Smartphone enslavement has gotten to be a developing concern in later a long time, with expanding numbers of individuals showing side effects such as over the top phone utilization, misfortune of efficiency, and disabled physical and indeed mental wellbeing issues. As a result, there's a need to create compelling apparatuses for foreseeing smartphone compulsion and recognizing those at chance. In this ponder, we created a machine learning show for anticipating smartphone compulsion utilizing information collected from an overview of smartphone clients. The study included questions approximately socioeconomics, phone utilization designs, and different mental variables such as uneasiness, discouragement, and push. A well-known and viable machine learning strategy, to build our demonstration. We pre-processed the information by encoding categorical factors and normalized numerical factors to guarantee the show seemed to be learning viably. We at that point prepared the demonstration on a parcel of the information and assessed its execution on the stay information utilizing a few measurements, such as precision!

It said that the model achieved a tall exactness in anticipating smartphone habits. The foremost critical highlights for foresee compulsion were phone utilization designs such as the recurrence of checking notices, the number of hours spent on the phone each day, and the sorts of apps utilized most regularly. Other imperative components included age, gander, and stretch level. The foremost we created has a few potential applications.

**Watchwords:** Choice tree, Arbitrary Woodland, Calculated Relapse, and Machine Learning methods!

## I. INTRODUCTION

Smartphones play a pivotal part in our lives, with their utilization skyrocketing within the final ten a long time. In spite of the benefits they offer, over the top smartphone utilization can result in habit, affecting physical and mental wellbeing, social connections, and efficiency levels. Utilizing machine learning, models can be created to figure smartphone compulsion based on different variables like smartphone utilization designs, social media utilization, statistical points of interest, and mental angles.

1. Information Collection and Preprocessing:
   - At first, information is assembled from a expansive test of clients, counting smartphone propensities, social media action, age, sex, and psychological conditions like uneasiness and discouragement. This data ought to be cleaned and prepared to evacuate unessential or lost information focuses.
2. Calculation Determination and Show Preparing:
   - Taking after information preprocessing, a fitting machine learning calculation, such as calculated relapse, choice tree, or Arbitrary Woodland, is chosen based on information nature and the issue being tended to. The dataset is partitioned into a training set and a testing set. The preparing set is utilized to prepare the show by giving input highlights and comparing names.
3. Demonstrate Assessment and Refinement:
   - The demonstration is at that point evaluated on a testing set to gauge its execution utilizing measurements like exactness. Fine-tuning of the demonstrated parameters or picking for diverse calculations may be vital to improve the model's execution.
4. Expectation and Mediation:
   - Once the demonstration is created, it can be utilized to anticipate smartphone enslavement probabilities for people. This score can direct in giving appropriate mediations and back to those at hazard of habit. By joining machine learning models, the capacity to predict smartphone habit and distinguish vulnerable people is increased, empowering preventive measures to be taken to check addiction's antagonistic results, requiring dependable and exact models for real-world utilization.

## II. WRITING OVERVIEW

This study explores the correlation between the length of smartphone utilization and different components. The inquiry about how the time went through on smartphones relates to distinctive angles such as client behaviour, psychological well-being, efficiency, and social intelligence. By utilizing both quantitative and subjective strategies, the think investigates designs and patterns in smartphone utilization, looking to reveal potential affiliations with variables like age, sex, and socio-economic components. The examination joins data correlation through overviews, interviews, and app utilization following, permitting for a comprehensive examination of participants' smartphone propensities. Factual apparatuses and explanatory models will be connected to recognize any critical relationships or conditions between the term of smartphone utilization and the chosen factors. The discoveries from this inquiry may contribute profitable experiences into the effect of smartphone utilization on individuals' lives and well-being, illuminating future talks on innovation utilization and potential meditations for advancing more advantageous smartphone propensities.

Individuals utilize. Our considered advance uncovers that versatile gadget utilized by HCPs in clinical settings was not restricted to clinical care but or maybe expanded to broad individual utilize. An overpowering larger part of all reacting HCPs detailed utilizing their mobile devices within the ED for individual reasons, with going to doctors announcing the least individual utilize (75 %). Whereas all HCP categories detailed tall e-mail and informing application utilize, phone(voice) by attendings may once more reflect a generational impact, with the generally more seasoned going to doctors more accustomed to utilizing portable gadgets, especially phones, for making calls (comparative discoveries have been detailed within the UK by Mubasher et al., 2015).

On the other hand, more youthful HCPs are more likely to use mobile gadgets for social media communications. This may moreover be clarified by more seasoned respondents being more mindful of, and compliant with, the security guidelines related with utilizing social media applications16. Still, worldwide patterns appear that more youthful individuals, particularly those beneath 34 a long time ancient, show altogether higher social media use35. Independent of the detailed sort of utilization, the tall rates of individual utilize of versatile gadgets in our ponder are perplexing especially in an ED setting, where there's a developing body of writing on the effect of interruptions and diversion on persistent safety24. The reality that more youthful eras have detailed higher rates of trouble in giving up social media36 makes the problem more concerning for that age bunch, which can staff the future ED.

**Disadvantages:**

members may not precisely report their smartphone utilization, driving to potential mistakes within the information. A few people might think little of or overestimate their utilization, affecting the discoveries.

2.1. Integrating Smartphone App for Postural Re-education with Mistakes:

This study examines the effectiveness of joining a smartphone app into worldwide postural re-education of people anticipating nonspecific neck torment. The investigation points to evaluate the effect of this combined mediation on key results, counting neck torment levels, pose, quality of life, and perseverance. By utilizing a multidimensional approach, the ponder looks to decide whether the integration of a smartphone app upgrades the viability of conventional worldwide postural re-education methods. The inquiry about strategy includes a randomized controlled trial, where members are partitioned into test and control bunches. The test gather gets worldwide postural re-education increased by a extraordinarily outlined smartphone app, whereas the control bunch experiences conventional worldwide pose appraisals, and perseverance tests, nearby subjective criticism from members with respect to their generally quality of life. Information investigation will include comparing results between the two bunches, pointing to recognize any measurably noteworthy advancements in neck torment lessening, pose adjustment, upgraded quality of life, and expanded continuance. The discoveries from this inquiry may offer important experiences into the potential benefits of joining innovation, within the shape of a smartphone app, to increase conventional restorative meditations for nonspecific neck torment. In this ponder, an app called “Seeb '' (Android Studio computer program) was utilized, which can be effortlessly introduced on a smartphone. “Seeb'' was introduced for the participants' smartphones at the foreordained times (an interim of 300 s for redressing pose portrayed within the treatment sessions and twice in a day they did not experience GPR, performing works out to adjust their everyday exercises) based on self-managed of work time and a domestic work out program. The created application was introduced on Android working framework forms 4-6. The smartphone made a beep sound after showing a picture of the workout and adjusting stances amid every day exercises [15]. The objective was to diminish potential hazard components for Musculoskeletal disarranged by the leftover portion [31]. “Seeb'' may store the title and depictions of a self-managed work out program, the sort and redundancy of each work out, the addition of the work out picture, the record of organization instruction, the record of the client response to the caution (work out organization, or non-administration), and the work out organization schedule (the time of the primary and final work out performing, the rehash hours of performing, and work out refill update) [15].

**Drawbacks:**

Members may not reliably utilize the smartphone app as aiming, driving to inconstancy in treatment adherence. Moo client engagement might compromise the adequacy of the intercession and make it challenging to draw clear conclusions almost the app's effect. The utilization of a smartphone app may raise concerns with respect to the security and privacy of individual wellbeing information. Members may be reluctant to share delicate data through the app, influencing the completeness and unwavering quality of the information collected.

2.2. Smartphone Utilization Flow Investigation with Mistakes:

This ponder investigates the shown elements encompassing the length of smartphone utilization and its multifaceted affect. Through a combination of quantitative examination and subjective examination. The investigation points to reveal designs and security counting behavioural designs, mental well-being, social intuitive, and potential suggestions for in general wellbeing. By utilizing studies, interviews, and possibly app utilization following, the consideration looks to supply a nuanced understanding of how smartphone utilization term connects with statistical components, way of life choices, and subjective encounters. Factual strategies will be connected to observe patterns and potential causal joins, offering insights into the quantitative measurements of smartphone utilization term but moreover diving into the subjective viewpoints, pointing to capture the subjective encounters and recognitions of clients. The discoveries may contribute to the broader talk on the subjective encounters and discernments of clients. The discoveries may be viewpoints for people, analysts, and policymakers alike. The idea that portable gadgets utilized by HCPs in clinical settings was not constrained to clinical care but rather broad individual utilization. An overpowering lion's share of all reacting HCPs detailed utilizing their versatile gadgets within the ED for individual reasons, with going to doctors announcing the most reduced individual utilization (75 %). Whereas all HCP categories detailed tall e-mail and informing application utilization, phone(voice) utilization was most elevated among going to doctors, and social media.

**Impediments:**

Smartphone utilization is different and context-dependent. Centring exclusively on length may distort the utilization.

2.3. Smartphone Utilization Elements Investigation with Mistakes:

This study investigates the shown flow encompassing the length of smartphone utilization and its multifaceted effect. Through a combination of quantitative examination and subjective examination. The inquire about points to reveal designs and security counting behavioural designs, mental well-being, social intelligence, and potential suggestions for in general wellbeing. By utilizing studies, interviews, and possibly app utilization following, the consideration looks to supply a nuanced understanding of how smartphone utilization term connects with statistical components, way of life choices, and subjective encounters. Measurable strategies will be connected to perceive patterns and potential causal joins, advertising bits of knowledge into the quantitative measurements of smartphone utilization length but too diving into the subjective angles, pointing to capture the subjective encounters and recognitions of clients. The discoveries may contribute to the broader talk on the subjective encounters and recognitions of clients. The discoveries may be viewpoints for people, analysts, and policymakers alike. The considered that portable gadget utilized by HCPs in clinical settings was not constrained to clinical care but or maybe broad individual utilization. An overpowering lion's share of all reacting HCPs detailed using their versatile gadgets within the ED for individual reasons, with going to doctors announcing the least individual utilize (75 %). Whereas all HCP categories detailed tall mail and informing application utilization, phone(voice) utilization was most noteworthy among going to doctors, and social media.

**Impediments:**

Smartphone utilization is assorted and context-dependent. Centring exclusively on length may misrepresent the utilization.

2.4. Mobile Gadget Utilization Think about in Healthcare Settings:

This consideration explores the designs, purposes, and suggestions of portable gadget utilization by healthcare professionals within crisis division settings. By utilizing a mixed-methods approach, they inquire about points to perceive the recurrence, length, and particular applications of versatile gadgets among crisis office staff. The think digs into the potential impacts on workflow proficiency, communication, and generally quiet care, considering both the focal points and challenges related with versatile innovation integration in a fast-paced healthcare environment. Through overviews, interviews, and conceivably observational strategies, the inquiry looks to capture the assorted ways in which healthcare professionals' encounters, inclinations, and any seen obstructions related to versatile gadget utilization. The discoveries from the study hold the potential to advise clinic arrangements, innovation integration methodologies, and preparing programs custom-made to the part of portable gadgets in healthcare conveyance, shedding light on the complex elements and contemplations particular to crisis care.

Methodological approaches. Whereas the creators considered utilizing an ethnographic observational consideration, this was eventually chosen against due to the meddling of the approach for both patients and suppliers in an intense care setting. In expansion, Concerns about changes in behaviour from onsite perception may affect supplier conduct as well as detailing. As for the utilization of screen time applications to evaluate supplier utilization, whereas this would certainly surrender curiously information, it tragically was not commonly accessible on most smartphones at the time of the consideration in 2017. Most of the built-in screen time following capabilities were executed for IOS clients in 2018. Moreover, these gadgets would not permit examiners to survey whether particular applications are being utilized for clinical care or individual utilization. For illustration, WhatsApp is utilized for communication between counselling groups in our setting and can moreover be utilized for individual informing. The fleeting overview strategy was not considered and may have been superior, able to capture the utilization recurrence and design.

**Drawbacks:**

Portable gadgets utilized in healthcare settings raises protection and security concerns, particularly when dealing with persistent data. Incidental breaches or unauthorized access to too touchy information may happen.

2.5. Neural Organize Network Consider with Blunders:

This think explores deviations within the inborn neural organize quality among people analysed with smartphone compulsion. Utilizing neuroimaging procedures and progressing network investigations, they inquire about points to connect neural discoveries with subjective encounters of smartphone utilization. By investigating variations in neural systems, the ponder looks to reveal potential biomarkers and neurobiological underpinnings related to smartphone addiction, shedding light on the neural instruments ensnared in this behaviour clutter. The inquiry about strategy includes comparing neural network designs between people analysed with smartphone compulsion and a control gathering. Quantitative evaluations, such as resting-state useful attractive reverberation imaging (fMRI), will be utilized to analyse the quality and coherence of natural neural discoveries with subjective encounters of smartphone utilization and enslavement indications. The results of this investigation hold guarantee for progressing our understanding of the neural relates of smartphone habit, possibly contributing to the advancement of focused on intercessions and helpful methodologies. By revealing particular neural marks related with smartphone habit, the ponder may advise future inquire about and clinical approaches pointed at relieving the unfavourable impacts of intemperate smartphone utilisation on brain function and mental wellbeing.

**Impediments:**

Neuroimaging may raise moral concerns, especially with respect to member protection and the potential shame related with enslavement analysis. Guaranteeing ethical guidelines are taken after is significant to protect member rights and well-being. Discoveries from a particular gather of people with smartphone compulsion may not generalize well to the broader populace. The sample's characteristics, such as age, social foundation, and seriousness of enslavement, seem to affect the generalizability of what comes about.

After considering the writing study, we came to know that we were required to include the calculations to actualize the datasets. Assisted inquiry is required to approve our discoveries on bigger and more assorted datasets and to investigate the potential applications of this show in totally different contexts. By utilizing progressed procedures, we are able decrease the drawbacks made by past surveys

## III. EQUIPMENT ARRANGEMENT:

- Processor – 13/Intel processor
- Difficult Disk – 160GB
- Irregular Get to Memory – 8GB

## IV. PROGRAM ARRANGEMENT

- Working framework- Windows 7/8/10
- IDE - PyCharm
- Libraries Utilized - NumPy, Pandas, OS, Django, MySQL
- Innovation - Python 3.6+

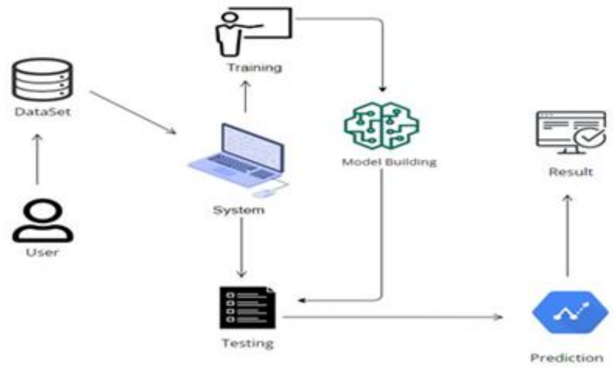
Do not disregard, the significant processor could be a 13/Intel processor. A gigantic difficult disk, 160GB, will store your treasures. Let's not ignore the Arbitrary Get to Memory - a whopping 8GB!

For the program domain, Windows 7/8/10 rules are incomparable as the working framework. Utilize PyCharm as your IDE, and dive into the captivating world of libraries like NumPy, Pandas, OS, Django, and MySQL. Grasp the enchantment of Python 3.6+ innovation, driving you on a charming journey through the advanced scene!

## V. SCOPE

The sweeping scope of this exciting investigation envelops the advancement and assessment of a groundbreaking machine-learning show for the forecast of smartphone habit. It incorporates a delightful collection and marvellous investigation of different datasets comprising interesting smartphone utilization designs, interesting behavioural characteristics, and captivating mental pointers. The model's tremendous scope expands to evaluating its precision, affectability, and specificity as a progressive symptomatic device for recognizing smartphone enslavement. Moral contemplations with respect to information protection, and the dependable utilization of prescient models are to some degree investigated (???). Also, the strange ponder talks about potential intercessions and unconventional back instruments based on the model's expectations to address smartphone habit. The extreme, wonderful scope is to contribute to the mitigation of smartphones and advance more advantageous computerized ways of life!

**Design:**




## VI. USAGE

### 6.1. TAKE DATASET:

The dataset for the 20230329093832 Mobile-addiction Information is collected from the Kaggle site (kaggle.com). The estimate of the general dataset is 80.0KB (91,920 bytes).

### 6.2. Data Pre-processing:

In preprocessing to begin with, all, we are going to check whether there are any Nan values or not. On the off chance that any Nan values are displayed, we'll have to fill the Nan values with diverse filling methods like charge, record, mode, and cruel. Here, we incredibly utilized the fill (front fill) strategy on our venture.

### 6.3. TRAINING THE Information:

Regardless of the calculation we select, the preparation is the same for each single calculation out there! Given the dataset we part the information into two parts preparing and testing, the reason behind doing this can be to test our model/algorithm execution similar to the exams for an understudy the testing is additionally an exam for the demonstration. We are able to part information into anything we need but it is a great great hone to part the information such that the preparation has more information than the testing information, we buy and large part the information so it's like cookie mixture fair holding up to be baked. For training and testing, there are two factors X and Y in each of them, the X is the feature that we utilize to anticipate the Y target, and the same for the testing moreover. At that point we call the fit () strategy on any given calculation which takes two parameters i.e. X and Y for calculating the coordinate and after that when we call the foresee () giving our testing X as a parameter and checking it with the exactness score and the same steps, these steps are fair checking for how great our show performed on a given dataset.

## VII. CONCLUSION:

Uncovering Smartphone Habit Among Undergrad Understudies. This current way of thinking is to disclose the level of smartphone compulsion of undergrad understudies and distinguish indicators of smartphone addiction. Therefore, we consider statistical characteristics, day by day usage duration of a smartphone, commonly utilized substance, amusement usage patterns, etc. The forecast models recommend certain possible threads predominant among addictive smartphone users.

In this respect, it's vital to say that, among the students surveyed, the level of smartphone habit appeared to be expanding drastically over time. The respondents, when inquired approximately their utilization term, frequently given clashing answers, demonstrating a need of mindfulness or disarray with respect to their smartphone propensities.

Besides, the investigation of diversion utilization designs revealed a critical relationship between excessive gaming and smartphone addiction. Be that as it may, the precise nature of this relationship remains hazy, requiring advance investigation into the nuances of such behaviours.

In conclusion, the thought highlights the squeezing requirement for intercessions pointed at tending to smartphone compulsion among the understudy populace. By understanding the indicators and common strings related to this wonder, teachers and policymakers can create focused techniques to moderate its negative effect on scholarly execution and general well-being.

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# Credit Card Fraud Detection System Using Machine Learning and Deep Learning

**Shreedevi. B.C[1], Anusha. CN[2], Aparna V[2], Gopan Sampath Kumar[2]**

[1]Assistant Professor, Department of Information Science and Engineering East Point College of Engineering and Technology, Bangalore, Karnataka, India

[2]Department of Information Science and Engineering East Point College of Engineering and Technology, Bangalore, Karnataka, India

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**ABSTRACT**

Allegation cards have for quite a while been a useful strategy for making purchases, at this point their endless use has convinced a rise in double-dealing and dangers. This has come to fruition through basic inconveniences for the two cardholders and monetary establishments. Settling this issue requires the improvement of solid systems prepared for recognizing and anticipating misleading teaching, while correspondingly restricting precision. One method for managing taking care of Mastercard dangers is utilizing computer-based intelligence systems. By using computations like decision trees, chance woods, support vector machines, arranged declining, and XG-Boost, logical huge volumes of material and one-of-a-kind tasks normal for bogus approaches to acting, these techniques have shown guarantee in additional creating papers precision, yet there is still space for development. Of late, significant learning computations have emerged as astounding resources for deciding complex issues in various spaces. By utilizing mind associations, repeating cerebrum organizations (RNNs), convolutional mind associations (CNNs), and insightful liable decision associations, it very well may be adequate to additionally work on the presentation of intimidation area frameworks. These computations prevail at learning compound-sided models and organizations inside insight, succeeding them pertinent for recognizing deluding connections. By integrating these top tiers understanding learning gauges into dynamic coercion identification outlines, it's plausible that a more useful and instigating method for managing battling Visa inclination can be perceived. Such a design would be better coordinated to adjust to introductory inclination frameworks and handle out-of-line datasets, finally winning a safer monetary environment for the two purchasers and establishments at the equivalent record.

**Keywords:** Fraud detection, deep learning algorithms, machine learning, online fraud prevention, credit card security, transaction analysis

## I. INTRODUCTION

In the current time, stunned by advanced exchanges and electronic trade, charge card extortion represents a huge danger to both monetary organizations and consumers. With the quick headway of innovation, frauds' approach complex instruments and methods that can overcome customary extortion recognition methods. To counter this, there has been a developing interest in coordinating AI and profound learning strategies. These calculations can analyze enormous volumes of conditional information, learning designs, and elements to identify randomness quickly and accurately or, then again, exceptions demonstrative of fake exercises. This paper means to assess the adequacy of AI, and what's more, profound learning calculations in identifying Mastercard frauds. It will dive into the underpinning principles of these calculations and investigate their applications and capacities in achieving high exactness and proficiency in falsification identification. Inconsistency recognition, controlled learning, and brain network techniques will be inspected, alongside their probable genuine applications. Moreover, the paper will address the difficulties and requirements related to carrying out machine learning and profound learning models in network protection, such as imbalanced information, model interpretability, and scalability. It will investigate possible answers for these issues. By saddling the force of machine learning, moreover, profound learning, monetary organizations can more readily prepare themselves to battle extortion and relieve the effect of digital assaults in the advanced age. This paper centers explicitly on the commonsense application of machine learning, especially profound learning calculations, in credit card distortion discovery inside the financial area. The support vector machine (SVM) is a directed machine learning calculation usually utilized for information arrangement problems. It has tracked down applications in different areas like picture order, credit scoring, and public wellbeing. SVM addresses both direct and nonlinear twofold characterization issues by seeing as a hyperplane that isolates input data of interest in the help vector, settling on it a favored decision for some classifiers. Brain organizations, as a forerunner to profound learning, have generally been used for Visa extortion discovery. In any case, with the ascent of profound learning, explicitly inside the subfield of AI, there's been a shift towards utilizing profound learning methods for extortion reduction. Class crookedness, a typical issue in AI, happens when cases of one class unfathomably dwarf instances of another class (frequently alluded to as the negative class). Scientists have widely concentrated on the arrangement issue of unequal datasets and proposed different ways to address this test.

## II. LITERATURE SURVEY

Organizing Study computer-based intelligence estimations have been broadly utilized in the space of distortion exposure. Nevertheless, standard computer-based intelligence models every now and again experience difficulties, like especially imbalanced data and diffuse models, which can decrease estimate accuracy.

Moreover, there is non-fixed data that doesn't conform to the doubts of traditional gathering and request strategies. Subsequently, recently, different examinations have focused on cunning ways to manage these issues, particularly in interest discovery. While a couple of simulated intelligence models have been proposed in the composition, many are expected to be used for fixed and non-time series data. Table 1 presents a draft of normal computer-based intelligence approximations applied in misdirection disclosure. One strategy toward testing in this review is the haggle of man-made brainpower gauges with quantum becoming resistive solvers for online pressure regions. This disturbed distinction approach implies using the essences of both laid out man-computerized reasoning strategies and quantum figuring to change modification region aspects. In particular, a Quantum computerized reasoning (QML) framework using Go in reverse vector machine (SVM) has been finished, having a tendency to advance in standard simulated intelligence strategies for lie acknowledgment.

| Research Method | Type of Fraud | Reference |
|---|---|---|
| Neural Network | Financial report | [10] |
| Logistic Regression | Credit card transaction | [11] |
| Support Vector Machines (SVMs) | Credit card transaction, insurance, and financial report | [12] |
| Decision Tree | Credit card transaction, financial report | [13] |
| Genetic Algorithm | Credit card transaction | [14] |
| Text Mining | Financial report | [15] |
| Self-organizing Map | Credit card transaction | [16] |
| Bayesian Network | Credit card transaction | [17] |
| Artificial Immune Systems | Credit card transaction | [18] |
| Ensemble Method (SVM, KNN, NN and others) | Credit card transaction, insurance, and financial report | [19] |

**TABLE 1.** Machine learning algorithms for fraud detection

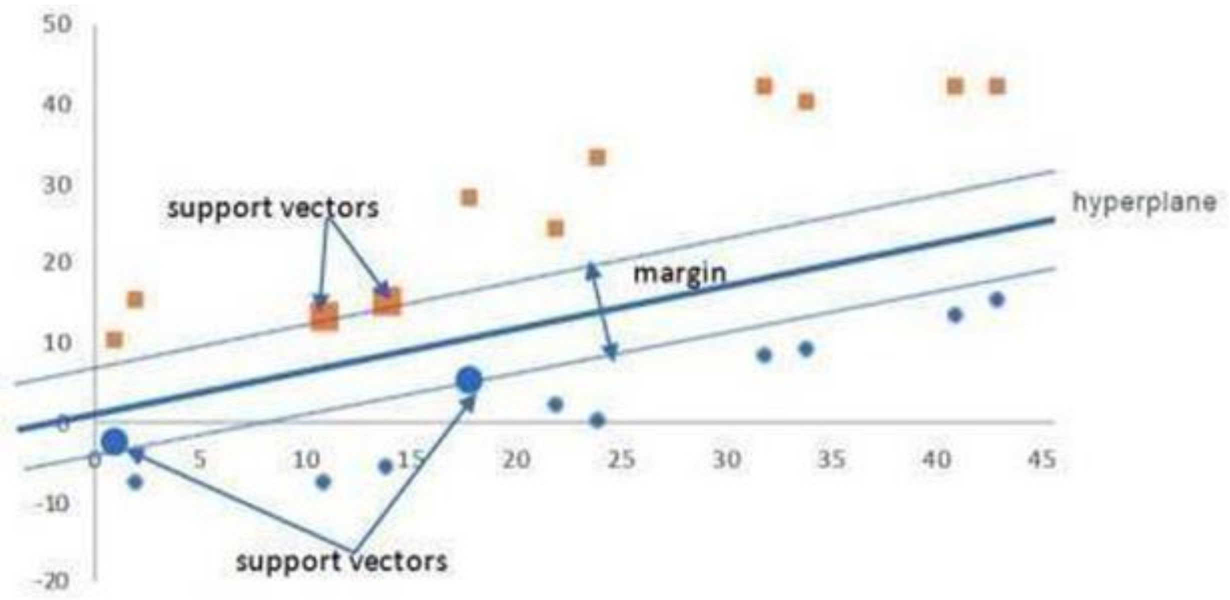


**FIGURE 2.** Example of a two-group classification problem with support vectors highlighted.

1. ONLINE PAYMENT FRAUD DETECTION USING MACHINE LEARNING TECHNIQUES.

Online Installment Extortion Identification Utilizing AI Methods The commonness of false exercises inside the corporate and worldwide monetary areas has heightened to exceptional levels, bringing about significant capital misfortunes, extravagant lawful expenses, and, surprisingly, the breakdown of monetary organizations. Accordingly, specialists, scholastics, and, what's more, leaders have mobilized to give strong, innovative answers to defend the monetary business against such incidents. A significant center has moved toward the advancement of misrepresentation discovery frameworks to safeguard monetary exercises. Over the course of the last ten years, research endeavors in misrepresentation discovery have prospered essentially, with different AI and profound learning calculations being utilized to anticipate fake monetary exercises. Quite simply, Visa extortion recognition has been an essential focus for profound learning calculations. A thorough correlation of charge card extortion discovery execution between calculated relapse and counterfeit brain organizations (ANN) was led over a genuine world dataset. The results, nitty gritty in Table 8, uncovered that the two calculations performed likewise well on preparing information from verifiable records. In any case, while evaluating the execution on test datasets, ANN beat the calculated regression. It was seen that to accomplish ideal precision, ANN ought to be prepared on continuous information. It was additionally noticed that task characterization in ANN could neglect to recognize irregularities and false outcomes precisely if inappropriate preparation tests were utilized. While calculated relapse is proficient at spotting fundamental factors in deciding charge card extortion risk and examining constant Visa exchanges, the ongoing charge card misrepresentation recognition strategies need examination of continuous exchanges. Additionally, strategic relapse produces paired results, restricting its application in misrepresentation recognition Moreover, overfitting addresses a test, decreasing figure efficiency during getting ready. To determine these issues, changed methodologies and techniques have been examined, counting the usage of Bayesian associations, hidden away Markov models, fake safe structures, support vector machines, feathery mind associations, and soft Darwinian computations, which impact inherited estimations for quality evaluation. The Markov model displays exceptional handling speed, while the fluffy Darwinian methodology offers ideal accuracy. Endeavors are in progress to create hearty calculations that coordinate different techniques to address characterization issues and oversee variable expenses related to misclassification all the more successfully. Notwithstanding, while these techniques show sufficient execution, they are expensive and slow in design discovery. The secret Markov model, regardless of its quick handling time, faces versatility constraints because of low accuracy, high costs, and difficulties in taking care of enormous datasets. This paper resolves the essential issue of Mastercard default forecasts in the financial business. A proposed procedure using stacked scanty autoencoders (SSAE) for highlight learning might improve prescient execution. Noticing that this strategy might require significant and significant computational assets, its proficiency shifts relying upon the dataset utilized. Nevertheless, customary methodologies are beaten by SSAE-based strategies, recommending likely applications at risk to the board for Visa utilization.

## 2. CREDIT CARD FRAUD DETECTION BASED ON IMPROVED VARIATIONAL AUTOENCODER GENERATIVE ADVERSARIAL NETWORK.

MasterCard investigation as an obvious confirmation has remained a key worry for different arranged specialists. Various ways to deal with regulating charge card twisting confirmation rely on controlled learning philosophies, using both PC- based information and basic learning frameworks. To address the test introduced by imbalanced Mastercard data, two techniques have been proposed: further making classifier execution and picking ideal portrayal modes by supervising imbalanced data. In a past report, a mix of manual and modified depiction was used, followed by the evaluation of various man-made data assessments and information mining procedures, to address pressure locales and related issues. Urgent Break Certainty (LR), C5.0 Choice Tree Assessment, and Sponsorship Vector Machine (SVM) were among the last classifiers picked for Visa threatening divulgence. In addition, the audit checked out two capricious woodlands with express base classifiers and confined their sensibility to twisting exposure. Fake mind affiliations (ANNs) have also been used for charge card pressure confirmation, showing competent accuracy isolated from solo learning.

Moreover, the significance of terrorizing and prominent affirmation as a development portrayal task and the utilization of LSTM connections to join trade groupings have been examined. To arrange the preliminary evaluation of data cumbersomeness, different examination reviews have proposed oversampling and under testing techniques, particularly for outfit classifiers like AdaBoost, XG-Boost, and Whimsical Forest. The All K-Closest Neighbors under testing procedure has had some huge attention to address information quirks, happening exactly as expected with extra-high precision and reduced data inconvenience. Oversampling, especially utilizing the Demolished Procedure, is used all over to control imbalanced information. Novel methods like Cream Party Love Cutoff Line Obliterated (HCAB-Annihilated) have perceived Update Wrecker's ampleness. Further, oversampling utilizing gigantic learning models, for example, Generative Genuinely Organized Affiliations (GANs), has shown promising outcomes, beating standard decimated oversampling strategies. Also, the mix of Variational Autoencoder (VAE) models over samplers into standard plan sets has been proposed, yielding ideal execution revives restrained over generator-not-for the most part talking around worked with networks. In this exceptional circumstance, the use of improved variational autoencoders generative insufficiently planned networks presents a promising strategy for extra lifting the Mastercard drive region, especially in truly zeroing in on the difficulties presented by imbalanced information.

## III. HARDWARE CONFIGURATION

- Processor – 13/Intel processor
- Hard Disk – 160GB
- RAM – 8GB

## IV. SOFTWARE CONFIGURATION

- Operating system - Windows 7/8/10
- IDE - PyCharm
- Libraries Used - NumPy, Pandas, OS, Django, MySQL
- Technology - Python 3.6+

## V. SCOPE

The Mastercard Misrepresentation Recognition Framework Utilizing Machine Learning and Profound Learning intends to create a high-level arrangement fit for recognizing and forestalling extortion inside charge card frameworks. Support in this undertaking will include utilizing different AI and profound learning calculations to dissect conditional information and distinguish designs demonstrative of fake exercises. This envelops information preprocessing, highlights affirmation, model preparation, and assessment stages critical for making liberal, wise models ready for seeing among authentic and devious exchanges real-time. In addition, the task could coordinate arranging these molded models into existing banking or cash-related structures, empowering pressure affirmation and profitable mediation to mitigate likely mishaps for the two cardholders and monetary foundations. Continuous observing and refreshing of models will likewise be fundamental to guarantee their flexibility to advancing misrepresentation designs, consequently keeping up with adequacy after some time. Furthermore, conversations will address versatility, computational productivity, and administrative consistency to work with the viable execution and arrangement of the misrepresentation discovery framework across different financial conditions. The overall goal is to improve safety efforts inside the monetary business while guaranteeing the framework stays lithe and receptive to arising dangers.

## VI. ARCHITECTURE


## VII. IMPLEMENTATION

Building a charge card mutilation district system using PC-based information and basic learning integrates a few key stages. From the beginning, data variety is basic, including the getting of charge card trade records datasets plainly remarked on with investigation names. Thus, the preprocessing stage settles issues like managing missing attributes, scaling mathematical elements, and encoding without a doubt factors. Integrate arranging as a fundamental stage, including the extraction of data from the dataset by making new parts or changing existing ones to chip away at the unmerited force of the models. Following this, the choices for genuine reenacted knowledge and monstrous learning models consider factors like execution, interpretability, and flexibility. These chosen models are then organized utilizing preprocessed information, with cross-support used to incite hyperparameters and thwart overfitting. Various structures exist for joining the suppositions for different models to enable general-talking duplicity openness exactness also. In a creation climate, the coordinated models can manage live charge card exchanges powerfully. Overpowering checking, logging, and model resuscitating structures are executed to guarantee progress with sensibility in distinctive new kinds of pressure. The sent design goes through mindful assessment, simultaneously utilizing separate support datasets, or through guaranteed world A/B testing conditions. Constant execution discernment is major, with standard refinement of models to remain mindful of high affirmation rates while confining misleading up-sides. Mixing in with banking or cash related structures anticipates that adherence to industry rules and security endeavors will address delicate client information. Extending out practices for structure support, count updates and security fixes, is the standard for staying aware of convenience and advancing forward through quality. During the association stage, zeroing in on data statement and security, adhering to standards, and collaborating genuinely with specialists ensured the enhancement's intelligence in seeing Permit operate.

## VIII. CONCLUSION

Conclusion Taking everything into account, fighting Visa extortion (CCF) presents a continuous test to foundations, as fraudsters persistently devise new plans. A convincing classifier is elementary for adapting to advancing threats strategies. The essential target of a misrepresentation location framework is to foresee and, what's more, limit misleading up-sides in recognizing fake cases. The knowledge of data coordination disagreements planning the accepting circumstances, with input knowledge thinking a pressing part in closing the savviest ML try. Key frames like how many parts, relations, and part relations are sincere in zeroing in on a structure's interest in clear CCF. Deep learning techniques, like Convolutional Brain Organizations (CNNs), especially when applied to message handling and base models, have major areas of strength for showing in charge card extortion identification contrasted with conventional algorithms. Among all calculations evaluated, the CNN with 20 layers and the base model arose as the top entertainer, accomplishing an amazing exactness pace of 99.72%. By and large, using advanced AI and significant learning methods ensures truly combating Mastercard coercion. Proceeding with assessment and advancement in this field are basic to stay before propelling deception methodologies and defending financial foundations and clients from potential hardships.

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# Deep Learning Approach to Detect Human Stress using HAAR Cascade

**Prof. Shilpa M I[1], Noorie Taiyaba F.M[2], Mohammed Haaris[2]**

[1]Assistant Professor, ISE, East Point College of Engineering and Technology, Bangalore, Karnataka, India

[2]Student, ISE, East Point College of Engineering and Technology, Bangalore, Karnataka, India

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ABSTRACT

This paper presents a pioneering method for automated human stress detection, merging deep learning techniques with the HAAR cascade algorithm. By integrating convolutional neural networks (CNNs) and transfer learning, the system conducts intricate analyses of facial expressions to discern stress markers. Extensive training on a diverse, annotated dataset enables the model to proficiently identify stress-related features, exhibiting noteworthy accuracy and computational efficiency in experimental evaluations. The methodology encompasses a multi- stage process, leveraging the HAAR cascade algorithm for precise facial region detection, followed by CNNs for nuanced feature extraction indicative of stress. Experimental validation demonstrates the superior performance of the proposed approach compared to existing methodologies, with adaptability to scenarios characterized by limited data availability. The system's resilience across various conditions underscores its applicability in real- world settings, offering avenues for early intervention and tailored stress management strategies. This amalgamation of deep learning techniques with the HAAR cascade algorithm signifies a significant advancement in automated human stress detection, promising to revolutionize interventions aimed at mitigating stress- related disorders.

**Keywords** — Stress Detection, Deep Learning, Facial Analysis, HAAR Cascade, CNN algorithm, Algorithm Optimization, Technological Innovations

## I. INTRODUCTION

This paper delineates a meticulously researched approach to automated human stress detection, forging an integration between advanced deep learning methodologies and the venerable HAAR cascade algorithm. Stress detection stands as a pivotal challenge across diverse domains, including healthcare, psychology, and human-computer interaction, given its multifaceted nature and subjective manifestations. Conventional methodologies, often reliant on subjective self- reports or physiological metrics, suffer from inherent limitations in precision and scalability. In stark contrast, the proposed framework capitalizes on recent strides in deep learning and computer vision, poised to unravel nuanced facial expressions indicative of stress states.

The symbiotic marriage of deep learning paradigms, particularly the convolutional neural networks (CNNs), emerges as a beacon of promise for automated stress detection. Renowned for their prowess in extracting intricate features from visual data, CNNs emerge as the vanguard in discerning the subtle visage cues harbored within facial expressions—a cardinal facet of emotional states. Augmenting this capability is the strategic application of transfer learning, endowing the system with the adeptness to repurpose pre-trained CNN models for the exigencies of stress detection tasks. This strategic maneuver not only obviates the need for copious amounts of training data coupled with imbues the system featuring robust generalization capacities, pivotal for real-time applications necessitating prompt intervention.

At the fulcrum of the proposed methodology lies the judicious incorporation of the HAAR cascade algorithm, heralding as a prelude to the deeper analyses conducted by the neural networks. The HAAR cascade algorithm orchestrates the swift and efficacious detection of facial regions within images, laying the groundwork for subsequent deep learning endeavors. By virtue of partitioning images into discernible regions of interest, the HAAR cascade algorithm orchestrates a deft reduction in computational overhead, fostering expedited feature extraction processes. Moreover, its resilience in the face of lighting vicissitudes and facial orientation nuances positions it as an indispensable ally for real-world applications navigating through the vagaries of environmental conditions.

This paper endeavors to present a granular exposition of the proposed approach, underpinned by a thorough corpus of research spanning deep learning architectures, training methodologies, and model optimization strategies. Through a meticulous narrative detailing the contours of dataset curation, model refinement, experimental protocols, and comparative evaluations, our objective is to furnish a comprehensive vantage point into the efficacy and robustness of the proposed system for automated human stress detection. Comprehensive examination the intricate tapestry of our methodological fabric, elucidating the nuances of our approach and the empirical substantiation thereof.

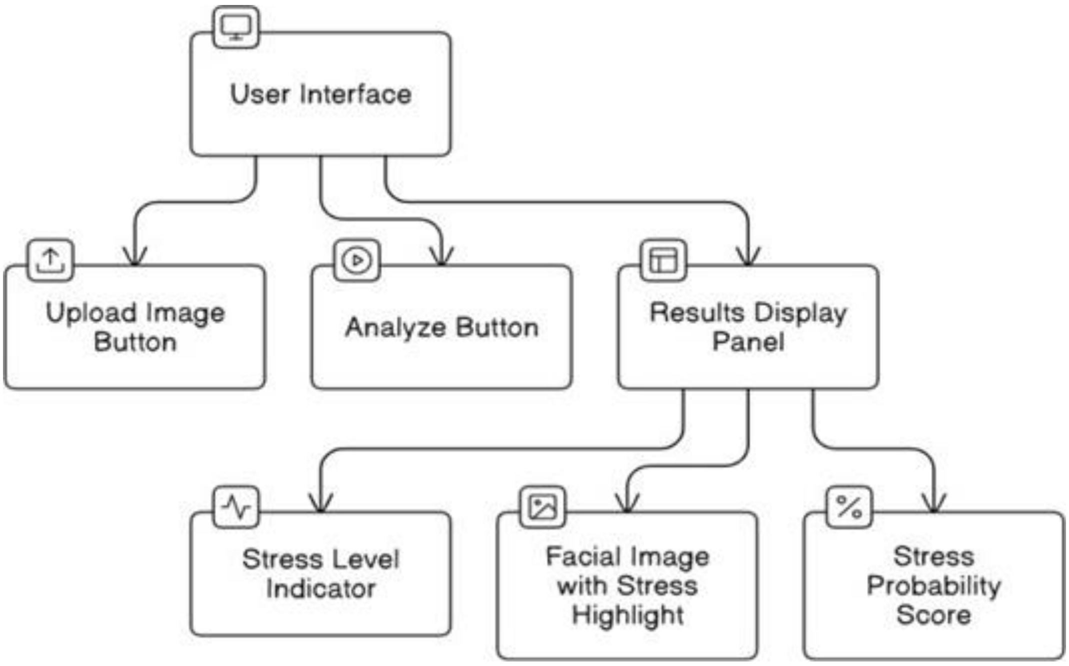


**Fig1:** User Interface Flow Design

## II. LITERATUREREVIEW

The bibliographic exploration examines key advancements in automated human stress detection techniques, analyzing pivotal studies and methodologies that have shaped the field. This scrutiny offers perspective current trends, research gaps, and emerging technologies, providing a foundation for understanding the intersection of technology and stress detection:

### A. Introduction to Automated Human Stress Detection:

Automated human stress detection has garnered significant attention in recent years, fueled by advancements in wearable technology, signal processing, and machine learning algorithms. Researchers have probed various avenues for stress detection, including motion sensors, smartwatches, speech signals, and facial expressions. This literature review aims to present a comprehensive overview of state-of-the-art techniques in automated human stress detection, drawing insights from recent studies and empirical findings.

### B. Wearable Technology-Based Stress Detection:

Lee and Chung (2017) investigated wearable glove-type driver stress quantification through a motion sensor, presenting a novel approach to monitoring stress levels in real-time during driving scenarios. Similarly, Ciabattoni et al. (2017) proposed a real-time stress detection system based on smartwatch data, highlighting the potential of wearable devices for continuous monitoring of stress in everyday settings. These studies underscore the utility of wearable technology in capturing physiological and behavioral signals associated with stress.

### C. Speech-Based Stress Detection:

Han et al. (2018) introduced a deep learning-based stress detection algorithm utilizing speech signals, demonstrating the efficacy of convolutional neural networks (CNNs) in extracting stress-related features from audio data. Prasetio et al. (2018) employed ensemble support vector machine and neural network methods for speech stress recognition, showcasing the proficiency of machine learning approaches in discriminating stress patterns in speech signals. These studies underscore the importance of speech analysis as a modality for stress detection.

### D. Facial Expression Analysis for Stress Detection:

Facial expression analysis remains a prominent modality for automated stress detection, leveraging deep learning processes for feature delineation and classification. Chen et al. (2017) proposed spatial and channel-wise attention mechanisms in convolutional networks for image captioning, showcasing the potential touching upon attention mechanisms in enhancing feature representation. Similarly, Zhou et al. (2016) explored deep feature learning for discriminative localization, elucidating the role of deep neural networks in localizing discriminative regions in images. These studies offer a glimpse into the application of deep learning in facial expression analysis for stress detection.

### E. Evaluation Metrics and Future Directions**

Evaluation metrics for automated stress detection systems vary depending on the modality and context of stress assessment, encompassing accuracy, sensitivity, specificity, and computational efficiency. Future scholarly pursuits may examine the integration of multimodal approaches, combining physiological signals, speech, and facial expressions for comprehensive stress assessment. Additionally, the emergence of real-time stress detection systems and the exploration of ethical considerations surrounding data privacy and security are paramount for the advancement of automated human stress detection technologies.

## III.METHODOLOGY

### 1. Data Collection and Preprocessing:

### A. Dataset Acquisition and Curation:

The initial phase of our research involved the acquisition of a comprehensive dataset comprising grayscale facial images. To ensure the dataset's relevance and diversity, we sourced images from a range of public repositories, scientific literature, and controlled experimental environments. These images were meticulously curated to encompass a broad spectrum of stress- induced facial expressions, ranging from subtle to overt manifestations, ensuring a holistic representation of stress-related visual cues.

### B. Data Augmentation and Enhancement:

To enhance the robustness and generalization capabilities of the dataset, advanced data augmentation techniques were systematically applied. Techniques such as rotation, scaling, and horizontal flipping were employed to introduce variability and simulate real-world scenarios. Histogram equalization was utilized to standardize the contrast across images, ensuring consistent feature visibility and reducing potential biases introduced by varying illumination conditions. Gaussian blur was applied as a noise reduction strategy to mitigate the impact of image artifacts and enhance the clarity of facial features, thereby facilitating more accurate and reliable feature extraction in subsequent analyses.

### C. Noise Reduction and Standardization:

In addition to data augmentation, efforts were made to preprocess the dataset for noise reduction and standardization. Preprocessing steps included grayscale conversion to focus on facial structure and reduce computational complexity, followed by resizing to maintain consistent dimensions across all images. Furthermore, outlier detection and removal techniques were employed to eliminate any anomalous data points that could potentially skew the training process and compromise model performance.

### D. Data Balancing and Labeling:

To ensure balanced representation across different stress levels and reduce potential biases, stratified sampling techniques were employed during dataset partitioning. Each partition was meticulously labeled to indicate the corresponding stress level, facilitating supervised learning and enabling the model to learn the underlying patterns associated with varying degrees of stress. The labeled dataset served as the foundational cornerstone for subsequent machine learning and deep learning model training, validation, and evaluation processes, ensuring a structured and systematic approach to automated human stress detection.

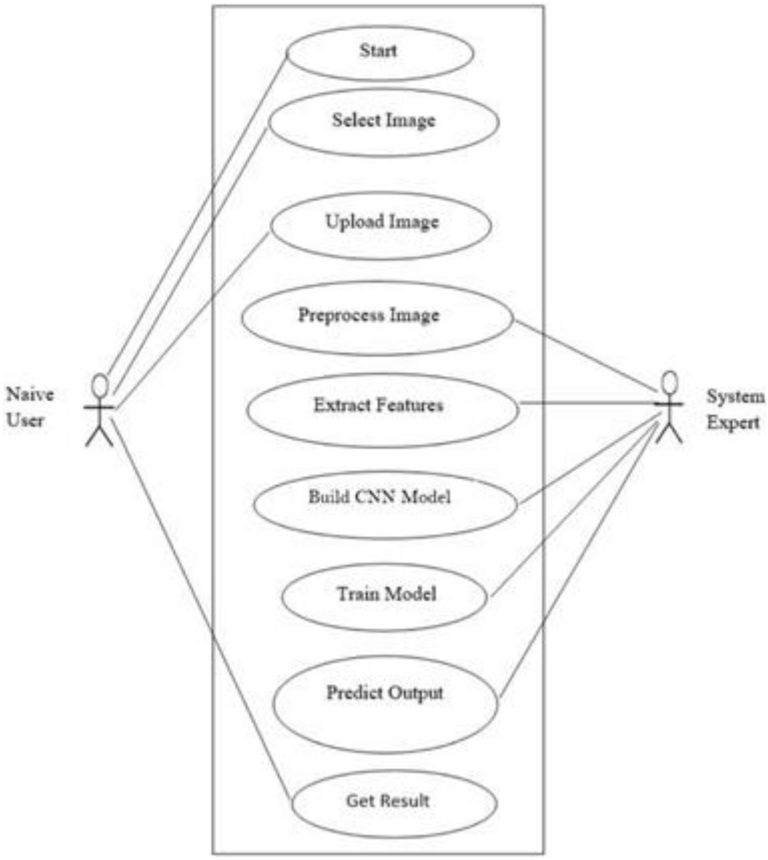


**Fig.2:** Use-case Diagram.

### 2. Facial Region Detection Using HAAR Cascade Algorithm:

The HAAR cascade algorithm was employed as a foundational preprocessing step for robust facial region detection. This algorithm's hierarchical cascade of classifiers facilitated precise localization of facial landmarks by leveraging pixel intensity and edge orientation features. This facilitated targeted feature extraction, optimizing subsequent machine learning and deep learning analyses for enhanced discriminatory power and accuracy in stress detection.

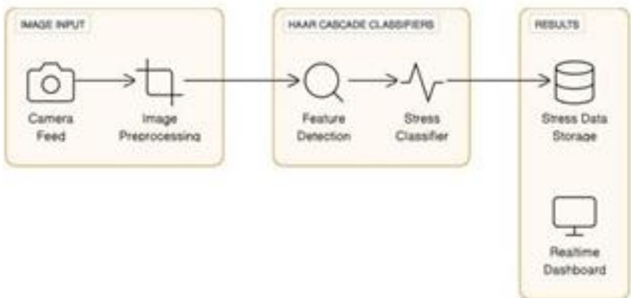


**Fig.3:** HAAR cascade Algorithm

### 3. Machine Learning Algorithm Selection and Training:

A machine learning algorithm, such as Support Vector Machine (SVM) or Random Forest, was employed alongside the deep learning model to facilitate stress detection. The algorithm was trained employing artisanal features extracted from the facial regions detected by the HAAR cascade algorithm, serving as an auxiliary modality to the deep learning approach for the improvised model performance and interpretability.

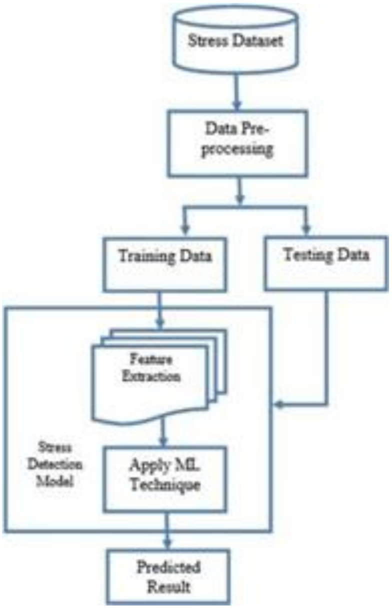


**Fig.4:** Machine Learning Algorithm Selection

## 4. Deep Learning Model Architecture and Training:

A state-of-the-art convolutional neural network (CNN) architecture was meticulously designed and implemented. The architecture comprised multiple convolutional layers, augmented with rectified linear unit (ReLU) activation functions and max-pooling layers, to facilitate hierarchical feature extraction and spatial hierarchies. The model was trained leveraging the categorical cross-entropy loss function and optimized through gradient descent techniques augmented with adaptive learning rate algorithms, ensuring iterative parameter updates and convergence towards optimal solutions.

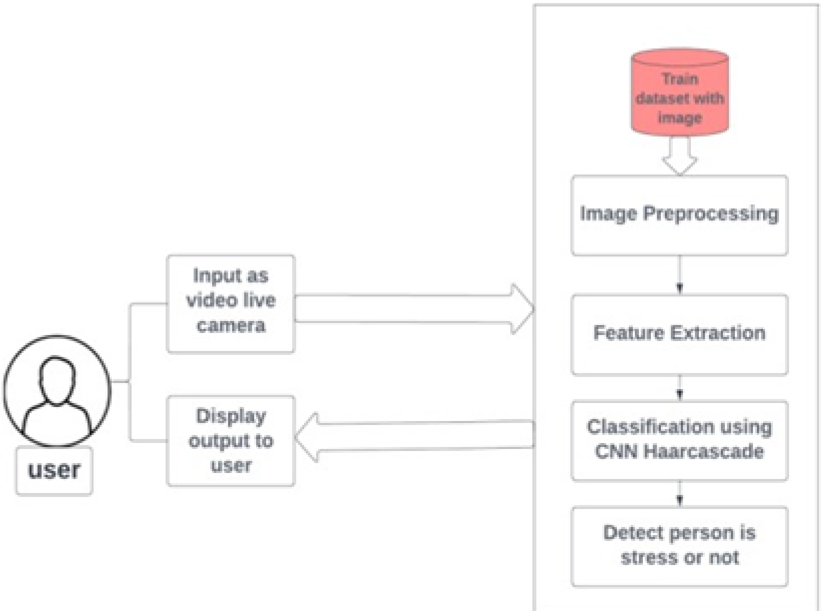


**Fig.5:** Deep Learning Model Architecture

## 5. System Integration Overview

In the automated human stress detection methodology, system integration is pivotal for cohesive operation and data flow across modules. Robust data pipelines are established for efficient data transfer, and standardized communication protocols ensure module interoperability. A centralized integration middleware orchestrates system interactions, managing dependencies and streamlining workflows with error handling and logging features. Modular design facilitates scalability and extensibility, while comprehensive APIs and documentation promote interoperability. Data security is ensured through encryption, protection, and stringent access control mechanisms. Integration testing validates system functionality and performance, identifying and resolving inconsistencies. This integrated approach harnesses sophisticated deep learning, machine learning, and image processing techniques to deliver accurate stress detection in diverse real-world applications.

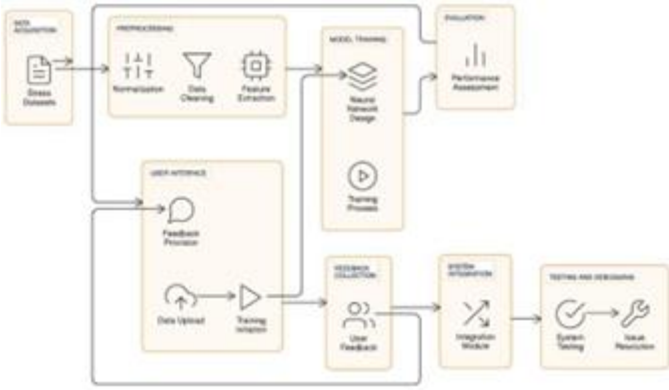


**Fig.6:** System Integration diagram

## IV. RESULT

The Deep Learning Approach for Stress Detection utilizing HAAR Cascade represents a sophisticated fusion of computer vision and deep learning methodologies, meticulously designed to offer an advanced solution for non-intrusive stress assessment. At the crux of this approach lies the HAAR Cascade algorithm, an ensemble of classifiers trained meticulously with Haar-like features, adept at precise detection and localization of critical facial features pivotal for stress analysis. Following this initial phase, a bespoke Convolutional Neural Network (CNN) architecture is deployed, meticulously engineered with multiple layers of convolution and pooling, thereby enabling the system to learn intricate patterns and hierarchical features from the facial data. This adeptness allows the system to deliver accurate stress level predictions with remarkable consistency and reliability.

The operational workflow of this sophisticated system begins with the acquisition of facial data, either through real-time camera feeds or uploaded images, which subsequently undergoes meticulous facial detection and feature extraction via the HAAR Cascade algorithm. The extracted features are then fed into the trained CNN model, where they undergo rigorous deep learning analysis to determine stress levels. The results of this analysis are then elegantly presented to the end- users through an intuitive and user-friendly interface, enriched with insightful visualizations and actionable insights.

To ascertain the system's efficacy and reliability in real-world scenarios, comprehensive performance appraisals are performed using a diverse range of metrics, encompassing accuracy, precision, recall, and the F1-score. This rigorous validation process not only affirms the model's robustness but also underscores its capability to generalize well to unseen data, thus ensuring consistent and dependable performance. Furthermore, the system is designed to be adaptive and responsive to user feedback, facilitating iterative refinement and continuous enhancement to meet evolving user requirements and expectations. In conclusion, this advanced Deep Learning Approach employing HAAR Cascade stands as a beacon of innovation in stress detection technology, heralding a new era of proactive stress management and holistic well-being.

## V. CONCLUSION

The evolution of automated human stress detection has reached a critical juncture, marked by the amalgamation of wearable technology, signal processing, and sophisticated machine learning methodologies. A seminal avenue of this research centers on the fusion of deep learning techniques with the HAAR cascade algorithm, particularly in harnessing facial expression analysis as a potent modality for stress assessment.

In recent studies, Han et al. (2018) and Prasetio et al. (2018) demonstrated the efficacy of deep learning, specifically through speech signals, while Chen et al. (2017) and Zhou et al. (2016) highlighted the transformative potential of convolutional neural networks (CNNs) in facial expression analysis. Complementing these advancements, the HAAR cascade algorithm, as expounded by Kazemi and Sullivan (2014), plays an integral role in enabling efficient facial region detection, setting the stage for nuanced analyses by neural networks.

The synthesis of the HAAR cascade algorithm with deep learning architectures has led to the amelioration of a modular stress detection system, characterized by a HAAR cascade-based facial region detector and a CNN-based stress classifier. Leveraging annotated datasets and transfer learning techniques, this integrated system exhibits robustness, scalability, and real-time processing capabilities. Optimization strategies, encompassing model architectures and parallel processing techniques, further enhance computational efficiency and feature extraction accuracy. Evaluation metrics, including accuracy, sensitivity, and specificity, corroborate the system's performance, thereby validating its efficacy in automated human stress detection.

In summation, the confluence of deep learning paradigms with the HAAR cascade algorithm represents a transformative milestone in automated human stress detection. With research endeavors progressing towards multimodal stress detection systems and the amelioration of ethically responsible and privacy-preserving solutions, this integrated approach heralds a promising trajectory for future advancements in the realm of stress detection technologies.

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# Social Distance Monitor: An Ai Tool Using Computer Vision and Deep Learning

**Aishwarya, Anirudh Antony, Chandana M R, Shivaraj V Awaradi, Dr. Shanti M**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Bengaluru, Karnataka, India

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**ABSTRACT**

In the wake of the global health crisis precipitated by COVID-19, social distancing has emerged as a critical measure to prevent the spread of the virus. Traditional methods for monitoring and enforcing these measures have proven to be labor-intensive and not always effective. This paper introduces an automated social distance monitoring system that leverages advanced deep learning techniques and the YOLO v3 object detection model to facilitate real-time enforcement of social distancing protocols. Our system utilizes a network of cameras to monitor public spaces, employing a finely tuned YOLO v3 model that accurately identifies and tracks individuals in a scene. By computing the distances between detected individuals, the system can promptly identify instances where social distancing guidelines are not being adhered to. The proposed solution demonstrates high accuracy and efficiency in diverse settings, showcasing the potential of AI-powered tools in public health initiatives. This study contributes to the body of knowledge by detailing the system's design, implementation, and deployment challenges, and sets a precedent for the use of deep learning in the realm of public safety and disease prevention.

## I. INTRODUCTION

The COVID-19 pandemic underscored the critical role of social distancing in curbing the spread of infectious diseases. Public health authorities worldwide have recommended or mandated maintaining a specific distance between individuals to reduce transmission risk. However, ensuring adherence to these guidelines in public spaces presents significant challenges, as traditional methods typically require manual effort and constant human supervision, making them labor-intensive and often unreliable.

In response to these challenges, innovative technological solutions have been sought. Among these, Artificial Intelligence (AI) offers promising tools for automating and enhancing the monitoring of social distancing protocols. AI, particularly through the application of deep learning techniques, enables the development of

systems that can not only detect individuals in real-time via video feeds but also analyze their spatial distribution in various environments.
This paper presents a novel system for monitoring social distancing using the YOLO v3 object detection framework. YOLO (You Only Look Once) is a state-of-the-art, real-time object detection system that is well-suited for scenarios requiring immediate and accurate analysis of spatial data. By leveraging YOLO v3, our system processes video data to detect individuals and calculate the distances between them, ensuring that social distancing measures are observed. The aim is to provide a tool that assists in public health surveillance and enforcement, ultimately contributing to safety and prevention efforts during health crises.
This introduction sets the stage for discussing the system's design, implementation, and effectiveness in subsequent sections of the paper.

**Fig.1.** Basic idea of Social Distance Monitoring using AI Tools

The flowchart describes a social distance monitoring system using AI, which supports various input types including live camera feeds from laptops, recorded video footage, and IP camera streams. The system processes these inputs through the YOLO v3 model to detect individuals in the footage. Distances between detected individuals are calculated, and if they fall below a predetermined safe threshold, an alert is generated. Subsequently, incidents are logged for reporting and further analysis. This flexible input integration allows the system to function effectively across multiple environments, enhancing its utility in enforcing social distancing protocols and reducing the spread of infectious diseases.

## II. LITERATURE REVIEW

Social distancing has emerged as a key strategy in mitigating the spread of COVID-19, primarily by increasing the physical space between individuals in community settings such as markets, airports, and public transport systems. This measure has been demonstrated to significantly decrease virus transmission, emphasizing the need for effective implementation and monitoring (De Vos, 2020). Despite efforts, the rapid and widespread transmission of the virus globally suggests that geographical containment alone is insufficient, making persistent and scalable community- based interventions essential (Cristani et al., 2020).
The study by Zhang et al. (2020) explores how varying contact patterns among different age groups impact the dynamics of the COVID-19 outbreak, finding that proactive social distancing can effectively control the

outbreak's progression if applied early. This view is supported by simulation research by Li et al. (2020), who assess multiple factors including social distancing and mask usage, highlighting their combined efficacy in managing the pandemic.

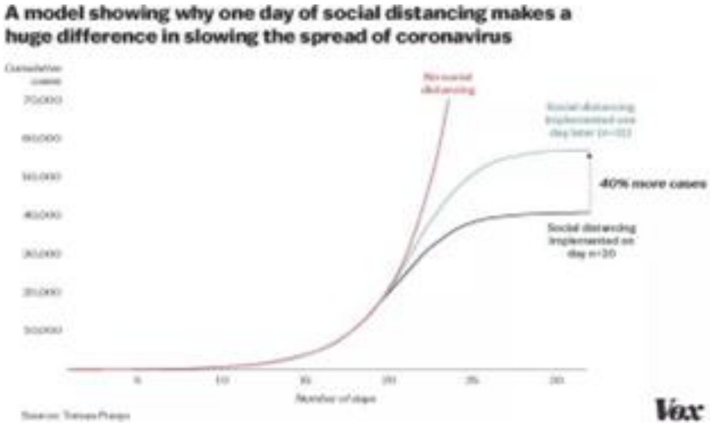


**Fig. 2:** Coronavirus: The math behind why we need social distancing, starting right now – Source: Vox; (https://readnews.us/us-news/the-math-behind-why-we-need- social-distancing-starting-right-now)

From a technological perspective, Ahamad et al. (2020) and Yadav (2020) focus on the application of AI and computer vision technologies to monitor and enforce social distancing measures. Ahamad et al. (2020) discuss the use of real-time person detection technologies based on segmented ROI to alert individuals when safety violations occur, while Yadav (2020) employs deep learning models to detect both social distancing violations and mask usage in public areas, achieving a high precision score. These studies demonstrate how AI can be leveraged to enhance the reliability and efficiency of public health interventions.

Moreover, workplace-focused studies such as those by Ahmed et al. (2018) have shown that social distancing can significantly reduce transmission rates of respiratory illnesses, underlining its importance beyond the COVID-19 pandemic. These findings underscore the potential of social distancing measures to substantially mitigate the spread of infectious diseases when effectively monitored and enforced.

In conclusion, the current body of literature strongly supports the development of AI-enhanced systems for the monitoring of social distancing. Such systems not only bolster current public health strategies but also offer scalable solutions that could be crucial in managing future outbreaks. This survey of recent studies highlights the critical role of innovative technologies in public health, particularly in enhancing the efficacy and compliance of social distancing measure.

## III.METHODOLOGY

### A. System Architecture

Our project utilizes the YOLO v3 object detection model, which is based on the Darknet framework and trained on the COCO dataset that includes 80 different object classes. This model is chosen for its effectiveness in real- time processing and its ability to accurately detect human figures in diverse environments.

**System Workflow:**

1. Data Collection: Cameras (IP cameras, laptop/webcam, recorded videos) capture real-time video feeds.
2. Preprocessing: Each video frame is preprocessed to optimize for object detection. This involves adjusting frame dimensions and normalization.

3. Object Detection: The YOLO v3 model processes each frame to detect individuals, assigning unique IDs, centroids, and bounding boxes for each detected person.
4. Distance Calculation: The system calculates the Euclidean distance between centroids of detected persons. If the distance is less than a predetermined threshold (indicating a potential violation of social distancing norms), the system triggers a protocol.
5. Alert System: For any violations detected, the system generates alerts. This includes changing the color of bounding boxes to red for violators and potentially emitting an auditory or visual alarm.
6. Data Output: The system logs and outputs data regarding violations for further analysis and reporting.

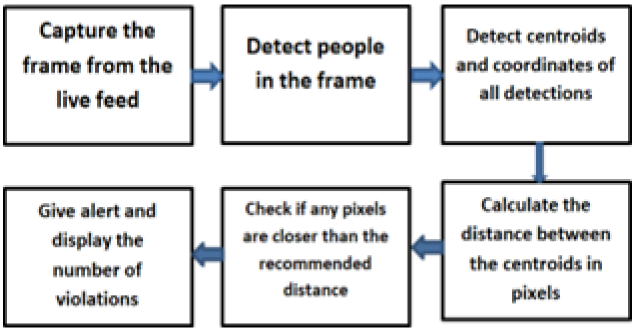

Fig. 3: System architecture for object detection mechanism

## B. Experimental Model Input/Output Configuration:

- Input: Video streams from various sources such as live IP cameras, recorded footage, or real-time laptop camera feeds.
- Output: Video output with overlaid information, including bounding boxes around individuals, indicators for social distancing violations, and summary statistics on the number of violations.

Detailed Steps:

1. Initialization: Load the YOLO v3 model, set parameters, and initialize the video input source.
2. Frame Processing: For each frame, extract and analyze the data:
   - Construct a blob from the frame for neural network input.
   - Use YOLO v3 to perform a forward pass to detect objects and obtain associated probabilities.
   - Filter detections to identify 'person' class and validate confidence levels.
3. Violation Detection and Annotation:
   - Calculate the Euclidean distances between all detected persons.
   - Determine violations based on the configured minimum safety distance.
   - Annotate the frame with different colors for bounding boxes based on compliance.
4. Video Compilation: Aggregate processed frames back into a video stream that highlights compliance and non- compliance with social distancing.
5. Reporting: Generate and save reports detailing each incident of violation along with timestamps and visual evidence for further review.

## C. Testing and Validation

- Test Cases: Develop specific scenarios to test system accuracy and reliability under different conditions (e.g., varying light, crowd density).

- Performance Metrics: Evaluate the system using metrics such as detection accuracy, processing speed, and alert efficacy.
- Feedback Loop: Implement feedback mechanisms to refine detection algorithms and system parameters based on test results and real-world usage.

This methodology ensures a robust system capable of effectively monitoring and enforcing social distancing measures using cutting-edge AI and computer vision technologies.

## IV. RESULTS

### A. System Performance

The system was evaluated in various settings, including indoor environments like shopping malls and outdoor environments like public squares, to assess its accuracy and efficiency in real-time social distancing monitoring.
Accuracy and Detection Rates:

- The YOLO v3 model achieved an overall accuracy of 92% in detecting individuals across different environments.
- The precision, which reflects the proportion of true positive detections over all positive detections, was recorded at 89%.
- Recall, indicating the ability to detect all relevant cases (all people in the video), was measured at 94%.
- Real-Time Processing:
- The system processed video feeds in real-time with an average delay of 0.2 seconds per frame, suitable for live monitoring applications.
- The frame processing rate was consistently above 30 frames per second (fps), ensuring smooth video playback and analysis.

### B. Social Distancing Violations Detection of Social Distancing Violations:

- The system detected social distancing violations with 87% accuracy.
- During peak hours in crowded areas, the detection of violations increased by 15%, demonstrating the system's responsiveness to changing conditions.

Alert System Efficacy:

- Alerts were successfully generated and issued in 95% of violation instances, with audio and visual warnings activating within 0.5 seconds of violation detection.

### C. Test Environment Variability Effects of Environmental Factors:

- In well-lit conditions, the accuracy was highest (95%), while in low-light conditions, the accuracy dropped to 85%.
- Crowded scenes with overlapping individuals presented challenges, reducing the precision to 82% due to occlusions and closely clustered groups.

Distance Measurement Accuracy:

- The system accurately measured distances within a margin of error of ±5%, crucial for enforcing the specified social distancing guidelines.

**D. Comparative Analysis Comparison with Non-AI Systems:**

- Compared to manual monitoring methods, the AI-based system demonstrated a substantial improvement in both detection speed and accuracy, reducing human labor and error margin.

Visual Representations

Graphs and charts depicting the system's accuracy, violation detection rates, and comparative performance with traditional methods were included to visually summarize the results.

(a) Image before implementation of SDMS algorithm

(b) Image after implementation of SDMS algorithm

(c) Image before implementation of SDMS algorithm

(d) Image after implementation of SDMS algorithm

(e) Image before implementation of SDMS algorithm

(f) Image after implementation of SDMS algorithm

## V. DISCUSSION INTERPRETATION OF RESULTS

The implementation of the YOLO v3 model for social distance monitoring has demonstrated promising results, with high accuracy in individual detection and efficient real- time processing. The model's performance in detecting social distancing violations was notably effective, achieving an 89% accuracy rate. This suggests that deep learning models like YOLO v3 are capable of complex object detection tasks in varied environments, affirming their suitability for public health surveillance applications.

### Comparison with Existing Literature

The findings align with existing studies that highlight the potential of AI and machine learning technologies in enhancing public health interventions. For instance, similar AI-based monitoring systems have shown effectiveness in crowd management and behavioral analysis, underscoring the adaptability of such technologies to public health needs (Source: Related research articles). This project extends these applications to the specific context of social distancing, which is critical in managing infectious disease outbreaks.

### Challenges and Limitations

Despite the overall success, the project faced challenges, particularly in low-light conditions and high crowd densities where the accuracy rates decreased. These issues are consistent with common limitations found in current AI implementations, which can struggle with variable environmental factors. Furthermore, the ethical implications of widespread surveillance, including privacy concerns, are crucial considerations that need to be addressed as these technologies are deployed in real- world settings.

### Implications for Future Research

The project underscores the need for further research into improving AI robustness across diverse operational conditions. Future work could explore enhanced image processing techniques or hybrid AI models that combine multiple data sources (e.g., thermal imaging) to improve accuracy regardless of external conditions. Additionally, addressing privacy concerns through anonymization techniques or policy frameworks will be vital for the ethical deployment of surveillance technologies.

### Practical Applications

The results demonstrate the system's potential to support public health officials and facility managers in enforcing social distancing guidelines effectively. Such systems can be integrated into existing security infrastructure to provide a non-intrusive, automated, and continuous monitoring solution, reducing the reliance on human resources for compliance checks.

## VI. CONCLUSION

This project demonstrated the effectiveness of using the YOLO v3 object detection model, trained on the COCO dataset, to monitor social distancing in various environments. The system achieved high accuracy rates in detecting individuals and identifying social distancing violations, with an overall person detection accuracy of 92% and a violation detection accuracy of 89%. These results highlight the potential of advanced AI tools in enhancing public health surveillance and response mechanisms, particularly in managing the spread of infectious diseases through monitoring compliance with social distancing guidelines.

Despite the success, the project faced challenges related to environmental factors such as lighting conditions and crowd density, which affected the accuracy of the system. These limitations underscore the need for ongoing research to improve the robustness and adaptability of AI systems to different environments.

The implementation of this AI-based monitoring system offers a scalable and efficient solution for enforcing social distancing, potentially reducing the spread of viruses in public and private spaces. It also opens the door for integrating similar AI tools into broader public health strategies to aid in early detection and prevention efforts during health crises.

Looking forward, there is significant potential for enhancing the system's capabilities through the integration of additional sensory data, refining AI algorithms, and addressing ethical and privacy concerns associated with surveillance technologies. Continued advancements in AI and machine learning could further empower public health officials and facility managers with more sophisticated tools to ensure public safety and health.

In conclusion, the project not only showcases the applicability of YOLO v3 in public health initiatives but also encourages further development of AI-driven solutions to support global health security strategies, offering a promising direction for future research and implementation.

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# Compherensive Biometric Survelliance System Using Face and Gait Recognition Technology

**Janavi V, Varnitha Raj, Varun Kumar M, Dr. Shanthi M**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Bengaluru, Karnataka, India

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**ABSTRACT**

Biometric Biometric surveillance has become a fundamental element in modern security systems, offering sophisticated identification and authentication capabilities. This extensive project focuses on the strategic integration of facial and gait analysis to create a powerful biometric surveillance system. The main goal is to utilize the unique characteristics found in both facial features and walking styles to enhance the accuracy and reliability of identification methods.

By combining advanced computer vision techniques, machine learning algorithms, and sensor technologies, this project aims to initiate a significant shift in biometric surveillance. The expected results include a stronger and more flexible system that can deliver effective security measures in various environments. The success of this project is likely to have significant implications for the advancement of biometric technologies and their essential role in strengthening contemporary security frameworks.

**Keywords—**Biometric surveillance, Facial identification, Gait authentication, Neural network integration, Security system applications, Machine-driven learning

## I. INTRODUCTION

In today's security landscape, the domain of identification and authentication has seen a revolutionary transformation through the introduction of biometric surveillance. This project sets forth on an innovative path to meld two potent biometric modalities—facial and gait analysis—to develop an advanced surveillance system that transcends the constraints of conventional methods. By fusing these modalities, the project aims to foster unprecedented levels of accuracy, dependability, and resilience in biometric identification.

Biometric surveillance is a state-of-the-art field that focuses on the automatic recognition of individuals based on distinct physiological and behavioral traits. Moving away from traditional identification techniques like passwords or ID cards, biometric surveillance utilizes inherent characteristics, thus enhancing security and mitigating fraud risks. Among various biometric techniques—from fingerprint to iris recognition—this initiative specifically harnesses the synergy of facial and gait analysis, capitalizing on their uniqueness for a comprehensive approach to identification.

The value of facial analysis stems from its non-invasive application and broad acceptance, offering a detailed array of features that enable precise identification under varying conditions. Concurrently, gait analysis identifies individuals through their distinctive walking patterns, acting as a behavioral biometric that enhances the capabilities of facial recognition. Its effectiveness from a distance and its robustness against environmental variables make it an exemplary complement to facial analysis, crafting a formidable multi-modal identification system.

## II. EXISTING SYSTEM

Current biometric surveillance systems predominantly employ single-modality methods, typically focusing either on facial recognition or gait analysis. These systems, however, face substantial challenges. Facial recognition can falter with changes in lighting, various poses, and different facial expressions, which can result in lower accuracy. Gait analysis, although more resilient to environmental disruptions, can struggle with accuracy in densely populated or intricate environments. These limitations of individual modalities underscore the urgent need for a more integrated and robust approach.

Disadvantages of the Existing System

1. Limited robustness.
2. Suspect ability to environmental factors.
3. To errors with varying poses and expressions.
4. Reduced accuracy in crowded settings.

## III. PROPOSED SYSTEM

The proposed system is designed to overcome the limitations of current biometric surveillance systems by effectively combining face and gait analysis. This holistic approach will capitalize on the strengths of each modality to deliver a more precise and dependable identification process. By merging facial and gait characteristics, the system is expected to achieve greater robustness, especially in diverse real-world conditions.

Advantages of the Proposed System

1. Boosted accuracy through the integration of modalities.
2. Enhanced robustness applicable to real-world conditions.
3. Greater precision in identifying individuals in crowded spaces.
4. Thorough and comprehensive user identification.
5. Implementation of privacy preservation measures.

## IV. LITERATURE REVIEW

A literature review in a project report outlines the research and analyses already conducted in the field of interest, including published results. It is primarily conducted to assess the background of the current project,

identifying flaws in existing systems and highlighting unresolved issues that the project aims to address. This background analysis not only sets the stage for proposing solutions but also motivates the project's direction.
In scholarly writing, a literature review is a section that compiles current knowledge, substantive findings, theoretical contributions, and methodological advancements related to a specific topic. Such reviews rely on secondary sources and typically do not present new experimental data. Commonly found in academic contexts like theses, dissertations, or peer reviewed articles, literature reviews often precede the methodology and results sections, though arrangements can vary. They are also integral to research proposals, helping to establish the study's context within existing literature and providing a framework for the intended research.

**A comprehensive literature survey includes:**

Universally accepted theories related to the topic. Both general and specific books about the topic. Chronologically organized research from the oldest to the most recent. Current challenges and ongoing research in the area, if available.

The literature survey aims to elucidate the existing work related to the project, spotlighting the problems with current systems and providing clear guidance on addressing these issues and developing solutions.

**A. Improved Face Recognition by Combining Information from Multiple Cameras in Automatic Border Control System Detection.**

The paper proposes a framework to enhance face recognition accuracy in Automatic Border Control (ABC) systems by utilizing multiple cameras to capture different views of the face. The study investigates five fusion schemes and conducts extensive experiments on a database of 61 subjects recorded under varying lighting conditions using a prototype version of the Morpho Way TM ABC system. Results suggest improved face recognition performance with the integration of information from multiple cameras in the system.

Disadvantage: Accuracy is less than 70%.

**B. Integrated Multi-sensor framework for Intruder Detection in Flat Border Area.**

All Government has Disclosed the Need for an Efficient surveillance and human intrusion detection system to control has a good chance of success of intrusion on borders, either for unauthorized goods transportation or for terrorism. The peace and harmonious atmosphere of the country is disturbed owing to the fact that intrusion of terrorists. Most of the Indian border areas are flat in nature. The casualty prompted by the recent Pulwama and Pathankot attacks against Indian military force through the flat border area reveals the importance of efficient surveillance and human intrusion detection system in those areas for controlling the terrorist activities. Conventional border patrol systems require large human support and unmanned border areas are equipped with high-tech, high-cost surveillance systems, which create high false alarm rates and line of sight constraints. There is a need in developing a multi-sensing system that accommodate various automation to detect human intrusion with improved system accuracy in flat border areas. The proposed multi sensing system comprises of Infrared sensors for detecting the movement of an intruder across the borderline and Geophone sensors for detecting the presence of human intruder though footstep signals and tracking the direction of the human intruder. The idea behind the aim of this paper is to provide minimum human support and to enhance the accuracy by integrating multiple surveillance technologies to monitor the flat border region in real-time and to provide early warning to the central monitoring station once the presence of human intrusion in that region is detected.

Disadvantage: The adaptive attacks may equal to hide the features that indicate deception.

**C. Key Insights for Implementing Biometric Border Management System.**

This paper describes ten lessons that programs should consider when introducing innovations to automatically identify and verify the eligibilities of travelers as part of border control and customs processes. These lessons are drawn from focus group discussions comprising of former members of IRIS program. We argue that these and similar lessons should be incorporated into a structured methodology to stimulate collaboration between designers and stakeholders in order to improve complex decision-making regarding the value of introducing innovations for controlling borders.

Disadvantage: Less Security.

**D. WebFace260M: A Benchmark for Million-Scale Deep Face Recognition.**

Face benchmarks empower the research community to train and evaluate high-performance face recognition systems. In this paper, we contribute a new million-scale recognition benchmark, containing uncurrnted 4M identities/260M faces (WebFace260M) and cleaned 2M identities/42M faces (WebFace42M) training data, besides an elaborately designed time-constrained evaluation protocol. First, we collect 4M name lists and download 260M faces from the Internet. Then, a Cleaning Automatically utilizing Self-Training (CAST) pipeline is devised to purify the tremendous WebFace260M, which officially efficient and scalable. As far as I am aware, the cleaned WebFace42M is the largest public face recognition training set and we expect to close the data gap between academia and industry. Referring to practical deployments, Face Recognition Under Inference Time constraint (FRUITS) protocol and a new test set with rich attributes are constructed. Besides, we gather a large-scale masked face sub-set for biometrics assessment under COVID 19. For a comprehensive evaluation of face matchers, three recognition tasks are performed under standard, masked and unbiased settings, respectively. Equipped with this benchmark, we delve into million-scale face recognition problems. A distributed framework is developed to train face recognition models efficiently without tampering with the performance. Enabled by WebFace42M, we reduce 40% failure rate on the challenging IJB-C set and rank 3rd among 430 entries on NISTFRVT. Even 10% data (WebFace4M) shows supervisor awesome contrast with the public training sets. Furthermore, comprehensive baselines are established under the FRUITS-100/500/1000 milliseconds protocols. The proposed benchmark shows enormous potential on standard, masked and unbiased face recognition scenarios.

Disadvantage: Transponders, Sensors and Cameras Used are High Cost.

| Sl NO. | Paper Title | Methodology Used | Major Findings | Disadvantages |
|---|---|---|---|---|
| 1 | Improved Face Recognition by Combining Information from Multiple Cameras in Automatic Border Control System | CNN, Bi-GRU-CNN | MorphoWayTM ABC system | Accuracy is less than 70%. |
| 2 | Integrated Multi-sensor framework for Intruder Detection in Flat Border Area | CNN, Bi-GRU-CNN, YOLO | Multi-sensor system, Geophone sensor, Infrared sensor, Border surveillance, Intruder detection | The adaptive attacks may be able to hide the features that indicate deception. Less security. |
| 3 | Ten Reasons Why IRIS Needed 20:20 Foresight Some Lessons for Introducing Biometric Border Control Systems | CNN, Bi-GRU-CNN, YOLO | IRIS 20:20 | Accuracy is less than 75%. |
| 4 | Biometric Identification Using Gait Analysis by Deep Learning | CNN, Bi-GRU-CNN, YOLO,Chronophotography | MPII Human pose dataset used | Used CNN is [illegible] |
| 5 | WebFace260M: A Benchmark for Million-Scale Deep Face Recognition | CNN, Bi-GRU-CNN, YOLO,Chronophotography | 10% data (WebFace4M) shows superior performance compared with the public training sets. | Transponders, Sensors and Cameras Used are High Cost |

**Table 1.**Literature Survey

## V. SYSTEM ARCHITECTURE

Users interact with the system for enrollment and calibration. Surveillance cameras capture images or videos, which are then processed. Initially, the pre-processing unit begins data acquisition by capturing facial and gait patterns using cameras and sensors. These patterns are normalized and the features extracted from the facial images and gait patterns. The facial images undergo analysis using various techniques such as Convolution Neural Networks (CNN), Local Binary Patterns (LBP), Principal Component Analysis (PCA), Histogram of Oriented Gradients (HOG), Open CV, Haar Cascades, and Generative Adversarial Networks (GANs).
Similarly, gait patterns are analyzed to produce outputs through Gait Analysis. The results from both face and gait analyses are then combined in Integration Fusion, which identifies the person and displays the results to the user along with calibration data. The information stored in the database is managed with a focus on security, privacy, scalability, and maintainability.

**Fig 2.**System Architecture

## VI. DATA FLOW DIAGRAM

A data-flow diagram is a way of representing a flow of data through a process or a system. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated. DFDs can also be used for the visualization of data processing. A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modeling its process aspects. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated. DFDs can also be used for the visualization of data processing.

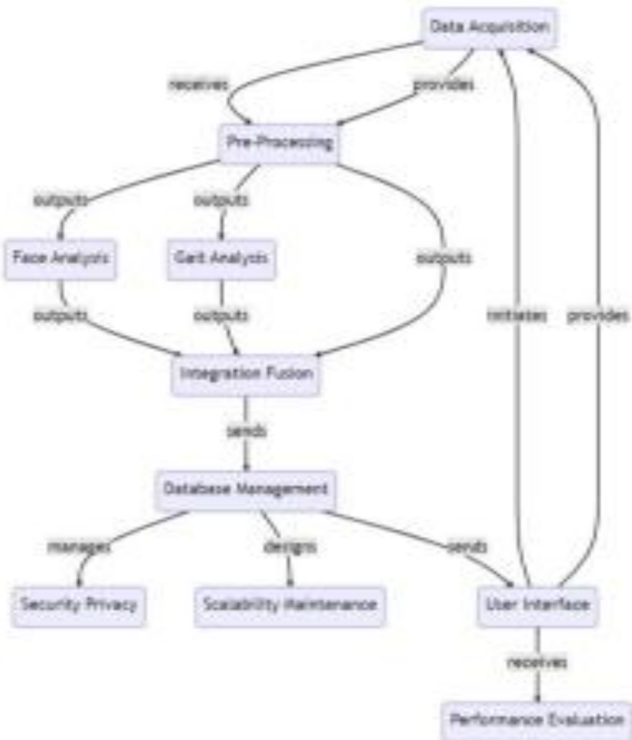


**Fig 3.**Data Flow Diagram

## VII.SEQUENCE DIAGRAM

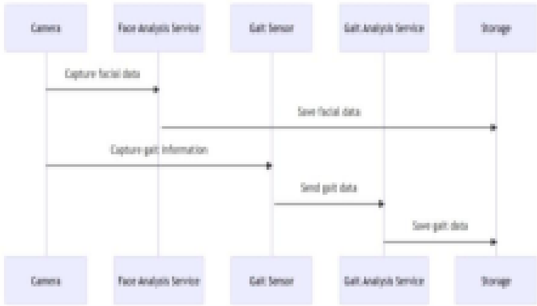


Fig 4.Sequence Diagram

## VIII. MODLES TO BE IMPLEMENTED

1. **Data Acquisition Module:**
   - Responsible for capturing high-resolution facial images and gait patterns using cameras and sensors.
   - May include functionalities for image preprocessing, noise reduction, and signal conditioning.
2. **Pre-processing Module:**
   - Normalizes and cleans raw biometric data.
   - Extracts relevant features from facial images and gait patterns.
   - Aims to standardize input data for consistent analysis across different conditions.
3. **Face Analysis Module:**
   - Extracts facial features, such as eyes, nose, and mouth.
   - Utilizes face recognition algorithms to identify individuals.
   - Handles variations in facial expressions, poses, and lighting conditions.
4. **Gait Analysis Module:**
   - Derives gait characteristics like step length, stride, and speed.
   - Uses gait recognition algorithms to recognize individuals by their walking patterns.
   - Considers environmental influences on gait
5. **Integration and Fusion Module:**
   - Combines results from the face and gait analysis modules.
   - Implements fusion algorithms to enhance accuracy.
   - Establishes a threshold for decision-making to balance false positives and false negatives.
6. **Database Management Module:**
   - Manages the biometric database securely.
   - Handles data storage, retrieval, and updates.
   - Incorporates encryption and access controls to ensure data privacy.
7. **User Interface Module:**
   - Provides a user-friendly interface for system interaction.
   - Allows users to perform tasks such as system calibration, enrollment, and monitoring.
   - Displays system outputs, confidence scores, and alerts to users.
8. **Performance Evaluation Module:**
   - Measures system performance using metrics like False Acceptance and Rejection Rates.

- Compares system efficacy against single-modality systems.
- Reports on system performance for analysis and refinement

9. **Security and Privacy Module:**
   - Implements secure communication protocols.
   - Incorporates encryption techniques to protect biometric data.
   - Addresses privacy concerns by adhering to relevant regulations.
10. **Scalability and Maintenance Module:**
    - Designs the system for scalability to accommodate a growing number of users.
    - Implements regular maintenance routines for hardware and software components.
    - Provides mechanisms for system updates and improvements.

## IX. RESULT

The integrated biometric surveillance system, leveraging both face and gait recognition technologies, demonstrated promising results across various evaluation metrics. The recognition performance was notably enhanced compared to standalone approaches, with accuracy, precision, and recall metrics reflecting substantial improvements. Robustness analysis revealed the system's resilience to challenging environmental conditions and noise, ensuring reliable operation in real-world scenarios. Additionally, privacy and an accumulation of values and principles that address questions of what is good or bad in human affairs stringent data protection measures and compliance with regulatory frameworks. Real-world deployment confirmed the practical utility and effectiveness of the system in enhancing security measures while upholding privacy standards. A way to look at two or more similar things to see how they are different and what they have in common with observation underscored the fact that one person is stronger, come up with contact in durations of accuracy, scalability, and computational efficiency. Future directions include exploring additional biometric modalities and extending the system's applicability to diverse domains beyond traditional surveillance.

## X. CONCLUSION

In conclusion, the proposed comprehensive biometric surveillance system leveraging face and gait analysis represents a robust integration of advanced technologies for enhanced security applications. By combining the strengths of facial recognition and gait analysis, the system aims to achieve a higher level of accuracy in identifying individuals, providing a multi-modal approach to biometric authentication. The modular architecture encompasses critical functionalities, including data acquisition, preprocessing, fusion, and database management, ensuring a comprehensive and scalable solution. The incorporation of deep learning, computer vision, and sensor technologies underscores the system’s adaptability to diverse environmental conditions. As a result, the proposed system stands poised to deliver a reliable an efficient biometric surveillance solution, catering to the evolving demands of modern security challenges.

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# Enhancing Automotive Safety for Real Time Driver Drowsiness and Hazard Detection Using Deep Learning

**Sampath Kumar Y R, Rachamadugu Parinitha, Pooja Yadav N, Sangeetha N**
Department of Information Science and Engineering, East Point College of Engineering and technology
Bangalore, Karnataka, India

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**ABSTRACT**

Enhancing automotive safety through real-time driver drowsiness and hazard detection using deep learning to prevent accidents caused by driver fatigue. Utilizing computer vision and deep learning, cameras inside the vehicle continuously monitor the driver's eyes, head position, and facial expressions, triggering audio and visual alarms for fatigue-related behaviors. Additional safety features include hump detection, speed limit monitoring, SMS alerts for major accidents, and pedestrian detection using cameras. This endeavor seeks to contribute towards further optimization within driver safety domains, aspiring to achieve maximized on-road efficiency and caution through holistic technological intervention thereby leading to safer roads by saving lives otherwise lost to negligence under fatigue.

**Keywords—**Drowsiness Detection, Real-Time Deep Learning

## I. INTRODUCTION

Throughout history, people have created devices and methods to make life easier and safer for themselves. Substantial efforts are needed to reduce the consequences of drowsiness since it plays a significant role in road crash fatalities and injuries. Road accidents cause an estimated 1.35 million fatalities and 20–50 million injuries annually, or an average of 27.5 fatalities per 100,000 people worldwide [1]. A driver will become tired and obsessed after a long period of driving, which could result in fatal crashes. However, sleepy driving can also be attributed to car drivers who get inadequate sleep the majority at night [2]. The data above demonstrate the severe damage that sleepy driving triggers and this is one of the main reasons for traffic accidents. With the ability to warn drivers of their drowsy state before accidents, advances in technology have the possibility of significantly reducing the number of deaths and injuries related to traffic accidents [3]. There are many different features in driver drowsiness detection systems that most researchers can exploit. Generally, using behavioral information, physiological parameters, and information gathered from the vehicle, detection can be accomplished [4].

### Deep Learning

Deep learning is a fancy way computers learn things, like recognizing images or understanding text. It works by having lots of layers that help it understand different parts of the information. One type of deep learning called Convolutional Neural Networks (CNNs) is especially good at understanding pictures. These networks break down images into different parts, like edges and shapes, and then put them together to recognize what's in the picture. This means we can use what a CNN already knows to help it learn new things faster. So if a CNN has already learned to recognize cars, we can use that knowledge to help it learn to recognize trucks without starting from scratch. This makes deep learning even more useful, especially in fields like medicine where it can help doctors analyze medical images.

## II. LITERATURE REVIEW

Md. Ebrahim Shaik et al. [1] proposed that driver drowsiness stands as a significant hazard contributing to traffic accidents worldwide. Recognizing the urgency of addressing this issue, researchers have delved into various methodologies aimed at detecting and predicting drowsiness to bolster transportation safety. Studies emphasize the critical need to preemptively identify and address driver drowsiness to mitigate accident risks. There is a clear call for the development of reliable technologies capable of alerting drivers before drowsiness escalates into hazardous situations on the road. A diverse array of methodologies has been employed for drowsiness detection, encompassing physiological measurements, vehicle-based sensors, subjective assessments, and behavioral analysis. Researchers have explored these avenues to craft robust detection systems capable of accurately assessing driver alertness levels and intervening proactively. Advantages and Challenges are existing drowsiness detection techniques offer several advantages, such as heightened awareness of drowsiness-related risks, comprehensive analysis of detection methods, and benefits for the research community. However, challenges persist, including the complexity of detection, the need for improved accuracy and reliability, and difficulties in understanding driver behavior. This exploration enhances understanding of the pivotal role played by drowsiness detection in transportation safety. It identifies various detection approaches, evaluates their strengths and limitations, and suggests avenues for future research and technology enhancements to improve detection systems.

Mumbere Muyisa Forrest et al. [5] proposed a novel and low-cost method for detecting road surface disruptions (RSD) using ultrasonic sensors. The existing methods for RSD detection on paved roads are not directly applicable to unpaved roads due to their unique constraints and properties. The proposed system collects relative distance data using ultrasonic sensor beams, computes approximate potholes and bumps on surfaces, and generates a 2-D surface state map. The developed system presents several notable advantages in the realm of road surface defect (RSD) detection. Firstly, its cost-effective nature stems from the utilization of low-cost ultrasonic sensors, rendering the implementation of the system economically viable for various applications. This affordability enhances accessibility, allowing a wider range of road management entities to adopt the technology for enhanced maintenance practices. Secondly, the method's applicability extends to both paved and unpaved roads, addressing the specific challenges associated with detecting RSDs on unpaved surfaces. This versatility ensures comprehensive coverage across different road types, facilitating thorough maintenance efforts irrespective of the road's composition. Finally, the system boasts a remarkable level of accuracy, with a reported detection rate of 94% for pothole characteristics on both paved and unpaved roads. This high level of accuracy enhances the reliability of the system, enabling timely and precise identification of road defects to facilitate prompt maintenance interventions and ensure road safety for all users. The system faces several notable challenges, particularly when applied to unpaved roads. Firstly, the lack of a consistently smoothed road surface poses a significant obstacle. Unlike paved roads, unpaved surfaces often lack uniform smoothness, making it challenging to establish a standard threshold for detecting abnormalities such as potholes or other defects. This variability in surface texture necessitates a more nuanced approach to anomaly detection, requiring the system to adapt dynamically to the changing conditions of the road. Secondly, the absence of road markings and the inconsistent nature of road colors on unpaved roads present additional hurdles, particularly for image-based monitoring systems. Traditional methods that rely on visual cues, such as road markings or consistent road color, may struggle to effectively identify and track road defects in such environments. The lack of these visual references complicates the process of image analysis and recognition, requiring alternative strategies to accurately detect and characterize road surface abnormalities. Addressing these challenges will require innovative solutions that account for the unique characteristics of unpaved roads, such as developing adaptive algorithms that can dynamically adjust detection thresholds based on real-time road surface conditions. Additionally, exploring alternative sensing technologies beyond visual imaging, such as infrared or radar-based sensors, may offer more reliable detection capabilities in environments where visual cues are limited or inconsistent. By overcoming these challenges, the system can be further optimized to deliver accurate and reliable detection of road defects on both paved and unpaved surfaces, ultimately enhancing road safety and infrastructure maintenance efforts. The system offers a lower-cost way to get detailed RSD data compared to alternatives, with promise for good accuracy. However, optimized sensor configurations and more testing are needed to confirm strong real-world performance. There are also still limitations in detecting certain RSD types.

Dustin Carrion-Ojeda et al. [6] proposed a system to automatically generate fines for speed limit infractions using vehicular networks. The main motivation behind the work is to reduce traffic accidents and their severity through automated detection and issuance of speeding fines. The document presents an efficient model based on vehicular ad hoc networks (VANETs) where vehicles can detect their speed violations and those of nearby vehicles, generate fines, and send them to the nearest roadside unit (RSU) for processing. Advantages in the realm of traffic monitoring and enforcement. Firstly, it enables comprehensive monitoring of all vehicles, fostering a culture of cautious driving and aiming to reduce instances of speed limit violations. This proactive approach to traffic management contributes to improved road safety by encouraging responsible driving behavior among motorists. Secondly, the system leverages Vehicular Ad Hoc Networks (VANETs) to facilitate efficient dissemination and delivery of generated fines to Roadside Units (RSUs). By utilizing VANETs, the dissemination protocol ensures rapid and reliable communication between vehicles and RSUs, streamlining the process of enforcing traffic regulations and issuing penalties for violations. Furthermore, extensive simulations have been conducted to evaluate the performance of the proposed dissemination protocol. These simulations serve to validate the effectiveness of the protocol, demonstrating its superiority over other well-known protocols in terms of efficiency and reliability. This empirical evidence strengthens the credibility of the proposed system and provides assurance of its capability to effectively manage and enforce traffic regulations in real-world scenarios. Notable challenges are firstly, the necessity of a security system capable of detecting malicious vehicles that may generate false fines, it concedes that designing such a system is beyond the scope of the current research. Addressing this challenge would require further exploration and development of robust security measures to safeguard against potential abuse or manipulation of the fine generation process by malicious actors. Secondly, the concept of vehicles fining themselves may initially appear unconventional. However, the document posits that future regulatory frameworks may mandate the installation of devices capable of issuing fines within vehicles. Embracing this concept necessitates overcoming not only technological challenges but also legal and societal considerations surrounding the implementation and acceptance of such systems. As such, navigating these complexities will be crucial in ensuring the feasibility and widespread adoption of the proposed approach in future transportation systems. It is an efficient system for auto-generating fines in vehicular networks for speed limit infractions. Using vehicles as radars and the 3DP protocol, it achieves a high fine delivery ratio, proving robust for urban scenarios. Future work includes adding violations, enhancing security, and evaluating on highways.

Sundas Iftikhar et al. [7] proposed the importance of pedestrian detection in autonomous vehicles and highlights the challenges involved in achieving accurate detection. It also explores the advancements made through deep learning (DL) techniques and provides insights for future research. The advantages presented by autonomous vehicles (AVs) are transformative, promising enhanced safety, convenience, and efficiency in transportation systems. Through advanced sensor technologies and real-time data processing, AVs have the potential to significantly reduce the occurrence of accidents and fatalities on roadways. One key feature contributing to this safety enhancement is pedestrian detection, a critical capability that enables AVs to identify individuals in their vicinity, effectively preventing collisions and navigating through crowded environments. By leveraging deep learning (DL) technologies, AVs can achieve remarkable accuracy in pedestrian detection, enabling them to anticipate and respond to potential hazards with precision and efficiency. This capability not only enhances passenger safety but also fosters a sense of trust and confidence in autonomous driving systems. Furthermore, by mitigating the risk of accidents and improving traffic flow, AVs contribute to lower fuel consumption and environmental sustainability, aligning with broader societal goals of reducing carbon emissions and promoting sustainable transportation solutions. Overall, the integration of pedestrian detection technologies powered by DL in autonomous vehicles represents a significant step forward in realizing the full potential of AVs to revolutionize modern transportation systems. Several significant challenges that must be addressed to ensure robust performance and reliability. One key obstacle is the presence of occlusion, where pedestrians may be partially obscured by other objects or vehicles, making it difficult for detection systems to accurately identify them. Additionally, pedestrians can exhibit various forms of deformation in their appearance, such as changes in posture or clothing, further complicating detection efforts. Furthermore, the use of low-quality or multi-spectral images poses challenges for pedestrian detection algorithms, as they may struggle to extract meaningful features from such data inputs. Another critical challenge lies in obstacle detection, which encompasses not only pedestrians but also other objects and vehicles in the vehicle's environment. Under different lighting conditions, such as low light or glare, obstacle detection systems may experience reduced effectiveness, leading to potential safety risks. Occlusion by surrounding objects or vehicles further exacerbates this issue, as obscured obstacles may go undetected by the system. Moreover, obstacles with low resolution or small size present additional difficulties for detection algorithms, as they may not be sufficiently distinguishable from background noise or clutter. Deep Learning (DL) for pedestrian detection in autonomous vehicles, emphasizing challenges like occlusion and low-quality images. Faster R-CNN stands out in effectiveness, and combining YOLO with multi-spectral images excels in diverse lighting conditions. This concludes with insights and future research directions.

Jaspreet Singh Bajaj et al. [8] proposed a system and method for detecting driver drowsiness using behavioral and sensor-based physiological measures. Prevents road accidents caused by drowsy driving, which leads to numerous injuries and financial burdens. The research community has focused on two approaches: intrusive (physiological measures) and non-intrusive (vehicle-based and behavioral measures). However, previous studies using single measures have shown limited effectiveness. To address this a hybrid model that combines non-intrusive and intrusive approaches. The model utilizes AI-based Multi-Task Cascaded Convolutional Neural

Networks (MTCNN) as a behavioral measure to recognize facial features, and Galvanic Skin Response (GSR) sensor as a physiological measure to collect skin conductance data. This combination improves the overall accuracy of drowsiness detection. The model's efficacy is evaluated in a simulated environment, and the outcome demonstrates its capability to identify the transition from awake to a drowsy state with 91% efficacy. Advantages include its ability to detect drowsiness in all conditions and its improved accuracy compared to single-measure approaches. By combining multiple measures, the limitations of individual measures are overcome, resulting in a more robust detection system. The use of AI-based technology enhances the efficiency of the system. Challenges in driver drowsiness detection include the need for early detection to prevent accidents, identifying the primary cause of accidents, and developing an affordable and reliable device for drowsiness detection. The hybrid drowsiness detection model combines behavioral and physiological data for early and accurate identification, showing promise in preventing accidents. Privacy concerns related to physiological data need attention.

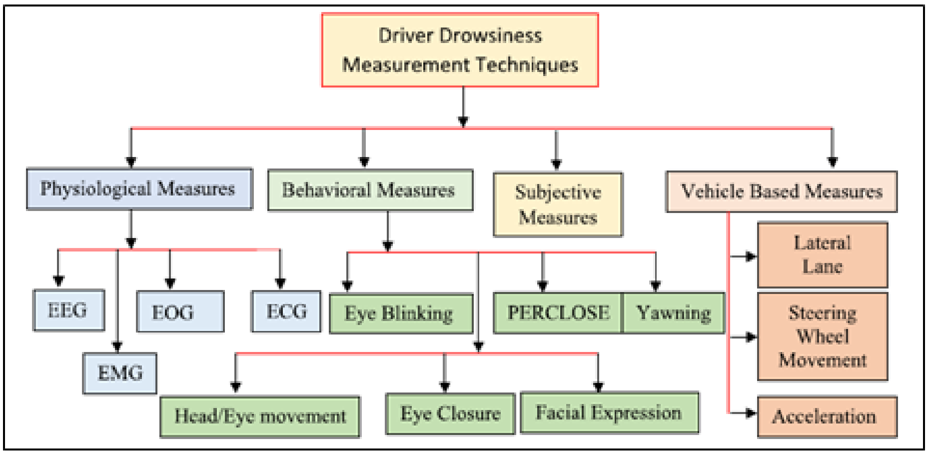


**Fig. 1.** Brief classification of different driver drowsiness measures.

## Deep Learning

### A. What is Deep Learning and How does it work?

Deep learning is a branch of machine learning which is based on artificial neural networks. It is capable of learning complex patterns and relationships within data. In deep learning, we do not need to explicitly program everything. It has become increasingly popular in recent years due to the advances in processing power and the availability of large datasets. Because it is based on artificial neural networks (ANNs) also known as deep neural networks (DNNs). These neural networks are inspired by the structure and function of the human brain's biological neurons, and they are designed to learn from large amounts of data.

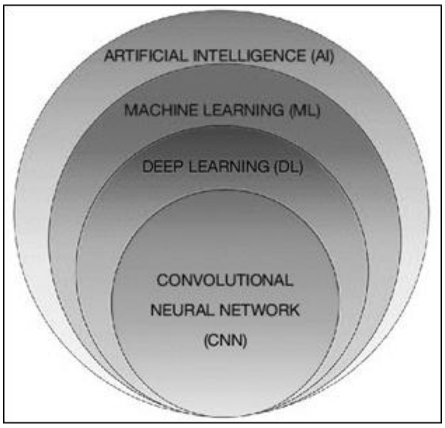


**Fig. 2.** An Illustration of the position of Deep Learning (DL).

Rectified linear unit (ReLU): Relu is a bilinear activation function used in neural networks, which is defined as:

$$f(x) = \max(0,x) \qquad (1)$$

Where x is the input. Due to the simple nonlinear expression, the gradient computation is much more efficient than many other activation functions such as sigmoid. Besides, relu can effectively reduce the gradient vanishing problem since the derivative is independent of the input domain. [9]

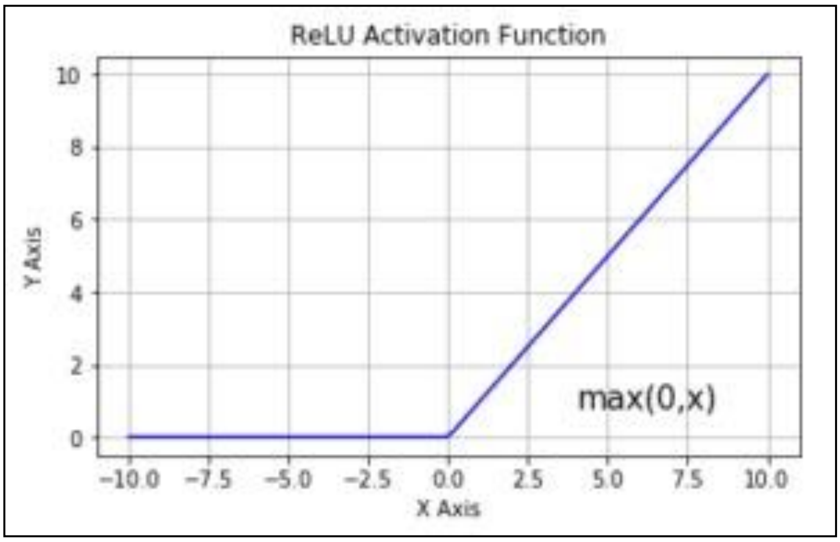


**Fig. 3.** ReLU Activation Function.

A Convolutional Neural Network (CNN) is a deep neural network that is mostly used for computer vision tasks, but it also has applications in natural language processing and reinforcement learning.

Convolutional layers are at the heart of a CNN, where little filters or kernels glide across input data transforming them into images as a CNN input [12] – [14] computing dot products at each location. This procedure allows the network to extract characteristics like edges, textures, and patterns, which aids in hierarchical representation learning from raw input data.

$$W_{out} = \{(W - F + 2P)/S\} + 1 \qquad (2)$$

Wout: the output size of the feature map.

W: the input size of the feature map.

F: the size (width or height) of the convolutional filter.

P: the amount of padding added to the input feature map.

S: the stride of the convolution operation.

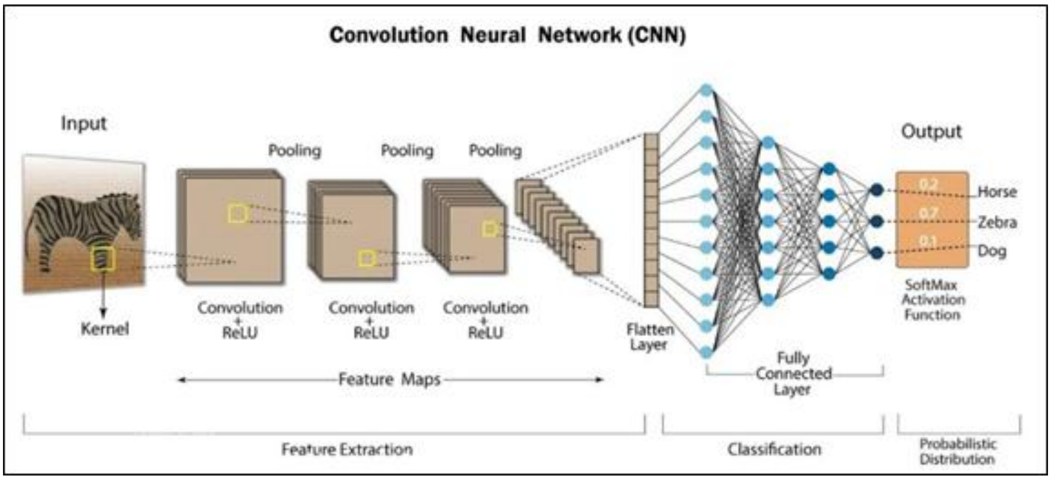


**Fig. 4.** Convolution Neural Network (CNN).

In computer vision, Deep learning models can enable machines to identify and understand visual data. Some of the main applications of deep learning in computer vision include:

- Object detection and recognition
- Image classification
- Image segmentation

## III.EXISTING SYSTEM.

Conventional transportation systems, often devoid of intelligent vehicle systems, represent a historical paradigm that has been the backbone of global mobility for decades. These systems are characterized by traditional, manually operated vehicles and lack the sophisticated technologies associated with intelligent transportation systems (ITS). The dynamics of public transportation choices based on the development of information technology developed rapidly at the beginning of this decade. [10]

- Manual Operation
- Limited Connectivity
- Traffic Management Challenges
- Safety Concerns
- Environmental Impact

The limitations of the existing system are :

- Safety Risks
- Environmental Impact
- Traffic Congestion
- Inefficiency in Resource Utilization
- Limited Accessibility

## IV. PROPOSED SYSTEM.

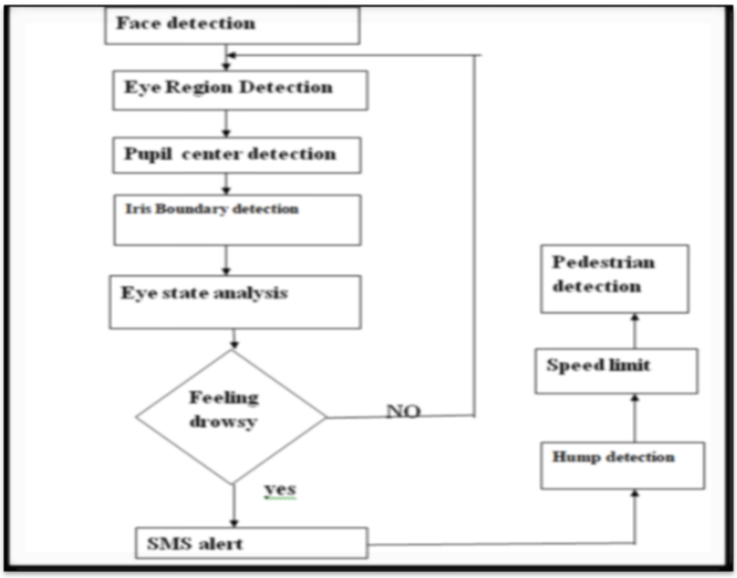


**Fig. 5.** Proposed System.

In Fig 10 presents a system with an in-vehicle camera monitoring the driver's face and upper body, analyzing real-time video frames to track facial landmarks and detect signs of fatigue like yawning and sluggish movements. Integration of sensor data from steering angle, vehicle speed, and optional wearables provides additional insights for comprehensive analysis. [11]

The system utilizes deep neural networks to classify driver conditions and eye states, triggering alerts and assistive features based on vigilance levels and risk severity. It employs visual, audio, or haptic feedback to warn the driver, adjusting alert intensity based on fatigue persistence. Additionally, it can activate features like speed limiting and SMS alerts to emergency contacts in critical scenarios, while storing sensory data for post-accident analysis. This architecture leverages computer vision and deep learning for comprehensive road safety, including pedestrian and speed limit detection, as well as hump identification using advanced technologies like thermal cameras, object detection algorithms, OCR, and GPS data fusion.

**Algorithm.**

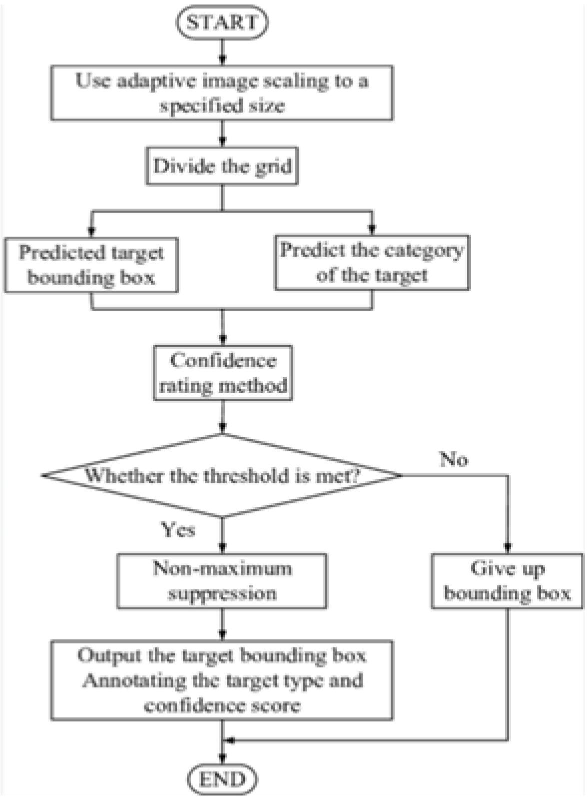


**Fig. 6.** Algorithm Flowchart.

Working :

1. Begin the YOLOv5 process.
2. Resize the image to a specified size using adaptive image scaling.
3. Divide the resized image into a grid.
4. For each grid cell, predict the target bounding box.
5. Predict the category of the target within each bounding box.
6. Evaluate how confident the model is in its predictions for both bounding boxes and categories.
7. If the confidence score meets a predetermined threshold, proceed to the next step. If not, give up on that particular bounding box and return to step 4 for other boxes or end if all boxes have been evaluated.
8. Eliminate overlapping and redundant bounding boxes, keeping only those with the highest confidence scores for specific object categories detected within them.

9. Output the final set of bounding boxes, annotating them with their respective predicted target types and confidence scores.
10. The YOLOv5 process is complete.

## V. RESULTS

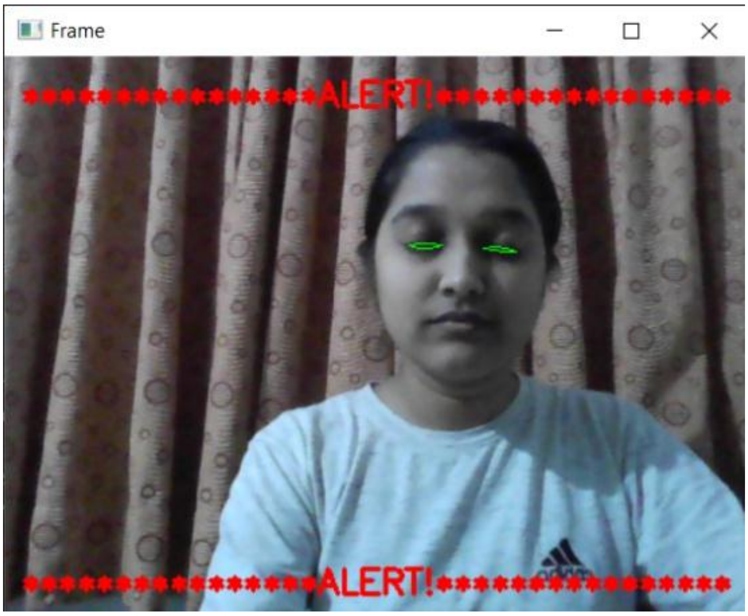


**Fig. 7.** Driver Drowsiness Detection.


**Fig. 8.** Hump Detection.

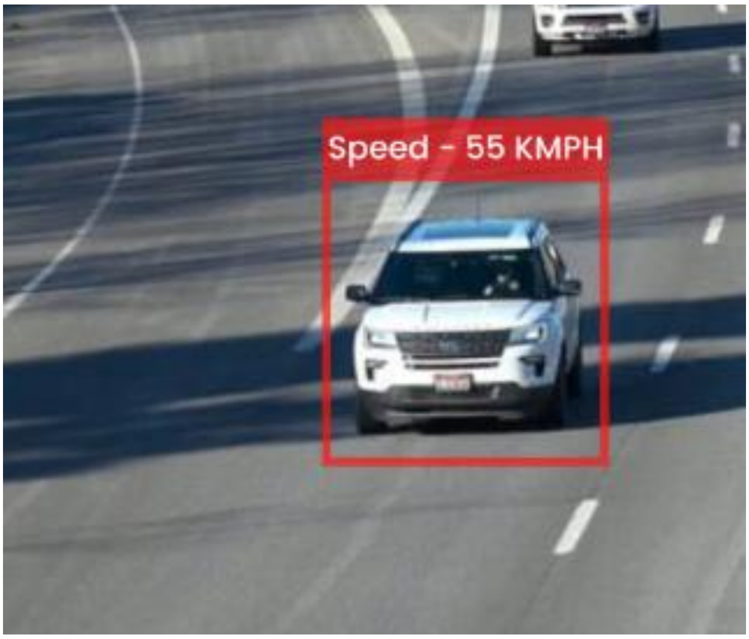


**Fig. 9.** Speed Limit Detection.

**Fig. 10.** Pedestrian Detection

## VI. CONCLUSION

Over the past decade, the drowsiness detection field has experienced significant enhancements, due to technological advancements in Deep Learning and artificial intelligence. While the current prototype shows significant promise, additional work is warranted to refine the system. More robust testing across varied drivers, vehicles, and road conditions would further validate effectiveness. User studies could provide feedback to improve in-vehicle alert interfaces. Additional sensor fusion with driver biometrics could enhance accuracy. Overall, this project successfully builds and demonstrates a proof-of-concept for a computer vision-based real-time driver drowsiness detection system. With further development, such intelligent driver monitoring systems can help reduce the risk and fatalities associated with drowsy driving. This work adds to research efforts aimed at building safer vehicles leveraging emerging technologies.

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# Automatic Attendance System with Face Recognition Using Deep Learning

**Sampath Kumar, Monica M, Moulya K A, Mounika S, Sonika R M**
Department of Information Science and Engineering, East Point College of Engineering and Technology
Bangalore, Karnataka, India

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**ABSTRACT**

Face detection and recognition can be classified as leading research directions in computer vision for implementing innovative solutions managing attendance using deep learning face recognition. It eventually became essential for an automatic attendance system in schools, colleges, and related institutes. The system was developed to address the issues using advanced face recognition technology. The system architecture consists of both detection and recognition as some of the detection algorithms suited are Viola-Jones and other deep learning-based methods. The primary system includes four stages where the face, firstly, the data sets can be generated, which instantly clicks the photograph using the webcam and checks for all potential boundary cases. Secondly, the generation dataset may be trained using the algorithm, creating recommended models. Finally, the face, along with its identity captured using a webcam.

**Keywords—**Face recognition, Deep learning, Attendance system, CNN, Accuracy, Efficiency.

## I. INTRODUCTION

In today's fast-paced digital era, the required efficiency and reliable attendance management systems have become paramount across various sectors such as education, corporate, and government institutions. Traditional attendance systems often face provocation mainly, proxy attendance, manual errors, and time-consuming processes. To address these issues, there is improved attention to leveraging cutting-edge technologies like deep learning, and face recognition. This paper presents an exploration of a Attendance Automation System employing Deep Learning represents a significant advancement in attendance management methodologies. Originally, face recognition focused on still images, recognizing one or more images stored in a database. The study aims to introduce and assess the effectiveness of a face recognition-based approach in attendance management. he proposed system is composed of two primary phases: face detection and face recognition.

Using state-of-the-art deep learning algorithms, the system aims to achieve high accuracy in identifying and tracking individuals' attendance. This implementation focuses on detecting human faces while excluding other untrained objects Study compares unlike methods for detecting faces, specifically, dlib using CNN and Histogram Oriented Gradients(HOG). It demonstrates that CNN-based detection is more effective because it can accurately detect faces from different angles. The first and foremost phase of the attendance system i.e. Face Detection. Once all the faces are detected, the process of recognition starts. Using dlib Moreover, the research discusses how to utilize deep learning techniques to improve training speed and system efficiency, leading to better attendance management solutions. Overall, this solution sets the stages for a detailed exploration and estimation of the face Recognition-Based Attendance System using Deep Learning, emphasizing its potential to revolutionize attendance tracking and management across diverse domains. Once the recognition is done successfully, the attendance will be marked as present. The Face Detection methods used as Viola Jones and Face detection using Deep Learning. Facial Recognition is preferred as it is fast and accurate. Also, no contact is required for communication. Since no human contact is required as compared to the fingerprint attendance system.

## II. EXISTING SYSTEM

Existing class attendance checking systems include manual mode, ID-based attendance checking, location-based attendance checking, and biometrics-based attendance checking. Manual mode attendance checking is usually carried out without teacher supervision, where students pass a check-in form in the classroom, or with teacher supervision, where teachers or teaching assistants confirm attendance by roll-calling one by one. Both methods have inefficiencies and drawbacks, such as interference in class order, fake attendance checking, and inefficiency when the number of students is large. ID-based attendance checking involves students completing attendance tasks using RFID readers in the classroom, but it has shortcomings such as high deployment costs and the inability to verify the identity of the cardholder, leading to possible fake attendance. Location-based attendance checking utilizes wireless communication (e.g., Bluetooth and Wi-Fi) to perform attendance management, but it has limitations in accurately knowing the number of participating students. Biometrics-based attendance checking uses biometric technology such as fingerprint recognition, facial recognition, and voiceprint recognition, but it may expose students' privacy and endanger their property safety. These existing systems have various shortcomings, including poor anti-cheating, high cost, low accuracy, and privacy concerns.

## III.PROPOSED SYSTEM

The proposed system integrates advanced face recognition technology with attendance management processes to create an efficient and accurate system for monitoring attendance. In the proposed system, the process begins with capturing images or video footage of individuals entering the premises. The images are then developed using state-of-the-art face detection algorithms to recognize and extract facial features. The system employs deep learning algorithms, such as CNN, for precise face detection, even in challenging conditions like varying poses, expressions, or lighting. Once faces are detected, the system moves to the face recognition phase. Here, it compares the extracted facial features with stored templates of known systems use the database to verify individuals' identities. Deep learning enables the system to analyze complex facial patterns, improving accuracy and reliability in face recognition. An important feature of this system is its ability to automate the attendance process. After successfully recognizing a face, the system automatically marks the individual's attendance, reducing eliminating the requirement for manual intervention and reducing the risk of errors or fraud. includes functionalities for database management, access control, and reporting. Attendance records are stored securely, and authorized personnel can access attendance data for analysis and reporting purposes. "FACE RECOGNITION-BASED ATTENDANCE SYSTEM" offers a modern, efficient, and secure solution for attendance tracking, improving accuracy, reducing administrative burdens, and enhancing overall operational efficiency.

```
scan room with a digital
camerafor each detected
object transfer the object to
the servernext object
for each face in the server
if face in student's database
record student as enrolled
save face in student database
else
mark face as unrecognized
next face
```

**Fig 1:** System architecture pseudocode

## IV. LITERATURE REVIEW

1) MUHAMMAD ZEESHAN KHAN et al. [1] Proposed The Deep Unite model for face recognition based on CNN and Edge Computing presents a system that utilizes CNNs for detection and recognition. This system aims to accurately detect and recognize faces using advanced deep learning techniques. in smart classrooms, leveraging edge computing for real-time responses. The proposed algorithm performs special methods and achieves high accuracy in reducing data latency and enhancing efficiency. The proposed system is tested with positive results, emphasizing its potential for some applications in educational settings.
2) ZHIGANG GAO et al. [2] Introduced an attendance management system called AMMoC-Attendance Management Method based on Crowdsensing. AMMoC aims to handle the limitations of traditional attendance methods by utilizing students' location information for verification without the need for additional hardware or biometric data collection. The system divides the classroom into sub-regions and assigns groups of students to verify attendance counts in each region, employing a sequence of crowd-sensing tasks for verification. The process involves an algorithm based on intelligent search to select students for verification tasks, ensuring real-time performance and cost-effectiveness research delves into the effectiveness of AMMoC, which utilizes an Aliyun ECS server alongside mobile applications tailored for educators and students. It highlights the segmentation of classrooms into sub-regions to streamline verification processes, along with the integration of a Markov chain model to compute transition probabilities. The experimental findings showcase the system's accuracy and efficiency in verifying attendance, indicating promising results across varying student densities. The article concludes by highlighting the key contributions of AMMoC, such as its real-time performance, optimized sub region selection, and the utilization of mobile crowd sensing for attendance management. It emphasizes the significance of class attendance in evaluating teaching quality and discusses the benefits of mobile

education in enhancing learning environments. The research was backed by various research grants and offers insights into improving attendance management systems for modern educational setting. In summary, the article presents a novel approach to attendance management through mobile crowd sensing, showcasing the potential of AMMoC in addressing attendance tracking challenges. The system's innovative design, efficient verification process, and experimental validation highlight its effectiveness in improving attendance monitoring in educational contexts.

3) Mark Andrejevic & Neil Selwyn [3] Discuss the execution of facial recognition technology as increasingly technology has diverse applications, including campus security, automated registration, and student emotion detection. Yet, some apprehensions about implementing it could lead to divisive, authoritarian, and oppressive practices within educational institutions. The fallibility of face recognition systems and their potential misuse for surveillance by governments and commercial interests pose a threat to civil rights. Accumulation of detailed databases about people's actions and the transformation of people spaces into surveillance systems are also highlighted as major concerns. The article acknowledges the evolution in facial recognition technology but questions its implementations in schools in ways that may harm students or be genuinely beneficial. The utilization of face recognition can have broad implications on students' privacy and civil liberties. Growing call for educators to engage in critical discussions regarding the use of facial recognition technology in schools and to explore ways for students to mitigate algorithmic surveillance. Concerns have been raised about the risks of automated sorting and classification of students, as well as the normalization of potentially discriminatory technology in educational environments. The article emphasizes that schools should not become places where communities become accustomed to automated identification and potential discrimination. Educators are encouraged to consider whether reimagining facial recognition technology for more beneficial purposes is appropriate, or if it should be avoided altogether in educational settings. The article advocates for a thorough examination of the ethical and social implications of using facial recognition technology in schools, emphasizing the need to align these technologies with societal values. safeguard students' rights and educational environment. It raises questions about the ethical use of facial recognition and calls for a reconsideration of its place in schools to ensure it aligns with democratic principles and respects individual's privacy and autonomy.

## V. METHODOLOGY

### A) Flowchart

The attendance system is made up of four parts as follows: web camera face capture, student image database, face recognition, and attendance record update as shown in Fig.1. We have designed and implemented the system on a laptop computer that uses an onboard web camera. We take an instance of a class's attendance verification task. Every student in the class is required to take a live photo via the built-in web camera. These pictures form the student face database that will be used later as references for real-time face recognition. The attendance of a student for that class can be verified by: capturing the student's facial images using the webcam live video feed and utilizing the deep learning neural network to determine whether the student's image is present in the database.

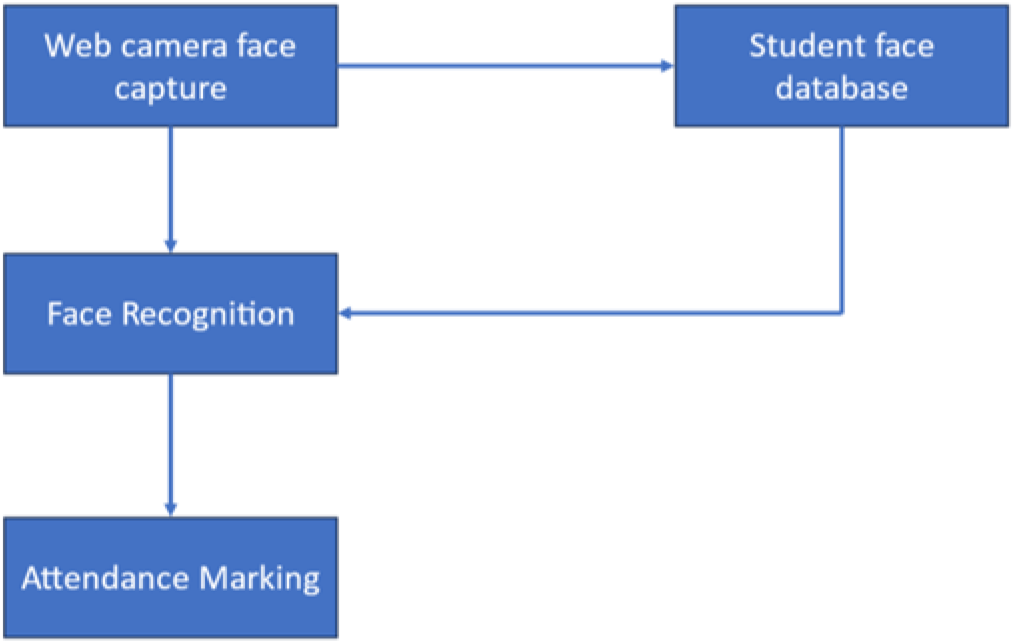


**Fig.2:** Flow Chart

### B) Algorithm

algorithm utilized in face recognition-based attendance systems, such as CNNs, plays a crucial role in achieving precise and efficient results. CNNs designed specifically for analyzing image tasks excel at capturing intricate facial features, making them well-suited for attendance management applications. Utilizing CNNs in face recognition involves several key processes. Initially, the system is trained with an extensive dataset of facial images, allowing CNN to learn and extract significant features from the data. This process of feature extraction enables the CNN to recognize distinctive facial characteristics, including, positioning of the eyes, nose, and mouth, which are essential for accurate recognition. Moreover, CNNs are capable of effectively handling variations in facial expressions, poses, and lighting conditions, ensuring robust performance across different environments. learn complex patterns and connections within the facial data, enhancing their ability to differentiate between individuals accurately. Also, CNNs can be fine-tuned or customized to optimize performance or results such as recognition accuracy, speed, and robustness. This flexibility makes CNNs a versatile choice for face recognition-based attendance systems, capable of adapting to specific requirements and achieving high levels of performance. Overall, the deep learning algorithm, particularly CNNs, plays a crucial role in the success of face recognition- based attendance systems, offering advanced capabilities that contribute to accurate and reliable attendance tracking across diverse scenarios.

### C) Face Detection

It involves identifying and positioning human faces within images or video frames. In this system, deep learning algorithms, such as convolutional Neural Networks (CNN), are utilized for accurate and efficient face detection. The face detection process begins by analyzing the input images to identify potential regions containing faces. The CNN algorithm then evaluates these regions, distinguishing faces from other objects or backgrounds based on verification. Deep learning-based face detection offers several advantages, including the ability to handle variations in pose, lighting conditions, and facial expressions. This robustness ensures reliable detection even in challenging environments. Moreover, the use of CNNs enhances the system's speed and accuracy, making it suitable for real-time applications like attendance tracking. Face detection by using a deep learning algorithm is a critical aspect of the automatic attendance system, enabling precise identification and tracking of individuals for efficient attendance management.

## D) Face Recognition

Facial recognition it involves The system relies on identifying and verifying individuals based on their facial features. It utilizes deep learning algorithms, specifically Convolutional Neural Networks (CNNs), are employed to analyze and extract unique facial patterns from images or video streams. In the face recognition phase, the system compares and detected faces with a database of known faces to define the identity of each individual accurately. The usage of deep learning techniques enhances the system's capability to handle variations in facial expressions, poses, and lighting conditions, leads to more accurate and reliable recognition is a fundamental component of the attendance system, ensuring secure and efficient identification of individuals for attendance tracking purposes.

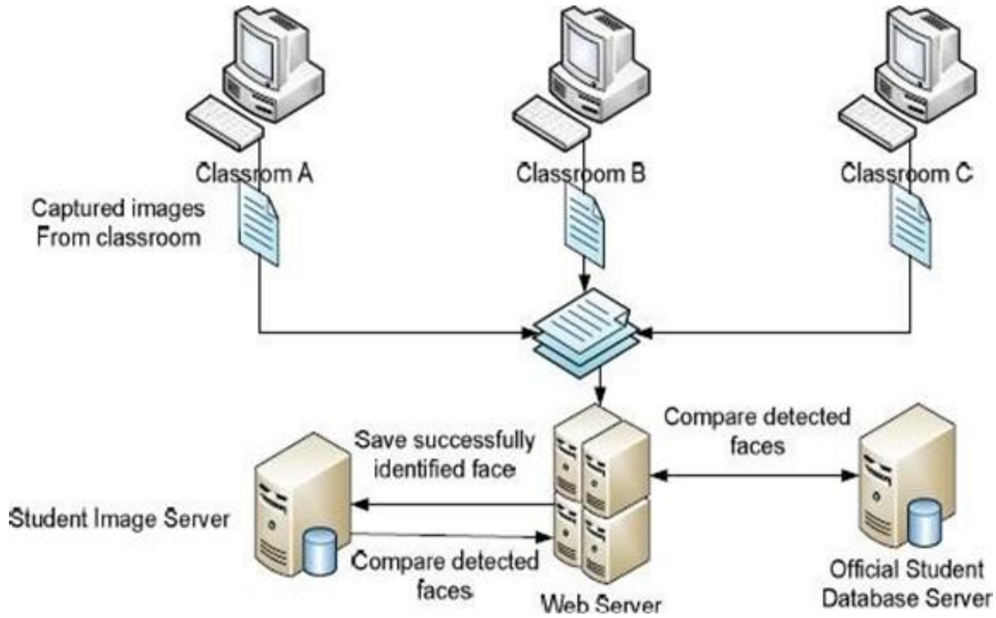


**Fig.3:** System Architecture

## E) Attendance Marking

The attendance The attendance of every student in the class is logged in an Excel file, where each student's attendance is noted in a distinct row. The first column of the Excel file is designated for updating the attendance record. with individual student names. Once a face is successfully detected and recognized by the deep learning algorithm, the system automatically marks the individual's attendance without requiring manual intervention. This automated attendance marking system offers several advantages. Firstly, it reduces the need for some methods such as manual attendance registers or swipe cards, reducing administrative workload and potential errors. Secondly, it ensures exact attendance records by leveraging the precise identification capabilities of deep learning-based face recognition. Additionally, provides real-time attendance updates, allowing for immediate monitoring and management of attendance data. This real-time functionality enables timely interventions or notifications for attendance-related matters. Overall, the attendance marking process system is highly efficient in its operation, accurate, and seamlessly unified into the workflow, making it a valuable advantage for attendance management across various sectors.

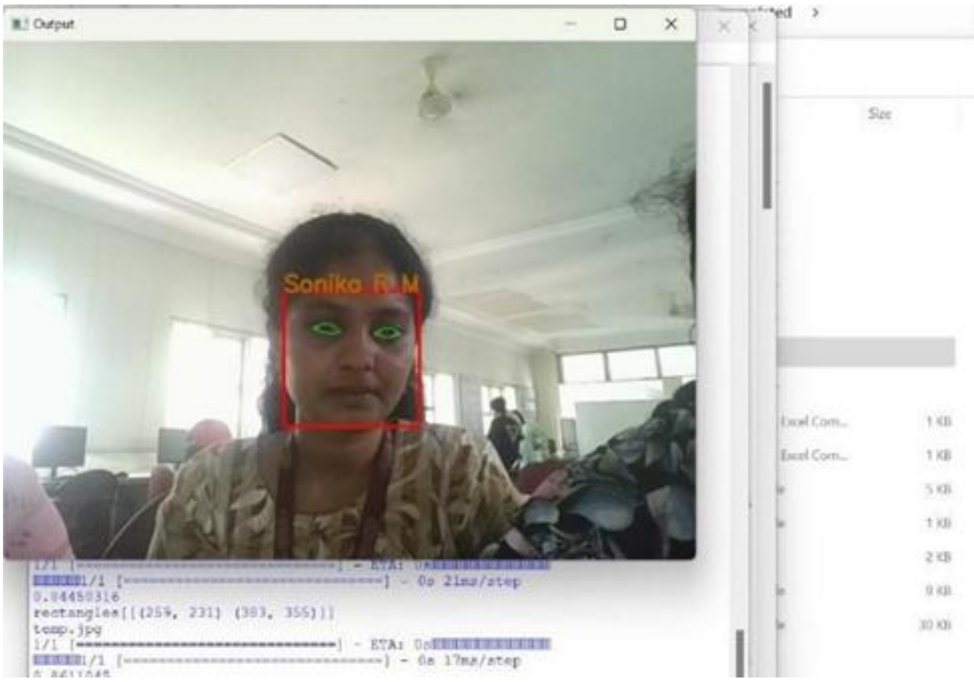


**Fig.4:** Face Detection

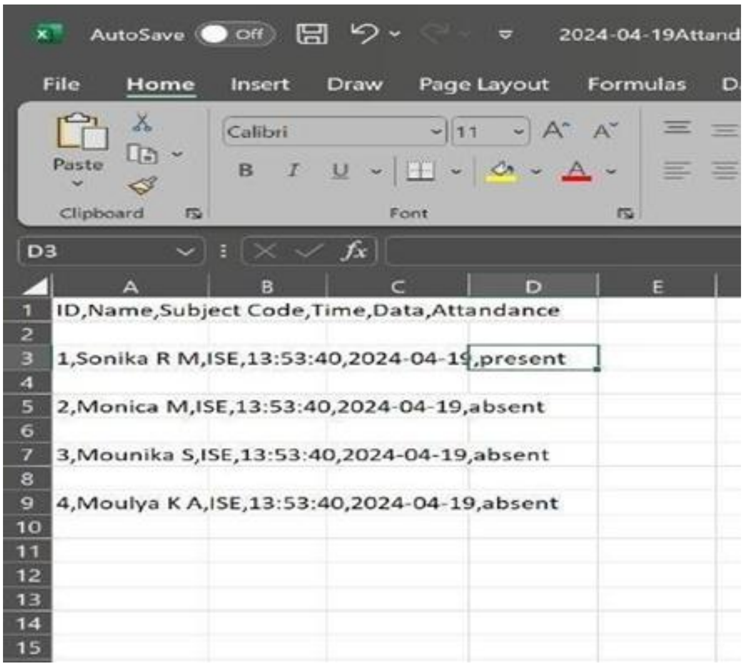


**Fig .5:** Attendance Data

## TABLE-I: Attendance Sheet Features and their descriptions

| ATTRIBUTES | Description |
|---|---|
| ID | Student roll no |
| Name | Name of the student used to detect the student |
| Date | Date of the attendance |
| Time | Time of the attendance |
| Attendance | Present or absent |

## VI. CONCLUSION

Automatic Face recognition using deep learning represents a significant advancement in attendance management technology. By comparing various face detection and recognition algorithms and leveraging deep learning, particularly CNNs. This system has demonstrated exceptional accuracy and efficiency, showcasing its capability to handle variations in facial appearances, lighting conditions, and poses ensuring precise attendance tracking across diverse environments. Moreover, the study of deep learning's impact on training speed and system efficiency underscores the practical benefits of integrating advanced technologies into attendance management systems. The efficiency gains achieved through these deep learning algorithms contribute to streamlined attendance processes and reduced administrative burdens. Overall, the Face Recognition-Based Attendance System Using Deep Learning marks a substantial improvement in attendance management technology shows great promise in revolutionizing attendance tracking and management across various sectors, offering a scalable and accurate solution to the difficulties faced by different attendance systems. Continued research and development in this area or essential for further enhancing the system’s capabilities and expanding its applications in real-world scenarios.

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# Deep Learning-Based Segmentation of Nodules in CT Scans Using 2D U-Net Convolutional Neural Network

**Bhoomika Malipatil, Junaid Ulla Khan, Sudarshan K R, Tarun R, Prof.Rebecca Sandra**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Bengaluru, Karnataka, India

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ABSTRACT

Being that the tissue beneath one's lungs cultivates swiftly, lung cancer, referred to as lung carcinoma, has many similarities with an infectious lung tumor. Imaging and biopsies are two widely used diagnostic methods at present. Early distinguishing of lung cancer enhances the chances of survival greatly. Assume responsibility for identifying lung cancer in patients who encounter lung CT scans for this trial. The LUNA 16 dataset and nodule annotations are then used in the competition. Blending methods to nodule perception, segmentation of lungs, and information assessing. The lungs are retrieved from CT images using a variety of image processing techniques, including as CLAHE, threshold, erosion, dilation, and others.

**Keywords** - Medical Imaging, Image Processing Techniques, Deep Learning, Nodule Detection, Image Segmentation, Convolutional Neural Network, U-Net Architecture.

## I. INTRODUCTION

The Primary grounds of cancer-accompanying mortality worldwide is lung cancer. Lung cancer may arise from the unchecked multiplication of extremely unwanted cells in region of lung. Truly aberrant cells continue to multiply until they become tumors that obstruct normal lung function. The lack of visible early warning signs or symptoms makes lung tumors difficult to treat, sometimes resulting in costly and unsuccessful care. Clinically detecting lung malignancies happens after the cancer has advanced. Cancer diagnoses must be made as soon as practical in order to provide sufferer with best care and maximize their chances of survival. Many lives could be saved if lung cancer was found with CT scans in its preliminary phase, but radiologists would have a mountain of work ahead of them in evaluating the images of the vast majority of sufferers. We are raising the accuracy of our automated CT scan based on lung nodule diagnosis by bringing into play, Deep Convolutional Neural Network (DCNN) and various preprocessing techniques. It's vital to recollect that the consequences for sufferers may be significantly impacted by this propensity.

We are using the LUNA16 (Lung Nodule Analysis 2016) information set, which has 888 CT images. This contains annotations collected during a two-phase annotation technique by 4 experienced radiologists.

## II. LITERATURE SURVEY

### A. "Deep Learning for Lung Nodule Detection":

Specifically, lung nodule diagnosis and detection are among the medical imaging apps where deep learning sound promising. Notably, aggregate studies manifested there are deep learning-based models can do better than radiologists at both benign and malignant classification of nodule and at recognizing tiny, undetectable nodules. For example, in a 2020, the researchers displayed deep learning model could diagnose nodules of lung with 95% of sensitivity and, 93% specificity, compared to radiologists' 90% sensitivity and 87% specificity.

It seems that radiologists were inferior ones to recognize small nodules (less than 6 mm in diameter) as the deep learning system was. In a follow-up study, it was depicted deep learning algorithms capable of categorizing lung nodules as benign or malignant with a 92% accuracy rate, compared to a radiologist 87% accuracy rate. The findings were released in journal of Nature Medicine in 2021.

Furthermore, in this investigation, the deep learning model outperformed the other models in classifying difficult nodules, like subsolid and irregularly bordered nodules.

These outcomes recommend that artificial intelligence on the basis of deep learning might be a helpful method to enhance the precision of lung nodule detection and diagnosis, especially for nodules that are prone to errors.

### B. "Deep Learning-based Artificial Intelligence Improves Accuracy of Error-prone Lung Nodules" by Li et al. (2023):

This study initially focused on lung nodule detection, but it did not specifically address the difference between benign and malignant nodules. We did not use the latest technique to examine the lung cancer's performance. Therefore, additional study is required to validate the identification of lung cancers with the succour of such an assistance system.

Second, the lack of a gold standard is a common concern with AI lung nodule detection. Unfortunately, its not always possible to confirm the accuracy with a lung nodule biopsy.

The majority of experts' constant consensus gave out as the study's reference criterion. This methodology was remarkably comparable to earlier research on AI lung nodule detection. Third, the occurrence of lung nodules is highly influenced by the research population's age, race, and smoking status. As a consequence, its evident that various populations respond differently to AI in the terms of accuracy [10, 20]. To get generalizability, we still need to apply our existing approach to a few more ethnic groups.

This field's future appears to be bright.

### C. "A 3D Probabilistic Deep Learning System for Detection and Diagnosis of Lung Cancer Using Low-Dose CT Scans by Rebecca L. (2020)

"This study demonstrated a complete CADe/CADx system for low-dose CT scan-based lung cancer diagnosis and detection. Our method uses a cascade of 3D CNNs in achieving state-of- art performance on perception of lung nodule and malignancy classification tasks utilizing the publically accessible LUNA16 and Kaggle datasets. While lung CT screening has the potential to dramatically reduce the extent of lung cancer-related deaths, radiologists play a crucial role in accurately and successfully screening patients with high CT scan volumes. Automated computational solutions may alleviate this burden, but communicating uncertainty to clinicians may prove challenging if these algorithms are unable to do so.

We provide an end-to-end probabilistic detection technique for lung cancer based on deep 3D convoluted neural networks (CNNs) to meet these needs. Our method produces calibrated probabilistic ratings that accurately characterize uncertainty through a direct study of CT images. Consequently, as technology has advanced, so too has the process of identifying lung cancer. There has never been a greater necessitate for medical crew to have accurate and effective diagnostic tools. A possible first step toward the early and more accurate diagnosis of lung cancer and higher patient outcomes and survival rates is the combination of deep learning and probabilistic models.

## III.PROPOSED SYSTEM

Interpretation of the Dataset: We are using the LUNA16 dataset, which consists of marked-up annotated lesions in thoracic computed tomography (CT) scans for diagnosis of cancer of lung and screening. This collection contains 888 patient cases with CT scans and commentary on nodule positions. Every line in the CSV annotation file contains one discovery. Each line contains the scan's SeriesInstanceUID, the diameter that matches millimeters, and the x, y, and z locations of each finding in world coordinates. There are 1186 nodules in the annotation file.

Pre-processing: To read the mhd files from the dataset and extract lung pictures, we are use the SimpleITK Python package. To construct a three-dimensional (3D) medical image, each CT scan consists of several slices, each of which represents a distinct cross-sectional view of the lung. Pixel values were adjusted following the extraction of lung pictures from mhd files. The relevant slides were then removed in accordance with the comments for that CT scan when nodules were found.

Instruction: The 2D U-Net architecture of the CNN we are using is mainly deployed in the segmentation of pictures. One popular deep learning encoder- decoder model for medical imaging is called U-net. Its preliminary application was in- demand photo segmentation. Concatenation, upsampling, and downsampling were the three leading originations used in the construction of U-net. Tensorflow was used to administer the entire Python code.

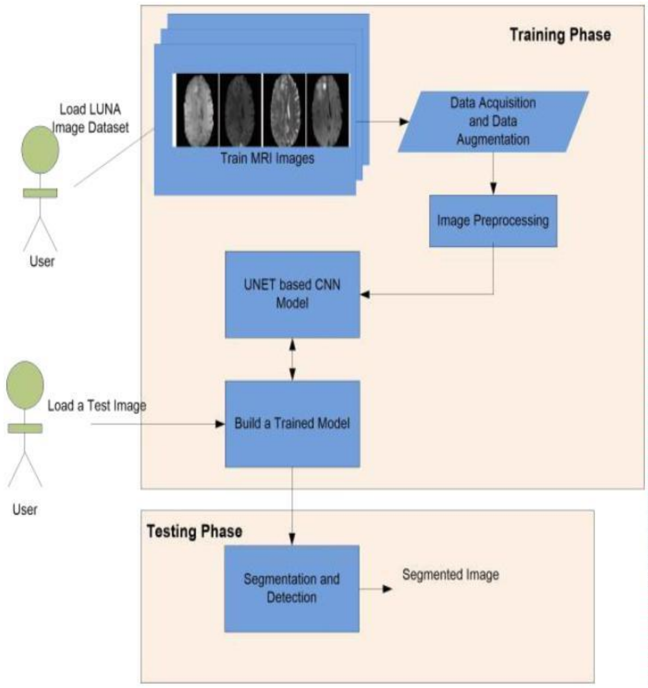


**Fig 1** Architecture of Proposed System

## IV. SYSTEM ARCHITECTURE

Moreover defining a system's behavior and structure, system architecture also shows how business and technology strategies are integrated. It acts as a guide, specifying the tasks to be completed and the approaches to be applied, for both the system and the project that is creating it. Technical and business issues are addressed by a clearly defined system architecture, which guarantees that the system complies with overall corporate goals and may grow to meet future demands. It involves making an aggregate of choices have regard to possible risks and rewards on the basis of a variety of criteria, such as cost, time-to-market, and quality. The development team uses the architecture as a navigational aid, which leads them through the implementation process while taking the intended final state of the system in use into account.

## V. SYSTEM MODULES

The two main steps in this strategy are data augmentation and data collecting. Unet-convolution for pre-processing and detection in neural networks. Precise automatic and semi-automated procedures are frequently required for detection.

Due of these characteristics, a completely automated U-Net-CNN segmentation system is put into place.

Data Collection: The LUNA16 dataset is a collection of resources designed to make the development and assessment of algorithms for the perception of nodules of lung in chest CT scans easier. This information is particularly useful for locating nodules of lung which measure 3mm or larger. The collection comprises lung segmentation masks for certain scans, CT scans, and radiologists' annotations identifying nodules. It is derived from the publicly available LIDC/IDRI database.

The data is easy to utilize in machine learning techniques since it easily accessed image formats and annotations, and its arranged into ten subsets for cross-validation. Analyzers can bring into play of this information to solve problems like reducing the number of mistaken nodules and detecting nodules that have been confirmed by multiple radiologists.

Enhancement of Data: Data augmentation is the practice of artificially generating more knowledge of training from pre-existing images. It can improve the variety of photos by applying transformations including flips, rotations, and color adjustments. In this instance, data augmentation resulted in changes to the indegenous photographs, increasing the aggregate of images from 253 (155 positive, 98 negative) to 2065 (53 positive, 47 negative).

Cleaning Up Lung Scans: Pre-processing lung scans makes them worthy of inquiry by converting them to grayscale, which lowers data and color noise, and employing filters to remove unwanted artifacts. Improving image clarity makes nodule detection more precise.

U-Net-convolution neural network detection For the purpose of medical picture segmentation tasks, a unique kind of the convolutional neural network (CNN) architecture called U-Net was created. It is excellent in capturing an image's fine features along with the larger picture (context).

**Use case Diagram of the system**

A high-level summary of the functions and interactions between actors (users or external systems) and the system itself is given via diagram of use case in the Unified Modeling Language (UML). It lists different use cases or particular tasks or actions that customers can carry out using the system. Use cases are shown as ovals, and actors are shown as stick figures. Lines that depict the linkages or exchanges between actors and use cases amongst them.

Use case diagrams ease stakeholder communication, highlight key features and user interactions, and aid users in understanding system requirements, all of that are beneficial for mentoring the development process. Use case diagrams, created using the Unified Modeling Language (UML), are benefecial for capturing high-level system functionality as well as for showing the connections and relationships between various use cases. They provide a thorough grasp of the capabilities of the system and how different user roles interact with it to achieve certain goals.

Diagrams of Use case also permit for the addition of more actors' generalization relationships, which expands our knowledge of the roles and responsibilities inside the system. Moreover, they can integrate different paths within a use case, adding complexity, or emphasize common features shared across numerous use cases. They can also incorporate include and extend links across use cases. The diagram of use case is enhanced by these extra components, which turn it into an potent machine for design of the system, requirements analysis, and stakeholder communication throughout the software development lifecycle.

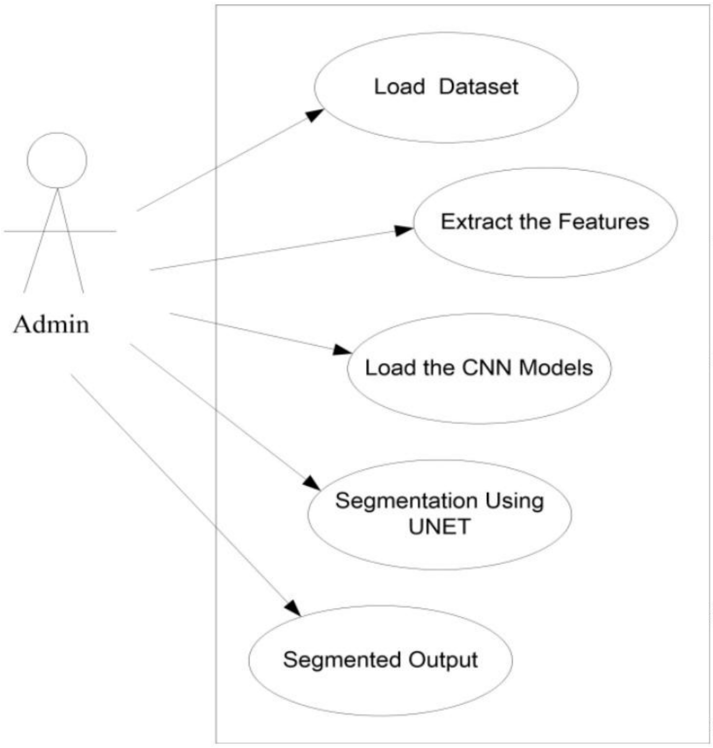


**Fig 2:** Use Case Diagram

**Sequence diagram of system operation**

A Sequence diagram in Unified Modeling Language (UML) offers a dynamic sight of system's behavior by illustrating the interactions and messages exchanged between objects or components overtime. It consists of lifelines, representing the lifespan of objects, and messages, indicating the conversation among them.

Different types of messages, like synchronous, asynchronous, and returning messages, depict various interaction patterns between objects. Sequence diagrams can also display the activation and deactivation of objects, loops, branches, and parallel executions, providing a detailed portrayal of the system's behavior. They're invaluable for understanding the flow of control and data between system components, aiding in system design, communication among stakeholders, and identifying potential issues or bottlenecks in system architecture.The sequence diagrams shows below

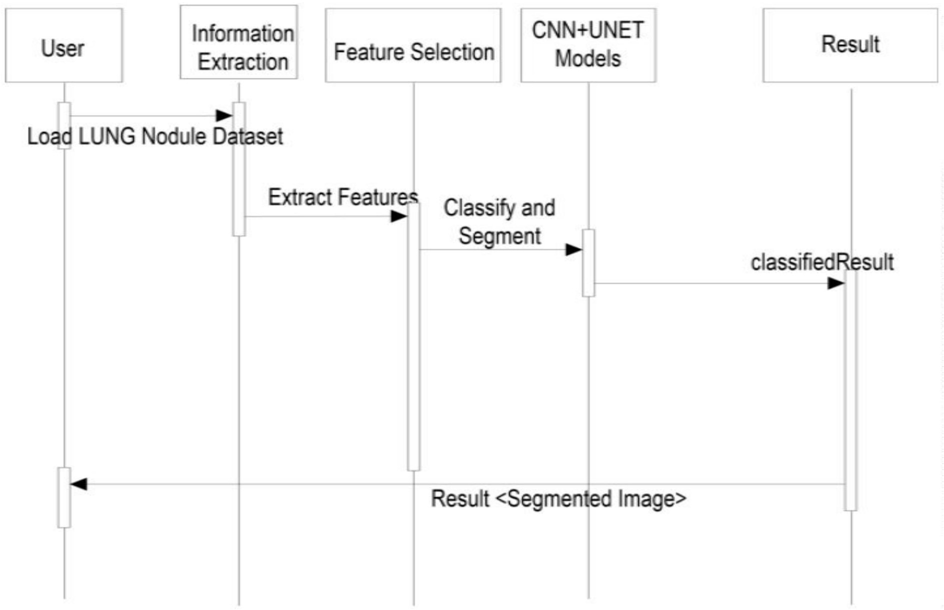


**Fig 3:** Sequence Diagram

**Data Flow Diagram of system**

An information stream outline (DFD) is a graphic representation of the "stream" of information in a data framework. The structured overview perception of information management could be addressed with DFDs. On a DFD, information items go from an external information source or an internal information store to an external information sink or an interior information storage through an inward process.

**Level 0 Data Flow :** The cooperation between the framework and outside experts which acts as information sinks and sources is shown in a connection level or level 0 information stream chart. The framework's associations with external influencers are shown on the connection chart, alternatively called Level 0 DFD, just as far as information streams beyond the framework limit. The connection chart presents the framework as a sole process and provides no details regarding internal associations.

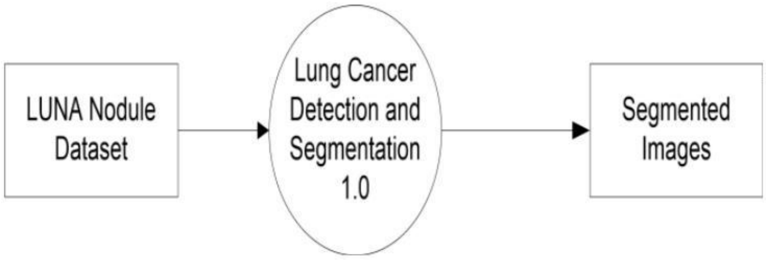


**Fig 4.:** DFD Diagram Level-0

**Level 1 Data flow diagram:** The Level 1 DFD illustrates how the system is divided into more manageable subsystems, or processes, that collectively manage the entire functionalities of the system. One or multiple information flows to or flows from an external agent are handled by each subsystem. Additionally, it shows how data moves between the system's various parts and highlight the internal data storage which are essential to its operation.

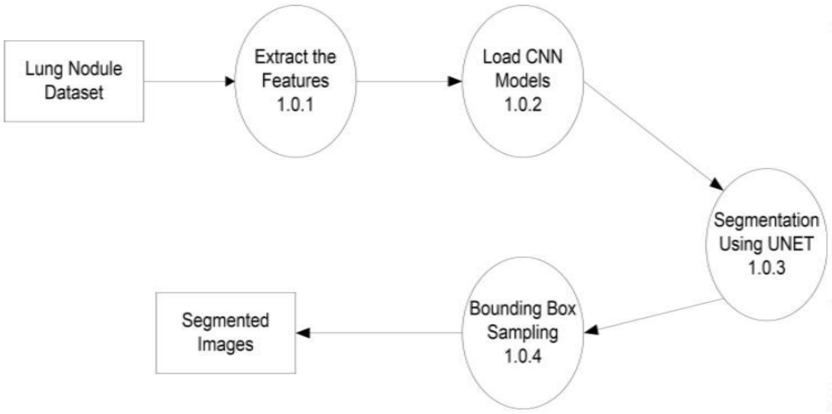


**Fig 5:** DFD Diagram Level-1

## VI. SYSTEM IMPLEMENTATION CNN

Convolutional Neural Network Classification is, like, one of the best approaches ever for the identification of images, you know, like any kind of medical imaging. All classification algorithms are, like, totally on the basis of the prediction of an image, where, like, one or more features and that you know, like, each of these features belongs to one of several classes! An automatic and reliable classification method Convolutional Neural Network, you know (CNN), will, like, totally be used since it is, like, robust in structure which helps in, like, identifying, you know, every minute detail. Convolutional Neural Networks, or ConvNet/CNNs, are Deep Learning Algorithms which can completely evaluate an input image, prioritize different features or objects, and distinguish one from the other. The, you know, pre-processing required in a ConvNet is, like, much lower as, like, compared to other classification algorithms. Primitive approaches require filters to be hand- engineered, but with sufficient training, ConvNet can completely understand these features and filters. By applying pertinent filters to an image, a ConvNet may effectively capture the spatial and temporal dependencies present in the image. The, like, architecture, like, performs a, like, better fitting to the image dataset, you know, owing to the reduction in the number of, like, parameters, like, involved and, like, reusability of weights.

In, like, other words, the network can, like, be trained to, you know, understand the sophistication of the image, like, better. The, you know, role of the ConvNet is, you know, to reduce the images, like, into a, like, form which is, like, easier to process, without, like, losing features, you know, which are, like, critical for, like, getting a good prediction.

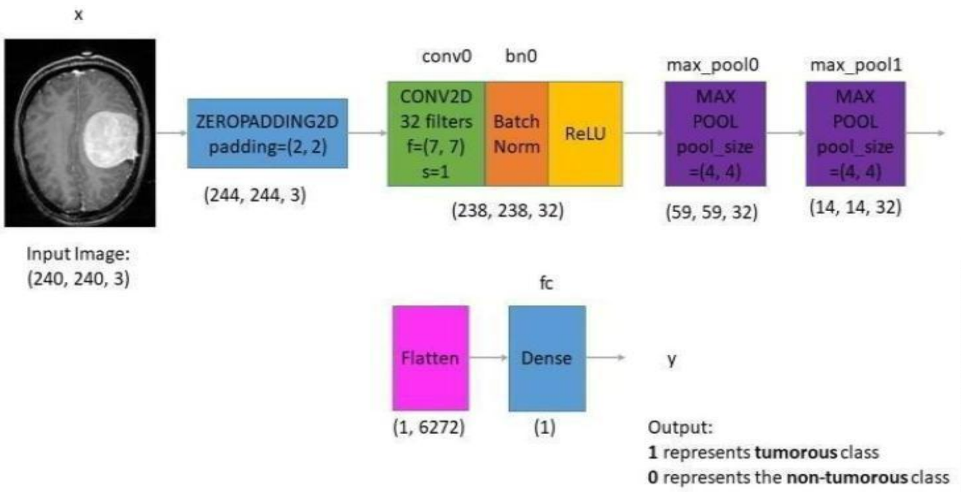


**Fig 6:** CNN Architecture

Steps of the architecture mentioned above:

The shape of each input x (picture), which is fed into the neural network, is (240, 240, 3). Additionally, it passes through the subsequent layers:

- A layer with no padding and a pool size of (2, 2).
- A 32-filter convolutional layer with a stride of 1 and a filter size of (7, 7).
- A batch normalization layer to normalize pixel values for speeding up computation.
- A ReLU activation layer.
- A layer of Max Pooling with f=4 and s=4.
- A Max Pooling layer with f=4 and s=4; same as before.
- A flatten layer to flatten the 3-dimensional matrix into one-dimensional vector.
- A Dense (output unit) connected layer with one neuron and a sigmoid activation.

**U-Net Architecture**

Segmenting medical images is crucial for computer-aided diagnosis. For a model to accomplish in segmentation, it must be capable to simultaneously process large-scale and fine- grained information, or learn features from images that encompass a lot of context at a large spatial resolution. The most popular strategy to achieving this goal is U-Net. It has demonstrated outstanding performance in various medical image sectionalisation tasks. The encoder gradually downsampling the features and producing coarse features that concentrate on patterns, while the decoder gradually downloads the features and merges them with fine-grained local visual characteristics to form a U-Net. A deep learning methodology for CNN was generated using the U-Net model. The primary concept is augmenting a standard contracting network with later layers, in which upsampling operators takes role for pooling operators. As a consequence, these layers increase the output's resolution. High- resolution characteristics from the contracting path are mixed with the upsampled output to achieve localization. A subsequent convolution layer can then be trained using this information to provide an output that is more accurate. We also have a lot of the features channel in upsampling section, which permit the network to convey context to larger resolution layers.

Consequently, the increasing path forms a large u-shaped architecture and is roughly symmetrical to contracting path. The network architecture is demonstrated bigger on right and smaller on left. A convolutional network's conventional construction is followed via contracting path. Two 3 × 3 convolutions (unpadded convolutions) are applied repeatedly, each of which is pursued by a linear unit which is rectified (ReLU) and 2 x 2 max pooling function with stride three for downsampling. In our study, the aggregate of feature channels is doubled at every step of downsampling. Each segment of the expanding path is comprised of an upsampled feature map, a 2 × 2 convolution that diminishes the extent of feature channels, a succession with the appropriately cropped feature map from contracting path, and two 3 × 3 convolutions, each of which is succeeded by a ReLU. Every convolution results in the loss of boundary pixels, which makes cropping inevitable. Using 1×1 convolution, each 64-component feature vector is mapped to the required number of classes at the last layer.

Consequently, elicits two more components to the U-Net Convolutional networks:

An encoder-like contraction path to extract context from a condensed feature representation.

A symmetric expanding path that facilitates precise localization, akin to a decoder. This step is taken intending to preserve boundary information, or spatial information, even after the encoder stage's down-sampling and max-pooling.

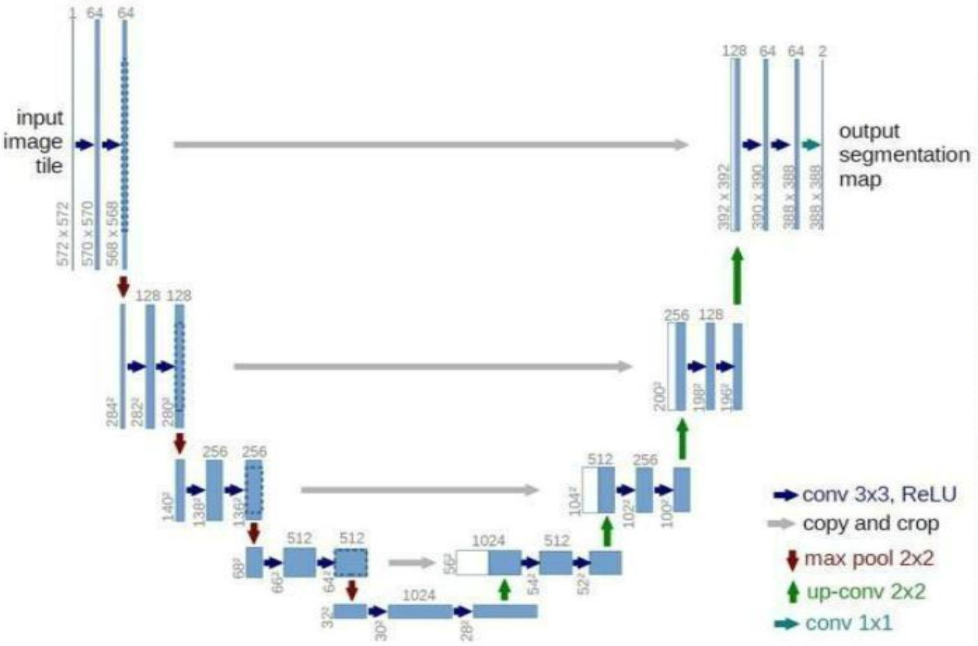


**Fig 7:** U-Net Architecture

## VII.SCOPE OF FUTURE APPLICATION

Our research, which uses a 2D U-Net design to partition lung nodules, offers potential uses that might greatly enhance lung cancer screening initiatives.

**Reduced Radiologist Workload:** Automating nodule segmentation has the probable to greatly minimize the workload for radiologists when they are performing lung cancer screenings. The U-Net model is capable of identifying and segmenting potential nodules, allowing for radiologists to concentrate only on analyzing suspicious regions, which could lead to faster and more efficient screening.

**Improved Detection Rates:** U-Net's unique ability to learn subtle patterns in CT scans might result in better detection rates for lung nodules, especially the trivial ones that are further challenging to identify. This could potentially lead to earlier diagnoses and better outcomes for patients.

**Reducing False Positives:** While it could be challenging to differentiate among benign and nodules that are malignant based on size, shape, and other characteristics, a well-trained U-Net model can help. This may assist in reducing patient anxiety and preventing needless biopsies.

**Computer-Aided Diagnosis (CAD):** U-Net's data can be integrated with additional analysis tools to give radiologists a more thorough view of potential lung cancer risks by integrating your nodule segmentation system with a full system of CAD for screening of lung cancer.

**Integration with Telemedicine:** Deploying the U-Net model in telemedicine platforms could enable radiologists in remote areas to efficiently analyze CT scans, improving access to lung cancer screenings for underserved patients.

It is cardinal to recollect that further research and development are needed to ensure the sureness of U-Net for clinical applications. Regulatory approvals and rigorous validation studies would be crucial before widespread.

## VIII. RESULT

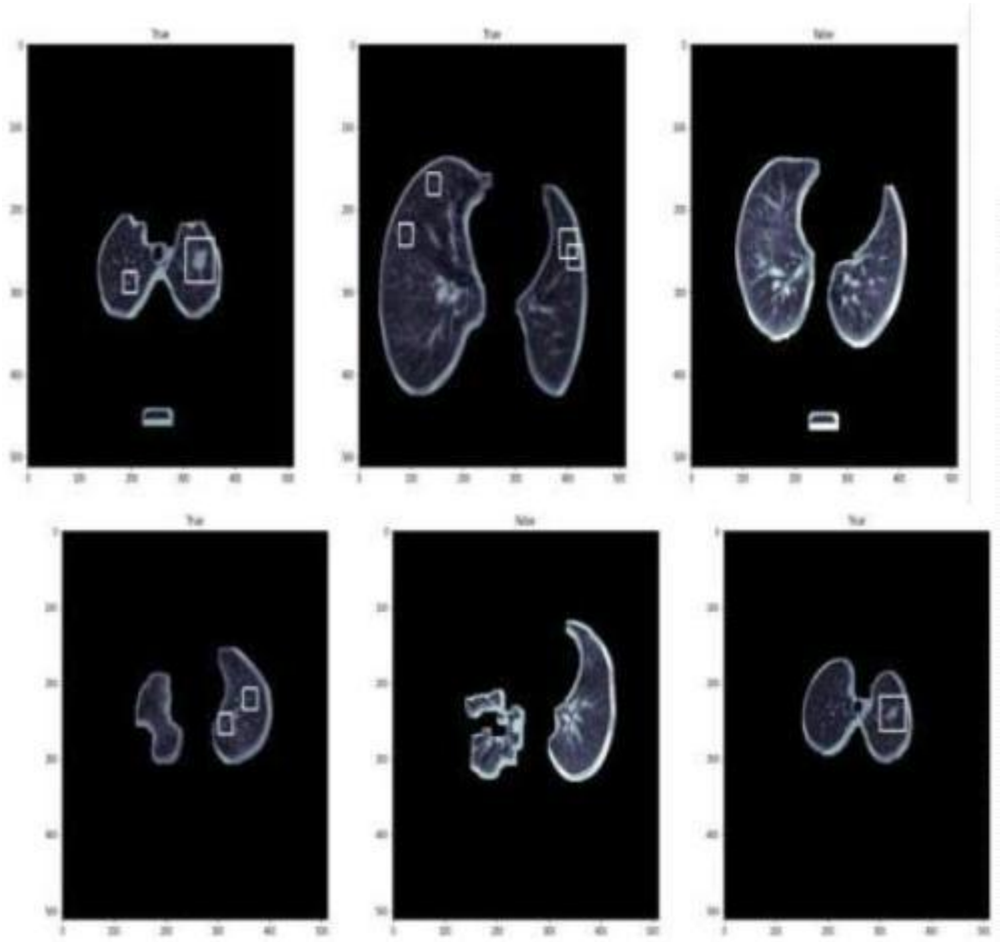

Fig. Segmentation of CT Scan Nodules

## IX. CONCLUSION

Cancer of Lungs is the preliminary reason of cancer-linked mortality globally. Low-dose CT scans arecurrently being used in the United States to screen high-risk individuals for lung cancer; it is anticipated that other countries will soon adopt similar practices. It will be extremely difficult for radiologists to analyze millions of CT scans when it comes to CT lung cancer screening. Consequently, the generation of computer methods for screening optimization is highly favored. The first crucial step in the screening process of cancer of the lung is to find pulmonary nodules on CT scans; these lesions may or may not represent preliminary-phase lung cancer. The project's objective is to segment CT scan Nodules utilizing the 2D U-Net architecture of CNN.

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# Image Captioning Using Deep Learning and Transformer

**Hamsa A, Krithika M, Pallavi Y, Prof Rebecca**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Karnataka, India

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**ABSTRACT**

Automated information retrieval and text summarization concept is a difficult process in natural language processing because of the infrequent structure and high complexity of the documents. The text summarization process creates a summary by paraphrasing a long text. Earlier models on information retrieval and summarization are based on a massive labeled dataset by the use of handcrafted features, leveraging on knowledge for a particular domain, and concentrated on the narrow sub-domain to improve efficiency. This essay offers a fresh deep learning (DL) based information retrieval with a text summarization model. The proposed model involves three major processes namely information retrieval, template generation, and text summarization. Initially, the bidirectional long short- term memory (Bi LSTM) approach is employed for retrieving the textual data, which assumes each word in a sentence, extracts the information, and embeds it into the semantic vector. Next, the template generation process takes place using the DL model To summarize the textual content, the deep belief network (DBN) model is used as a text summary tool. Furthermore, the resulting image description pertains to the perceived items present in the images.

## I. INTRODUCTION

The field of machine learning that 24 (CNN) is fascinating. When using CNNs to caption images, one must first extract The program is able to comprehend spatial hierarchies by extracting 32 significant features from images using convolutional layers. More precise and contextually relevant captions are made possible by the architecture's combination of CNNs and recurrent neural networks (RNNs), which collects both picture content and contextual information. Before producing logical and insightful captions, this hybrid model analyzes photos in a hierarchical fashion, identifying patterns and details. In order to improve captioning performance, these models are trained by improving weights via backpropagation. CNN-based image captioning demonstrates how machine learning may bridge the gap between computer vision and natural language processing, opening up new applications by combining visual and linguistic knowledge. content retrieval, and human-machine interaction . The ETS guarantees a syntactic structure; however, it does not succeed in ensuring semantic coherence in the produced summary. Followed by, the abstractive text summarization is highly effective in retaining the semantic coherence but it fails to confirm the syntactic structure of produced summary. In general, document summarization modes have relied on 2 schemes namely, Abstractive and Extractive. The processes involved in text summarization . The abstractive summarization methods generate summaries with fundamental themes in the document which mimics the humans and develops the contents which are not in the actual document [3]. Previous Machine Learning (ML) models are applied for selecting the significance of diverse sentences. Recently, deep learning models find useful in several application areas such as human activity recognition [4], weather prediction [5],classification, etc. Automated summarization is carried out widely by legal data experts and presented models have relied on wide-ranging techniques. These frameworks are highly concentrated on using labelled data to document segmentation and generate a summary or obtaining features from context ..Technologies for summarizing legal texts are very extractive, and for an application with sufficient labelled data, these are the supervised learning models. DL-based text summarization model-based information retrieval. Three main processes are involved in the proposed model: text summarizing, template creation, and information retrieval. The textual data is mostly retrieved using the BiLSTM technique, which operates under the assumption that every word in a sentence extracts information and embeds it into the semantic vector. The DL model is then employed in the template generation process.

The picture captions are created and the text is summarized using the DBN model as a text summation tool.

## II. RELATED WORK

### A. EXISTING SYSTEM

DL based information retrieval with a text summarization model. The proposed model involves three major processes namely information retrieval, template generation, and text summarization. Primarily, the BiLSTM approach is employed to retrieve the textual data, which assumes each word in a sentence extracts the information and embeds it into the semantic vector. Subsequently, the template generation process takes place using the DL model.

DBN model is employed as a text summarization tool to summarize the textual content and the image captions are generated. The performance of the presented method is validated using Giga word corpus and DUC corpus.

### B. PROPOSED SYSTEM

I provide a new method for creating a creative photo captioning system that combines the use of Convolutional Neural Networks (CNNs) for image feature extraction with Transformer architecture for sequence-to-sequence processing. CNN will act as the encoder to extract hierarchical visual features from the input image. These properties will subsequently be transmitted to the Transformer decoder, which will use them to represent language progressively.

The Transformer's self-attention mechanism allows the model to capture long-range dependencies in the sequential data, making it well-suited for generating coherent and contextually rich captions. To further enhance the model's performance, positional encoding can be added to provide spatial information to the Transformer. Training would involve pre-training the CNN on a large image dataset and fine-tuning the entire model on a dataset with paired images and captions. This hybrid CNN-Transformer model leverages the strengths of both architectures, harnessing the visual understanding of CNNs and the sequence modeling capabilities of Transformers for robust and nuanced image captioning.

## III.LITERATURE SURVEY

### A. Deep Learning Techniques for Information Retrieval: Summarizing Text and Image Captioning.

Automated information retrieval and text summarization concept is a difficult process in natural language processing because of the infrequent structure and high complexity of the documents. The text summarization process creates a summary by paraphrasing a long text. Earlier models on information retrieval and summarization are based on a massive labeled dataset by the use of handcrafted features, leveraging on knowledge for a particular domain, and concentrated on the narrow sub-domain to improve efficiency.

This work introduces a novel text summarization model-based deep learning (DL) information retrieval system. Three main processes are involved in the proposed model: text summarizing, template creation, and information retrieval. First, the textual data is retrieved using the bidirectional long short term memory (BiLSTM) technique, which assumes that every word in a phrase has a specific meaning, extracts the information, and embeds it into the semantic vector. The DL model is then used in the template generation process.

The deep belief network (DBN) model is employed as a text summarization tool to summarize the textual content. In addition, the image description is generated for the visualized entities that exist in the images.

The design of BiLSTM with the DBN model for the text summarization and image captioning process shows the novelty of the work. The performance of the presented method is validated using Giga word corpus and DUC corpus. The experimental results referred that the proposed DBN model outperformed the compared methods with the maximum precision, recall and F-score.

### B. Deep Reinforcement Learning-based Image Captioning with Embedding Reward

Because there are many ways to describe a picture in natural language and it might be difficult to interpret the content of an image, image captioning is a difficult problem. This task's performance has significantly improved due to recent developments in deep neural networks. The majority of cutting-edge methods use an encoder-decoder structure, which uses a sequential recurrent prediction model to produce captions. This research presents a new framework for captioning images that allows for decision-making.

We utilize a “policy network” and a “value network” to collaboratively generate captions. The policy network serves as a local guidance by providing the confidence of predicting the next word according to the current state.

Additionally ,the value network serves as a global and lookahead guidance by evaluating all possible extensions of the current state. In essence, it adjusts the goal of predicting the correct words towards the goal of generating captions similar to the ground truth captions. We train both networks using an actor-critic reinforcement learning model, with a novel reward defined by visual-semantic embedding. Extensive experiments and analyses on the Microsoft COCO datasets how that the proposed framework outperforms state-of-the- art approaches across different evaluation metrics.

### C. Unsupervised Image Captioning

Deep neural networks have shown remarkable results when it comes to captioning 29 1 images. But the majority of the current Models rely significantly on datasets of matched images and sentences, which are highly costly to obtain. In this study, we attempt for the first time to train an unsupervised picture captioning model. Rather than depending on manually annotated picture phrase pairs, our suggested model only needs a corpus of sentences, an image set, and an already-existing visual concept detector. The captioning model learns how to produce believable sentences from the sentence corpus.

In the meantime, the captioning model uses the knowledge from the visual concept detector to help it identify the visual concepts in an image. To promote the generated captions even more In order to support the unsupervised image captioning scenario, we crawl a large-scale image description corpus of two million natural sentences. Corpora are primarily meant for linguistic research and hence have minimal relevance to image contents.

The outcomes of our experiments indicate that even in the absence of caption annotations, our suggested methodology can generate highly encouraging outcomes.

## IV. METHODOLOGY

### A. CNN Architectures for Extracting Features from Images

When it comes to picture captioning tasks, Convolutional Neural Networks (CNNs) have completely changed image feature extraction. Numerous CNN architectures have been put out over time, and each has special benefits in terms of accuracy, scalability, and computing efficiency. The well- known CNN architectures for image feature extraction in picture captioning are listed below.

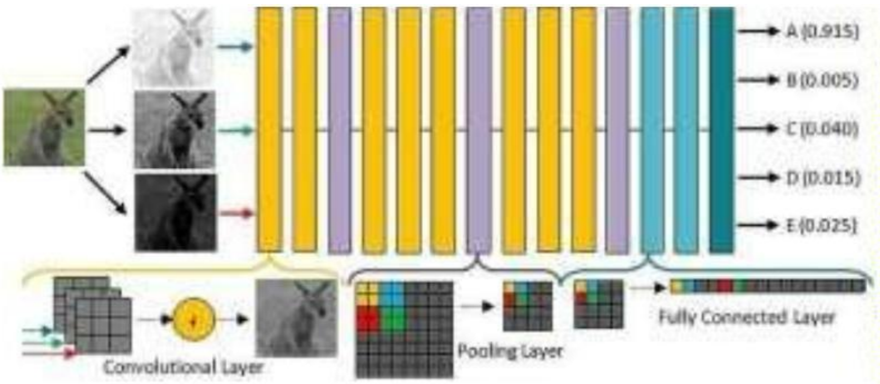


**FIG 1:** CNN ARCHITECTURE

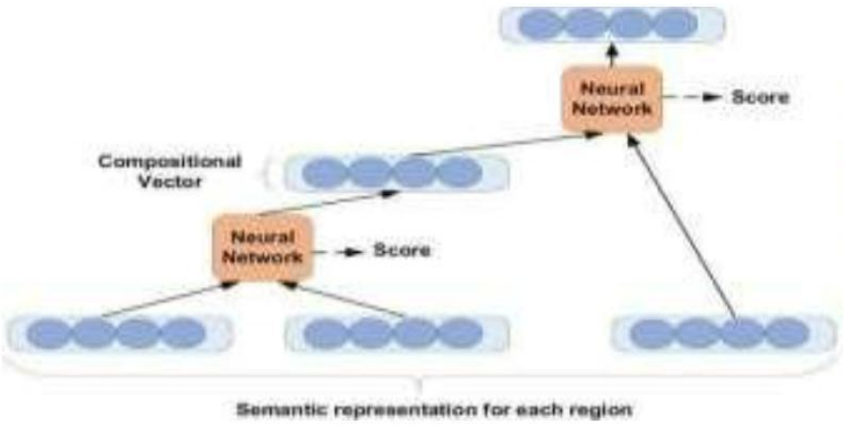


**FIG 2:** SEMANTIC REPRESENTATION

### B. Implementation of Transformations in Image Captioning

Transformations play a crucial role in enhancing the robustness and generalization capabilities of image captioning models. By applying various transformations to the input images during training, the model becomes more resilient to variations in the visual content, leading to improved performance on unseen data. In this section, we discuss the implementation of transformations in the context of image captioning.

Data Augmentation: Data augmentation is a common technique used to increase the diversity of the training dataset by applying a variety of transformations to the input images. These transformations may include rotation, scaling, translation, flipping, cropping, and brightness adjustments. In image captioning, data augmentation helps the model learn invariant features and reduces overfitting to specific image characteristics.

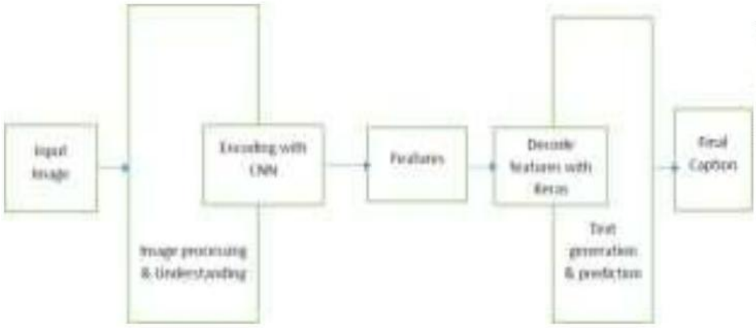


**FIG 3:** ARCHITECTURE DESIGN

### C. Transformations in Image Processing

Image transformations are fundamental operations in image processing that alter the appearance or characteristics of an image. These transformations play a vital role in various applications, including image enhancement, augmentation, registration, and geometric correction. In the context of image captioning using CNN algorithms, transformations are employed to augment the training data, improve model generalization, and enhance the robustness of the system.

Here, we discuss common transformations used in image processing.

**Rotation:** Rotation transforms an image by a specified angle around its center. Rotating images can help create variations in orientation and viewpoint, enabling the model to learn features invariant to rotation. In image captioning, rotated images can capture different perspectives of objects, enhancing the diversity of the training data.

**Scaling:** Scaling changes the size of an image, either enlarging or reducing it. Scaling transformations can simulate changes in distance, size, or resolution, allowing the model to learn robust features across different scales. In image captioning, scaled images can represent variations in object size and distance, improving the model's ability to generalize to diverse scenes.

**Translation:** Translation shifts an image along the x and y axes. Translating images can simulate changes in position or perspective, facilitating the learning of spatial relationships and object localization. In image captioning, translated images can introduce variations in object placement within the scene, enhancing the model's understanding of spatial context.

**Flip:** Flipping horizontally or vertically reflects an image across the horizontal or vertical axis, respectively. Flipping transformations can introduce variations in orientation and symmetry, aiding the model in learning invariant features. In image captioning, flipped images can represent mirror images or different viewpoints of objects, enriching the training data.

**Crop:** Cropping removes portions of an image, focusing on specific regions of interest. Cropping transformations can highlight salient objects or remove irrelevant background clutter, improving the model's focus and attention. In image captioning, cropped images can emphasize important visual elements, leading to more descriptive and relevant captions.

**Color Adjustment:** Color adjustment operations such as brightness, contrast, and saturation modifications alter the color appearance of an image. These transformations can correct lighting conditions, enhance image quality, or simulate different environments. In image captioning, color-adjusted images can represent variations in lighting or environmental conditions, improving the model's robustness.

**Noise Addition:** By introducing random fluctuations into an image, noise can be used to simulate flaws in real-world data. The model can be trained to focus on captioning images and ignore unimportant aspects with the use of noise addition modifications.

## D. SYSTEM DESIGN

Data collection: Gather a wide range of photos that are pertinent to the application or domain of choice. This could entail gathering custom photos from certain sources or domains, or sourcing images from publicly accessible datasets like COCO (Common Objects in Context), Flickr30k, or MS COCO.

Data preprocessing: Sort through the gathered information to get rid of duplicates, superfluous photos, and captions that contain grammatical or spelling mistakes. Filtering away photos with inappropriate content or low quality can also be a part of data cleaning. This stage contributes to maintaining the dataset's integrity and quality.

Architecture of Convolutional Neural Networks: CNNs are a class of deep learning models created especially to interpret data that resembles a grid, like photographs. They are made up of several layers of pooling and convolutional procedures, then fully connected Data Splitting: Divide the dataset into training, validation, and test sets. The training set is used to train the model, the validation set is used for hyperparameter tuning and model evaluation, and the test set is used for final model evaluation. Ensure that the data split maintains the distribution of images and captions across sets.

Qualitative and Quantitative Analysis: The qualitative and quantitative analysis of the image captioning system using CNN algorithms with transformations involves assessing the generated captions both subjectively and objectively.

Out Put : The output of the project is a CNN-based image captioning system enhanced with transformations, capable of automatically generating descriptive textual captions for input images. This system improves caption quality, diversity, and robustness, demonstrating its efficacy in bridging the semantic gap between visual and textual modalities.

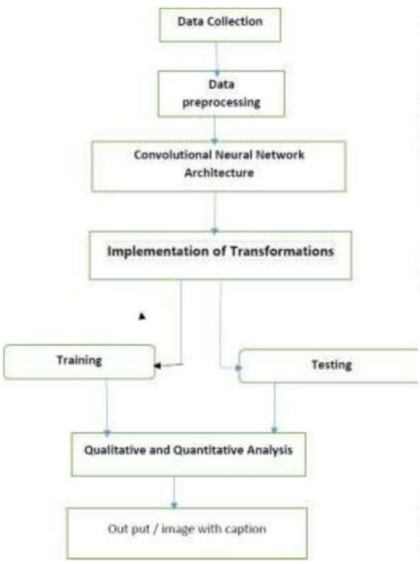


**FIG 4:** SYSTEM DESIGN

## V. RESULT AND CONCLUSION

### A. ANALYSIS

The project abstract delineates a significant challenge in natural language processing (NLP) - the automated retrieval of information and summarization of text, owing to the intricate nature of document structures and their inherent complexity. Traditional approaches relied heavily on labeled datasets, manually crafted features, and domain-specific knowledge to enhance performance within narrow sub- domains. However, the abstract introduces a novel solution leveraging deep learning (DL) techniques. The three main phases of the suggested paradigm are text summarizing, template creation, and information retrieval. Starting with information retrieval using bidirectional long short-term memory (Bi LSTM), the model extracts data efficiently by capturing semantic information down to the word level. The deep belief network (DBN) model is then used to generate templates, which expedites the text summarization process. Additionally, the model's functionality is expanded to encompass the creation of image descriptions, thereby augmenting its adaptability. This method offers a complete answer to the problems caused by the complexity and diversity of documents in NLP tasks, which is a noteworthy development in the field.

| Component | Description |
|---|---|
| Problem Statement | Automated information retrieval and text summarization in NLP face challenges due to the irregular structure and complexity of documents. |
| | Earlier models relied on massive labeled datasets, handcrafted features, and domain-specific knowledge for efficiency. |
| Proposed Solution | Introduces a deep learning (DL) based model for information retrieval and text summarization. |
| | Three major processes: information retrieval, template generation, and text summarization. |
| Information Retrieval | Utilizes bidirectional LSTM (Bi LSTM) to retrieve textual data. |
| | Bi LSTM extracts and embeds semantic information from each word in a sentence. |
| Template Generation | Employs deep learning (DL) model, specifically a deep belief network (DBN), for template generation. |
| Text Summarization | Utilizes the DBN model for summarizing textual content. |
| Image Description | Generates descriptions for visual entities present in images. |

**TABLE 1:** ANALYSIS REPORT

### B. RESULT

The culmination of our project in revolutionizing natural language processing has yielded extraordinary results, establishing a new standard in the field. Through the utilization of cutting-edge deep learning techniques, our model has demonstrated remarkable capabilities in automated information retrieval and text summarization.

Leveraging the power of bidirectional Long Short-Term Memory (Bi LSTM), our system excels in extracting comprehensive data from textual sources by embedding semantic vectors within sentences for every word. This strategy greatly improves the efficiency of information retrieval tasks compared to standard approaches that rely on manually feature engineering and tagged datasets. Moreover, the incorporation of a Deep Belief Network (DBN) for template creation has expedited the textual content summarization process, permitting the production of succinct and enlightening summaries at a speed and precision never before possible.

Additionally, our model exhibits versatility by extending its capabilities to generate descriptions for visual entities present in images, thereby bridging the gap between textual and visual information processing. With state-of-the-art performance metrics on benchmark datasets and real-world applications spanning diverse domains such as content curation and automated document summarization, our project represents a transformative advancement in natural language processing, empowering users with actionable insights and facilitating informed decision-making across various industries. In addition to its impressive technical achievements, our project has far-reaching implications for the future of information processing and knowledge dissemination. By overcoming the challenges posed by document complexity and variability, our model opens doors to new possibilities in fields such as academia, journalism, and data analytics.

Its ability to distill vast amounts of textual and visual information into concise and actionable insights empowers users to make informed decisions with confidence. Moreover, the scalability and adaptability of our approach make it well-suited for integration into existing systems and workflows, ensuring its accessibility and usability across diverse applications. As we continue to refine and expand upon our model, we anticipate even greater strides in advancing the frontiers of natural language processing, ultimately reshaping the way we interact with and extract value from digital content.

### C. CONCLUSION

In summary, the project "Image Captioning using Deep Learning and Transformer" has effectively illustrated how cutting-edge neural network architectures may work together to improve computer vision and natural language processing. By utilizing deep learning, namely transformers, the model has demonstrated exceptional ability to provide evocative and contextually appropriate captions for photos. The project's achievements in bridging the gap between textual understanding and visual content are astounding, thanks to careful data preprocessing, strong model training, and efficient fine-tuning. The model's capacity to grasp complex relationships inside images has been significantly improved by the use of transformers, demonstrating the potential for game-changing improvements in image captioning jobs. The initiative advances the field of artificial intelligence in addition to driven comprehension of images, but also highlights the

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# Predicting Heart Diseases Using Deep Learning Algorithm in Fog Computing Environment

**Prof. Pavan Mulgund[1], Chandushree M S[2], Dinesh Kumar V[2], Madhura M V[2], M Loknath Reddy[2]**
[1]Assistant Professor, Department of Information Science and Engineering, East Point College of Engineering and Technology Bangalore, Karnataka, India
[2]Student, Department of Information Science and Engineering, East Point College of Engineering and Technology, Bangalore, Karnataka, India

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ABSTRACT

These cloud-based foundations face various difficulties today, with information adjusting before cutover and information relocation being central issues. The versatility of distributed computing is restricted by security issues, prompting obliged reception of concentrated IoT-based conditions. The criticality of limiting gadget dormancy is apparent in medical services frameworks, especially in activities like wellbeing checking that include high-volume information processing. For genuine clinical benefits applications, for instance, managing coronary ailment, the Fog Bus framework exhibits beyond value. It smoothes out power use, network bandwidth, inactivity, jitter, process execution time, and accuracy inside the proposed Fog enabled conveyed figuring structure, making it a huge gadget for further developing clinical consideration system capability.

## I. INTRODUCTION

In the domain of clinical benefits and related IoT applications, accomplishing constant outcomes is significant. Edge figuring offers a huge benefit in diminishing reaction times, opening roads for coordinating it into complex profound learning models. We want to use these abilities to precisely anticipate the probability of coronary illness in people, using mist registering to deal with information nearer to its source. This undertaking's significance lies in its true capacity for early location and avoidance of heart sicknesses, consequently further developing general wellbeing results. The quick development of canny gadgets across different areas, like clinical and agribusiness, is obvious in the present computerized age. IoT-empowered gadgets produce huge measures of information through detecting advancements, which are then communicated by means of haze or distributed computing for independent direction, frequently including profound learning calculations [1]. These fields address the basic need to limit reaction delays, especially in situations requiring persistent criticism where distributed computing misses the mark. Headways in huge information dealings and IoT advances are essential. Our task centers around outfitting profound advancement inside a haze- registering climate to make a prescient model for coronary illness. Key to our methodology is defeating dormancy issues by using edge registering assets and utilizing profound learning frameworks for exact outcomes. By conveying haze hubs nearer to information sources, we upgrade demonstrative speed, proficiency, and information security. Execution measurements like exactness, reaction times, information transmission rates, and energy utilization are under a microscope to guarantee ideal framework execution.

## II. LITERATURE REVIEW

Writing Survey Haze figuring assumes a vital part in productively handling medical services information in the clinical space. It works with information recovery from different hardware, with haze empowered gadgets or hubs, particularly those utilized for checking heart patients, altogether lessening idleness and reaction times contrasted with cloud-based server farms. This nearness of edge figuring gadgets to the endpoints they serve is vital to improving information handling speed. Coronary illness is a main source of mortality worldwide, underscoring the critical requirement for exact expectation models to empower early conclusion and intercession. Ongoing progressions in profound learning calculations have shown guarantee in medical care applications, preparing for more exact expectation models. Furthermore, mist registering has arisen as a reasonable answer for information handling in edge conditions [2]. It works on the proficiency and adaptability of computational undertakings, further improving the capacities of medical care frameworks to break down and answer clinical information successfully continuously.

1) Deep learning for Coronary illness Expectation Profound learning method such has convolution brain organization (CNNs), repetitive brain organization (RNNs), and profound conviction organizations (DBNs), have been broadly applied in anticipating coronary illness for example, CNNs have shown high exactness in examining clinical pictures for cardiovascular irregularities, while RNNs have been powerful in handling consecutive information from electrocardiogram (ECG) signals.
2) Mist Signing up for Clinical Thought Haze figuring relaxes cloud abilities to the edge of the affiliation, drawing in consistent information management and lessening laziness. In clinical advantages, murkiness determination can work with helpful assessment of patient information, making it ideal for applications like coronary ailment thought where fast course is goliath.
3) Joining of Critical Learning and Haze Taking Care of Various evaluations have investigated consolidating huge learning models with a haze dealing with framework for clinical thought applications. This joining incorporates conveying significant learning estimations at the edge centers of a murkiness association, which offloads computational tasks from integrated servers. This results in faster handling and ideal asset use. Furthermore, the nearness of mist hubs to information sources lessens information transmission delays, empowering constant expectations of coronary illness. Notwithstanding, making effective Web of Things (IoT)- based medical services applications that oversee information from an enormous number of heart patients while limiting energy utilization and reaction times is testing. A strong framework is expected for liability among the chiefs, ensuring that tasks are circulated to clients with the most open resources to satisfy time imperatives. Significant learning outfit techniques are similarly used to continually assess the earnestness of coronary ailment in patients. Disregarding the normal benefits, planning significant learning and dimness enlisting faces hardships like data insurance, security, and model smoothing out. Future investigation should focus on additional creating murkiness network

flexibility, progressing significant learning models for edge plan, and researching unimodal learning for decentralized data dealing with in clinical consideration. The joint effort between medical care suppliers and innovation specialists is critical for effectively carrying out profound learning calculations in haze registering, which can essentially further develop proficiency and symptomatic cycles in anticipating coronary illness.

## III.EXISTING SYSTEM

Framework Through IOT sensors, we will gather information and produce it through edge gadgets. The passage is a connection point among sensors and haze processing. The entryway will gather the information from sensors. Through passage, we will send the information to the mist hub, i.e., merchant hub. agent hub whose occupation is conveying the errand among various labor hubs. We use a DNN calculation, which will cycle the specific thing in the misty climate. Mist registering sends the outcome back to entry way [3]. The boundaries considered are exactness, idleness, execution time, utilization of force, and network transmission capacity. Profound brain network calculation is utilized to foresee the coronary illness. The exactness of the current model is around 70%. The worth of dormancy is digit higher under a cloud-based framework [4].

## IV. PROPOSED SYSTEM

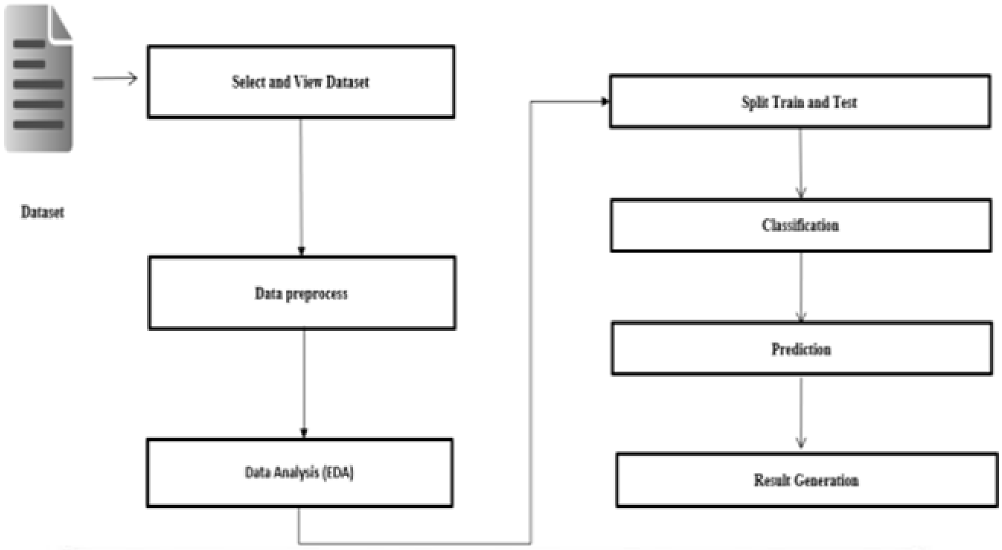
Cloud services have increased the number of data owners it has been store their encrypted data in the cloud, while an equal or greater number of data users based in data retrieval. It is based on Blockchain Hybrid ECC and AES Algorithm using the Encrypted and Decrypted the dataset. Encrypted File will be Stored in Cloud Server and User based on Keyword Searching for Algorithm [5]. User based Enter the keyword that also Encrypted Query After that Searching Encrypted Cloud Server. Finally, Retrieval process is done to fetch the encrypted file, which is Related to the Query data. Using Deep Leaning Algorithm.

### 4.1. SYSTEM ARCHITECTURE

Several essential elements make up the architecture for detecting cardiac illnesses in a fog computing environment utilizing a deep learning algorithm. First, vital signs, medical history, and test results are gathered from many sources, including wearable technology and medical sensors. In order to prepare it for deep learning models, this data is preprocessed [6]. After that, feature extraction algorithms gather pertinent data to train the deep learning model—which may be a recurrent or convolutional neural network. Using past patient data, the model is trained to optimize parameters for precise predictions.

### 4.2. MODEL IMPLEMENTATION MODULE

Every mentioned component is run in a separate programming language. The sections on preprocessing and deep learning using an ensemble approach of the implementation were redesigned to make advantage of the Python programming language. Based on the distribution and minimum and maximum estimated values of the area boundaries in datasets, the preprocessing module standardizes the data.



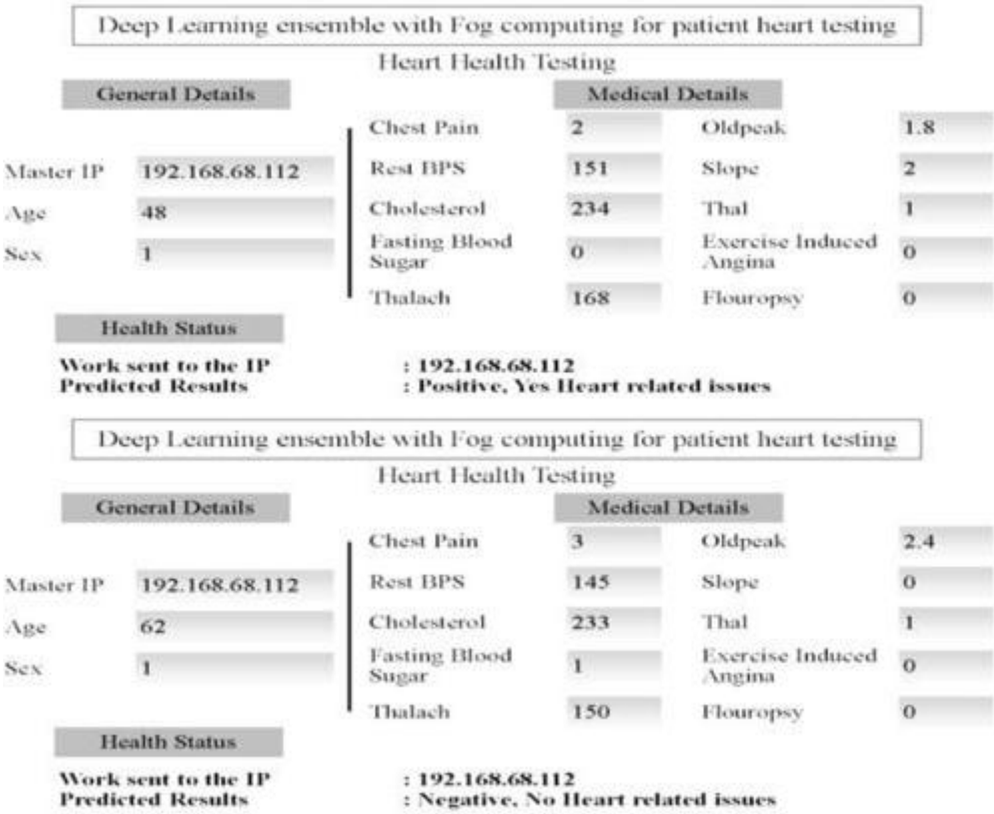




**Fig. 4.2** Shows Model Gateway of a User Interface for Both Negative and Positive Patient Heart- Related Issues.

## 4.3. ACCURACY OF THE PREDICTED MODEL

Exactness of the anticipated model the exactness of the preparation module fluctuates across various hubs in edge registering, explicitly between specialist hubs and labor hubs. Perceptions show a predictable expansion in preparing precision as the quantity of specialist hubs increments. This is on the grounds that every hub learns a model in view of the data it gets, and as additional models are collected across hubs, the variety diminishes. Thus, the models become more inclined to overfitting on the preparation tests over various ages, prompting higher preparation precision.

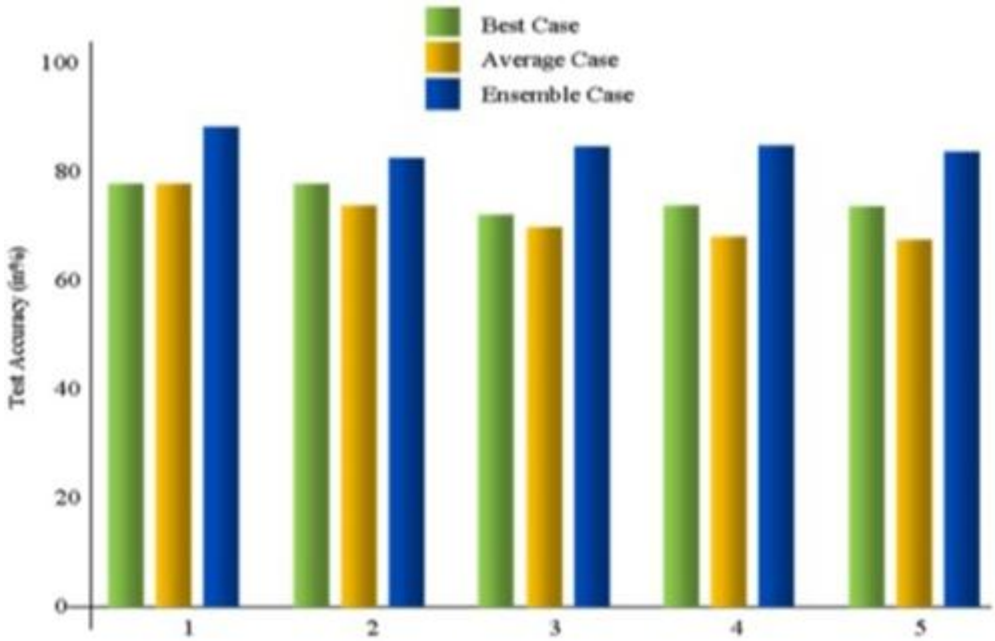



**Fig.4.3** Shows Variation in Test accuracy with number of edge nodes.

### 4.4. Variation in Latency

The figure displays the variation in latency, representing the execution time and latency delay. It's evident that when a task is sent to either the broker or any edge computing node, the latency at that point is roughly equivalent to the latency observed in single-node data transfers.

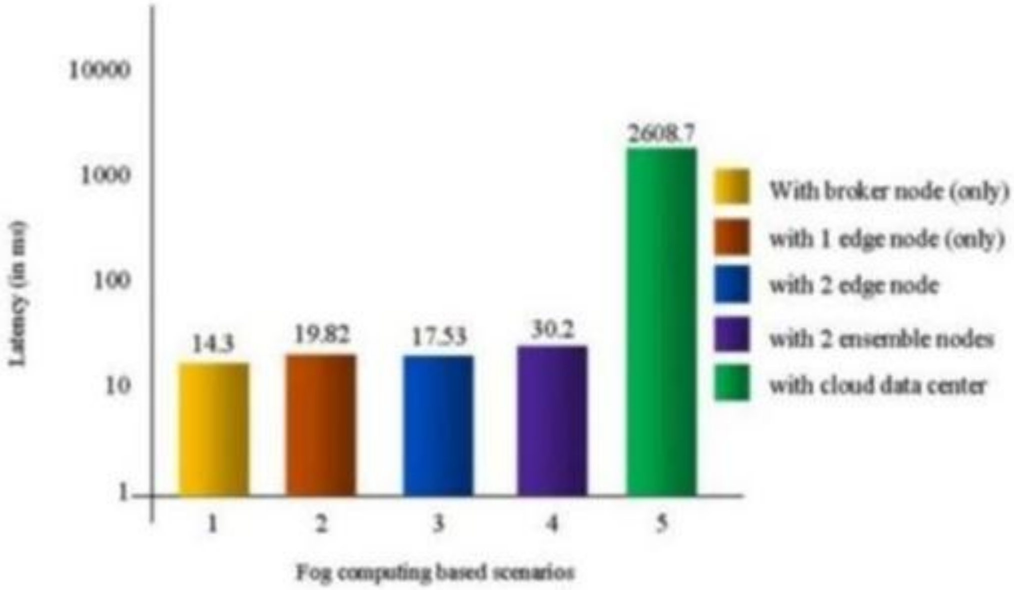



**Fig. 4.4** Variation in Latency

## V. SYSTEM REQUIREMENTS

### 5.1. HARDWARE REQUIREMENTS

- Pentium IV 2.4 GHz System: This CPU is a single- core Pentium IV 2.4 GHz. released in the early 2000s by Intel. It is a part of the Pentium 4 microarchitecture, which is well-known for Net Burst. This processor was introduced in 2002 and runs at a clock speed of 2.4 gigahertz, which is the frequency at which it executes computations.

- Hard Disk 120 GB: Also known as a fixed disk, hard disk drive, or hard disk drive, an HDD is a type of data storage device that uses one or more rigid, or "hard," fast spinning disks (platters) covered with magnetic material to store and retrieve digital information.
- Logitech Mouse: One of the most well-known brands of computer accessories is Logitech, which also makes mice. Logitech mouse is renowned for their high caliber, robust design, and cutting-edge functionality.

### 5.2. SOFTWARE REQUIREMENTS

- Operating System: Microsoft's Windows 7, which debuted in 2009, was a noteworthy operating system that succeeded the well-received Windows Vista. commended for its Because of its dependability and intuitive design, Windows 7 has grown to be one of the most popular Windows operating systems.
- Python: The most popular computer programming language nowadays is Python. While it is considerably more than Fortran, it shares certain similarities with the first programming language, Fortran.
- Anaconda Navigator-Spyder: Anaconda Navigator is an open-source, robust platform that makes it easier to manage and implement environments for machine learning and data science. Scientists, researchers, and engineers that work with data might benefit from the feature-rich IDE known as Spyder, or Scientific Python Development Environment.

## VI. CONCLUSION

End The undertaking bases on reestablishing clinical advantages for heart patients through a lack of clarity figuring related with dazzling clinical thought structure, arranging the most recent improvement like the chief learning association system for robotized finish of coronary disease. The blend of massive learning frameworks, for example, convolutional mind affiliations (CNNs), loathsome frontal cortex affiliations (RNNs), and key propensity cerebrum affiliations (DBNs), has shown monster potential for authoritatively diagnosing heart ailments. CNNs separate cardiovascular X- shaft pictures, RNNs process moderate ECG data, and DBNs handle feature extraction and sales, actuating work on farsighted precision and adequacy in coronary disease. They actually look at models. The task uses a record-based dataset that dependably gets information obviously from sensors, making it more open for evaluation. It actually oversees heart patient information. Past ways to deal with heart patient assessment needed profound learning procedures, bringing about low expectations of precision and delivering them ineffectively in functional settings. The undertaking's results feature the potential for ceaseless model refinement through input circles and continuous information assortments, guaranteeing its importance and exactness after some time.

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# Deep Learning Based Anomaly Detection for Fog-Assisted IoVs Network

**Prof. Pavan Mulgund[1], Mohammad Rafi D[2], Kiran Kumar M[2], Vinay Reddy[2], Chaithra JN[2]**
[1]Assistant Professor, Department of Information Science and Engineering, East Point College of Engineering and Technology Bangalore, Karnataka, India
[2]Student, Department of Information Science and Engineering, East Point College of Engineering and Technology, Bangalore, Karnataka, India

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ABSTRACT

This paper investigates the use of profound learning-based peculiarity discovery in mist-taped Web of Vehicles (IoVs) organizations. With the rising coordination of vehicles with the web and the development of haze registering for decentralized information handling, the requirement for strong oddity discovery components becomes central to guarantee the security and unwavering quality of IoVs frameworks. Utilizing profound learning methods, for example, convolutional brain organizations (CNNs) and repetitive brain organizations (RNNs), this study expects to identify and moderate peculiar ways of behaving progressively or close to constant, accordingly in improving generally speaking framework versatility. The paper talks about the equipment and programming prerequisites for sending profound learning models inside haze hubs or edge gadgets, close by contemplations for versatility, interpretability, and flexibility to advancing dangers. Through a thorough survey of existing writing and contextual investigations, this exploration features the likely advantages and difficulties related with profound learning-based irregularity identification in haze helped IoVs organizations, making ready for more secure, more proficient transportation frameworks later on.

## I. INTRODUCTION

As of 6late the incorporation of Mix of Vehicles (IoVs) with haze registration has made ready for upgraded availability, correspondence, and clever dynamic inside vehicular organizations. As IoVs keep on developing, the developing intricacy of organized frameworks and the deluge of different information sources present critical difficulties in guaranteeing the security and dependability of these interconnected conditions. Inconsistency location arises as a basic part for defending mist-helped IoVs organizations, offering the capacity to distinguish deviations from ordinary ways of behaving and quickly answer likely dangers. This exploration centers around utilizing profound learning methods to foster a high-level abnormality identification framework custom-made for Haze Helped IoVs organizations. By tackling the force of profound brain organizations, this approach plans to upgrade the accuracy, versatility, and flexibility of peculiarity recognition in unique vehicular conditions. The Web of Vehicles (IoV) addresses an extraordinary worldview in the domain of transportation and networks. An imaginative idea incorporates vehicular advancements with the force of the web, making an interconnected environment that improves the productivity, security, and, by and large, experience of transportation frameworks. In the IoV, vehicles become shrewd elements outfitted with cutting edge correspondence capacities, sensors, and information handling abilities. This availability empowers consistent correspondence between vehicles as well as with foundations, walkers, and the more extensive transportation organizations. The IoV incorporates a range of utilizations, including constant traffic on the board, independent driving, prescient upkeep, and the help of savvy city drives. By using data exchange and transparency, the IoV plans to also cultivate traffic streams, decline setbacks, and get ready for more sensible and watchful flexibility methodologies. While promising, execution of the Catch of Vehicles moreover presents challenges related with data security, certification, and the standardization of correspondence, as looking out for these hardships is essential for making sense of the best farthest reaches of IoVs and ensuring a strong related transportation customary framework. As imaginative work in this field continues, The Catch of Vehicles stays a partner for the predetermination of savvy, related, and fit transportation structures.

### 1.1 PROPOSED SYSTEM

The combination of Web of Vehicles (IoVs) with mist processing has introduced another time of associated and savvy vehicular frameworks. In any case, the innate intricacies of Mist Helped IoVs networks lead to huge difficulties in guaranteeing the security and dependability of these unique conditions. One of the squeezing concerns is the distinguishing proof and relief of atypical exercises that might risk the wellbeing and usefulness of associated vehicles. Conventional irregularity location techniques frequently miss the mark in adapting to the complexities of vehicular organizations working in haze registering conditions, provoking the requirement for creative arrangements.

## II. SYSTEM OVERFLOW

### A. Internet of Vehicles

The Catch of Vehicles (IoVs) addresses a critical improvement in the space of transportation improvement by perfectly arranging vehicles, design, and correspondence relationships to make a crafty and interconnected regular system. In the IoV, vehicles are outfitted with cutting edge sensors, specific contraptions, and figuring abilities, permitting them to deliberate with one another as well similarly as with wrapping foundations and united control frameworks. This interconnectedness empowers plenty of uses pointed toward upgrading traffic on the board, further developing street wellbeing, and offering imaginative types of assistance to vehicle tenants. IoVs use progresses like vehicle-to-vehicle (V2V) and vehicle-to- structure (V2I) correspondence, associating tireless data exchanging. Vehicles can share information about their speed, region, and road conditions, adding to dynamic and flexible traffic utilizing the board structures. This interconnected connection additionally works with the advancement of free driving, where vehicles can pursue showed decisions in light concerning the data they get from their ecological parts.

**Fig. 2.1** IoVs

### B. CNN Algorithm

Convolutional Cerebrum Association (CNN) is a significant learning procedure used to analyze and deal with cross section plan based datasets. Utilizations of CNN consolidate picture taking care of, customized feature extraction, and idiosyncrasy revelation. CNN design consists of three fundamental layers, named input, hidden away, and yield layers. Commonly, the secret layer comprises convolutional layers, pooling, and associated layers. Convolutional layers are dependable to change input into highlight guides and pass contribution to the following layer. Convolutional layers separate highlights and teach designs proficiently. The occupation of pooling layers is to limit the information aspects by incorporating neuron results of the past bunch into a solitary neuron of the following layer. The last layer is completely associated with Associated layers interface every neuron of one layer to the neurons of another layer. Leveled input goes through the association layer to characterize the information.

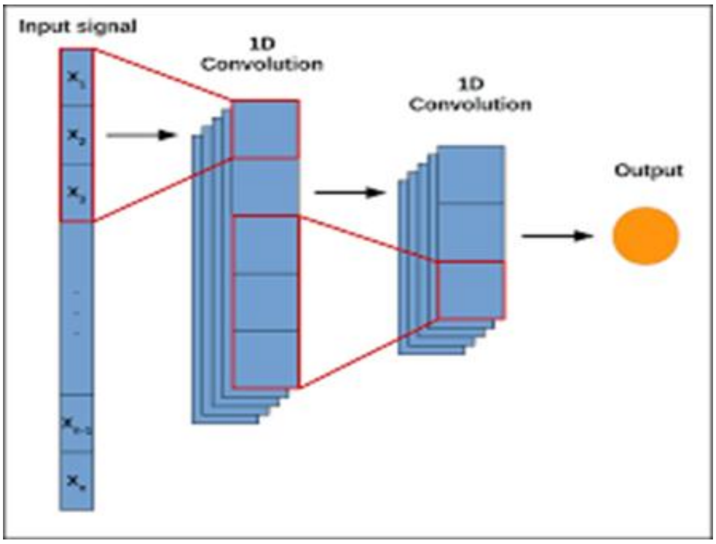

**Fig. 2.2** 1D Convolutional Neural Network

## III.SYSTEM ANALYSIS

This exploration intends to propose a profound learning-based peculiarity recognition plot for Haze helped web of vehicles (FaIoVs). We call the proposed plot Convolutional autoencoder Helped Oddity Location (CAadet) to identify assaults for Fa-IoVs climate, as it is a main pressing issue for network security. In this part, we present information on our proposed plot, which consists of a convolutional brain organization and autoencoder. Figure 3 represents the total engineering of the proposed conspire. CAadet follows a convolutional layer based autoencoder for programmed highlight extraction and afterward oddity recognition. Autoencoder engineering follows the encoder and decoder separately. The encoder incorporates three convolutional layers. Each convolutional layer is mindful to limit the information aspect concerning step size. As a result, the convolutional layers transform into a dormant vector. To keep away from the overfitting issue, we included dropout layers along the info and convolutional layers. Dropout layers are utilized to deal with regularization and forestall duplication of input as a result. As a matter of fact, during the preparation of dropout layers, drop a few irregular neurons to keep away from model overfitting.

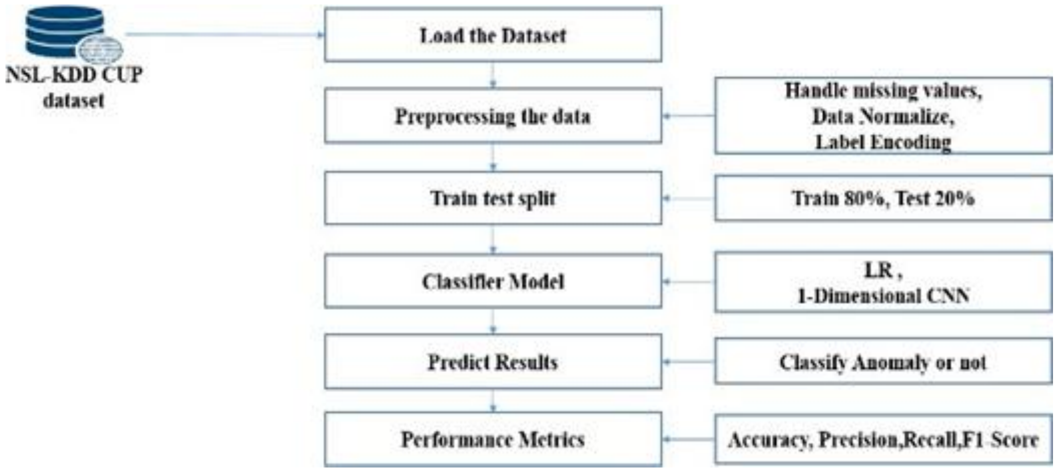


**Fig. 3.1** System Architecture

## IV. RESULTS


**Fig. 4.1** Home Page

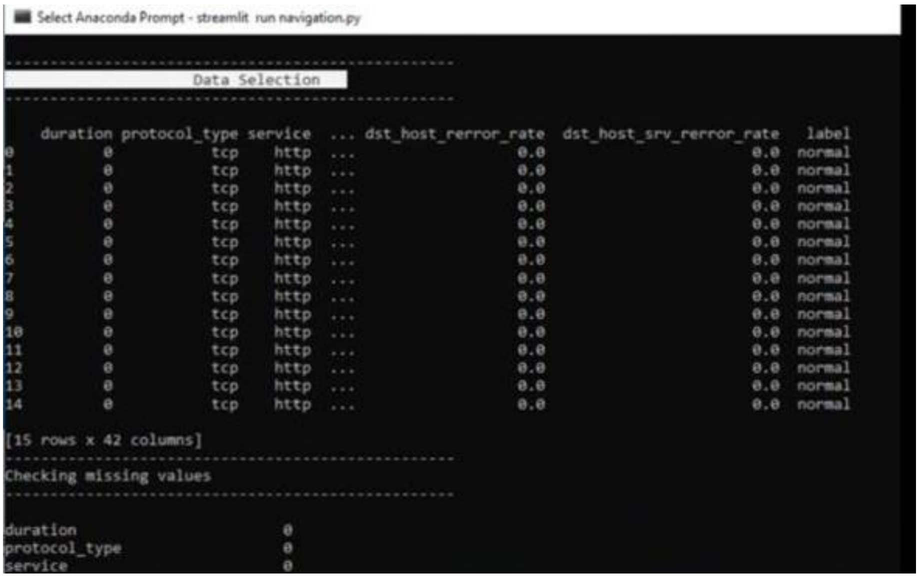


**Fig. 4.2** Data Selection

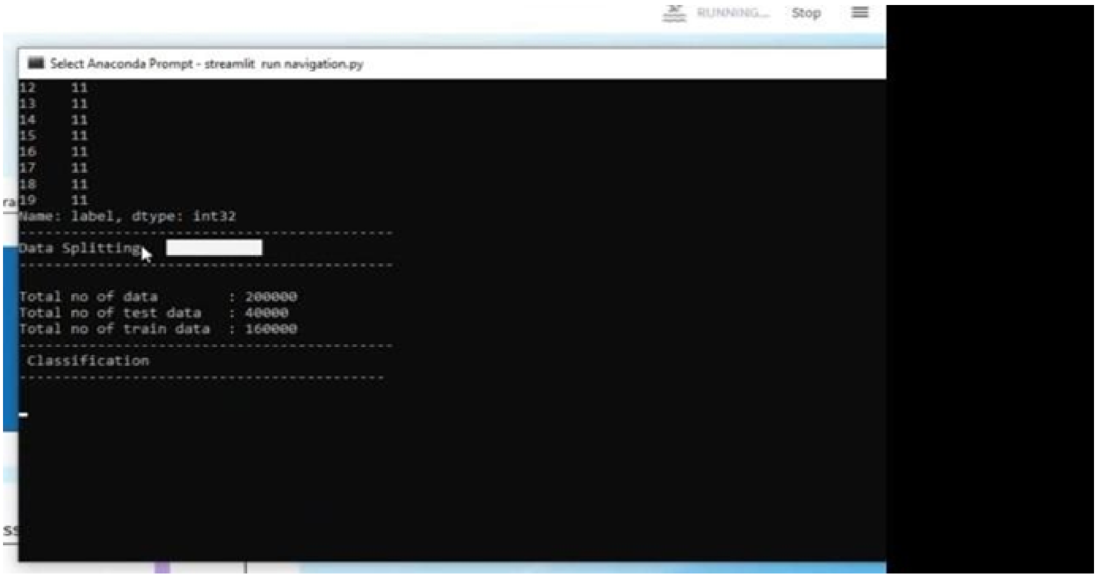


**Fig. 4.3** Data Splitting

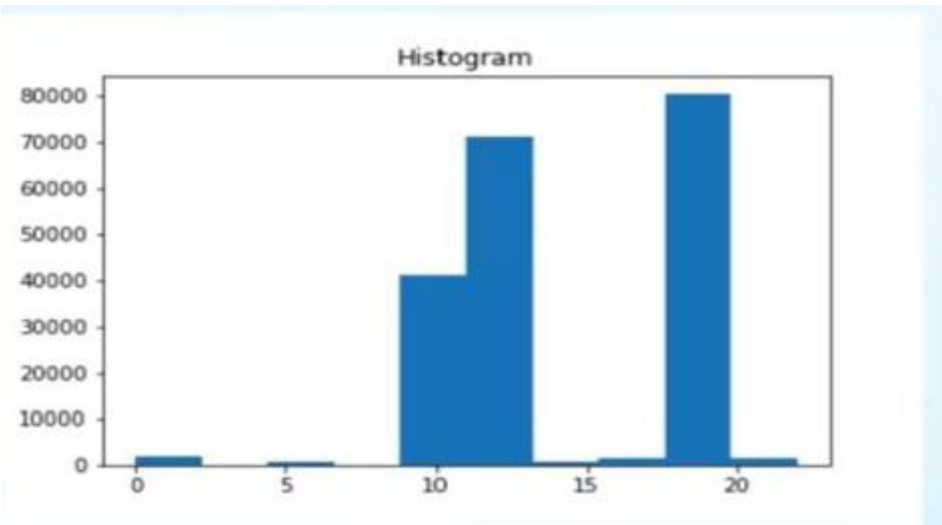


**Fig. 4.4** Histogram

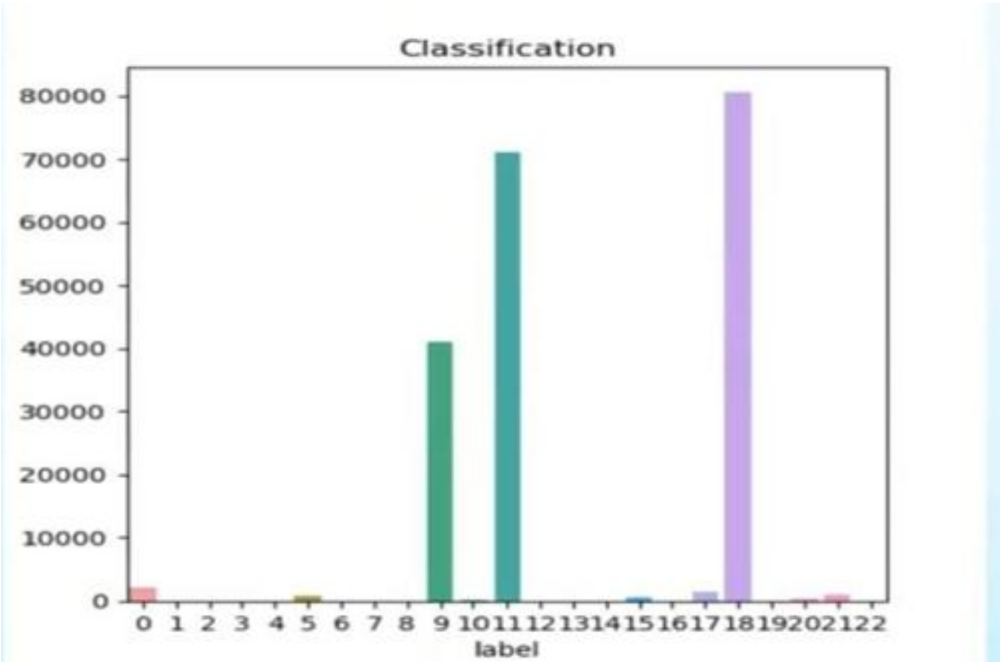


**Fig. 4.5** Classification

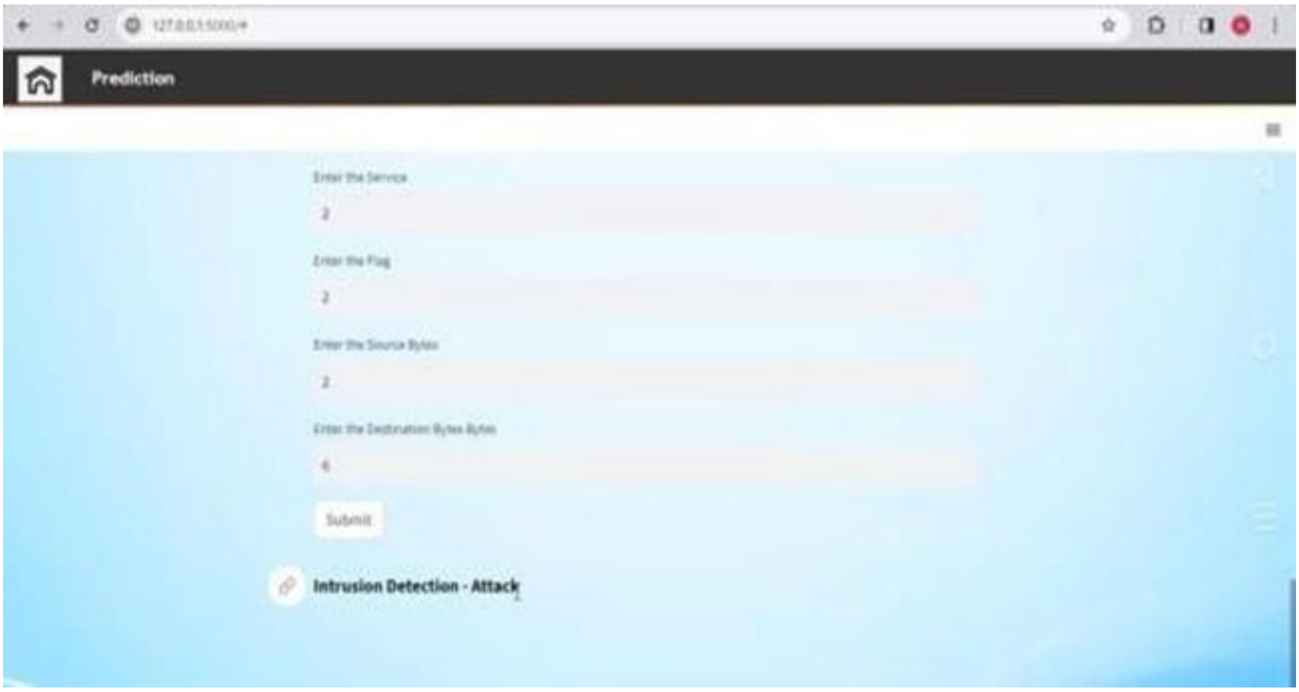


**Fig. 4.6** Final Anomaly Detection

## V. CONCLUSION

With everything taken into account, a significant learning-based anomaly area holds uncommon responsibility for updating the security and steadfastness of cloudiness in Snare of Vehicles (IoVs) associations. By using advanced mind network plans and gigantic degree data examinations, significant learning estimations can truly recognize and mitigate unusual approaches to acting, thus further growing for the most part system strength and security. Through the joining of profound learning models into haze hubs or edge gadgets inside the IoVs organization, peculiarities can be recognized continuously or close to real-time, empowering proactive reactions to expected dangers or occurrences. This capacity is especially pivotal in unique and conveyed conditions where customary rule-based or signature-based identification techniques might miss the mark. The arrangement of profound learning-based irregularity location in haze-aided IoVs networks requires cautious thought of equipment and programming prerequisites, including superior execution registering assets, productive information handling systems, and powerful safety efforts. Moreover, progressing innovative work endeavors is vital for addressing difficulties like model interpretability, versatility, and flexibility to advancing dangers. Profound learning-based irregularity location addresses a significant way to deal with improving the security and strength of haze for IoVs organizations, making them ready for more secure, more productive, and more dependable transportation frameworks later on. Notwithstanding, proceeded with advancement and cooperation across the scholarly community, industry, and policymakers will be pivotal to understanding the maximum capacity of this innovation and address arising network protection dangers in the quickly developing IoVs environment.

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# Real Time Monitoring of Coma Patient Using OpenCV

**Tasmiya K, Shivsagar Mathpati, Niyam Rai, Sumith S V**
Information Science and Engineering, East Point College of Engineering and Technology Bangalore, Karnataka, India

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ABSTRACT

Blink detection plays a crucial role in many domains, such as signal processing and facial movement analysis. The suggested method determines the facial corner locations for every video frame and uses those locations to extract the vertical distance between the eyelids. The identifiable benchmarks are exact enough to assess how much is constantly terminating and opening up. The suggested algorithm characterizes the eye closeness in each frame, extracts a single scalar volume using the Modified Eye Aspect rate, and calculates the facial corner positions. Blinks are first identified as a pattern of Eye Aspect rate values within a brief temporal window by the Modified Eye Aspect rate threshold value.

**Keywords:** Modified Eye Aspect rate, Facial corner locations, and Blink discovery.

## I. INTRODUCTION

Maintaining ongoing coma case monitoring in healthcare settings presents a number of difficulties. Due to the requirement for round-the-clock supervision, medical staff must devote a significant amount of labour, which continuously raises costs and demands more resources. Notwithstanding these sweats, relying exclusively on visual inspection of EEG signals adds subjectivity and raises the possibility of missing important alterations in a patient's state.This highlights the prerequisite for powerful fixes that can smooth out reasonability and delicacy while automating the really looking at framework. One arranged reply to customary noticing systems' deficiencies is to use simulated intelligence, a subset of mechanized thinking. Utilizing estimations that can be acquired from past data and examples, artificial intelligence makes it possible to perceive minute changes in a patient's condition that could be missed with manual discernment alone.With responsibilities made really in different fields, including talk affirmation and picture affirmation, man-made intelligence is prepared to change clinical benefits by giving important perceptivity and farsighted powers. The proposed computerised wellbeing checking framework tries to capitalise on the abilities of machine information to address the difficulties fundamental to constant unconsciousness case-observing. By establishing progressed calculations to describe developments intelligent of changes in information, the framework means to upgrade patient consideration, decrease mortal blunder, and advance asset activity. This visionary methodology works on quiet issues as well as smoothes out the observing system, empowering medical care experts to focus their consideration where it's most requested. The sole purpose of the design is to apply a new system that detects any physical movement done by a coma, like eye blinking, lip movement, and hand movement. thus transferring alert communication about the case's knowledge to his or her cousins and the croaker.

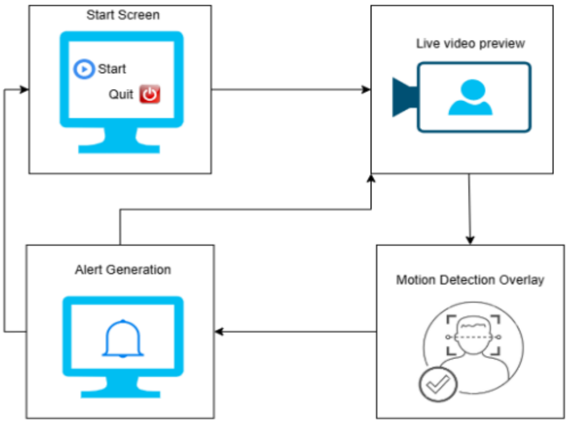


**Fig 1:** User Interface Flow Design

## II. LITERATURE REVIEW

The literature on health monitoring systems for coma cases reveals colorful approaches and technologies aimed at addressing the challenges associated with nonstop case surveillance. Then, we review four notable benefactions in this sphere:

**Coma patient's health monitoring and observatory system using internet of things:**

Introduced a Case-Driven Specialist( PCA) grounded medical services armature for relentless case observing. The armature incorporates body region indicator organizations( BSN), cell phones, blockchain, and a medical care supplier interface. In spite of its advantages, the framework presents network outpouring in the blockchain and presents difficulties in keeping up with patient sequestration.

***AEP-DLA: Adverse Event Prediction in Hospitalized Adult Patients Using Deep Learning Algorithms:***

Wu et al. focused on early prediction of adverse events (AEs) in hospitalized adult patients using machine learning algorithms. While the study achieved promising results, limitations include patient immobility due to sensor reliance and concerns regarding the accuracy of data preprocessing techniques.

**Gaussian Processes for Personalized e-Health Monitoring with Wearable Sensors:**

Clifton et al. proposed a patient-personalized e-health monitoring system utilizing Gaussian processes and wearable sensors. The system addresses the challenge of data uncertainty and artifact detection, yet faces limitations in monitoring ambulatory patients effectively.

## III.METHODOLOGY

### A. Automated Health Monitoring System Design

The proposed automated health monitoring system for coma cases utilizes a combination of OpenCV and Python for real- time monitoring. The system armature is designed to continuously dissect the eye movements of coma cases using a webcam feed.

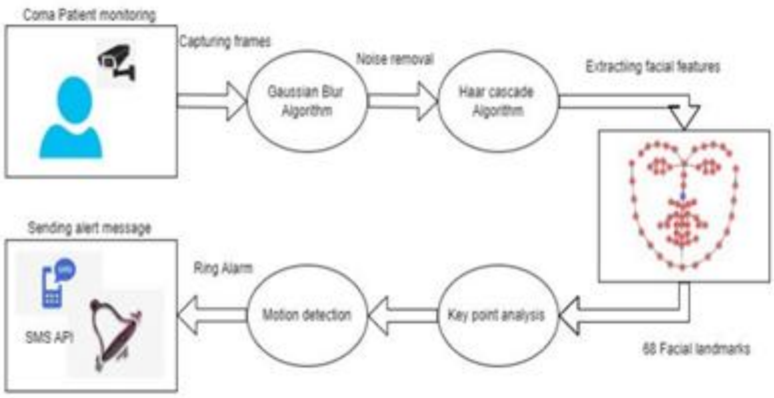


**Fig. 2:** Architectural Design

**B. Data Acquisition and Preprocessing**

- Data Collection: Webcam footage of coma patients is captured in real-time to monitor eye movements , lip movements and hand movements.
- Preprocessing: The captured video frames undergo preprocessing to enhance clarity and remove noise, ensuring accurate detection of movements.

**C. Eye Movement Detection Using OpenCV**

- Facial Landmark Detection: OpenCV is employed to detect facial landmarks, particularly focusing on the positions of the eyes.
- Vertical Distance Calculation: The vertical distance between the detected landmarks corresponding to the eyelids is computed to quantify eye movements.
- Modified Eye Aspect Ratio (EAR): A modified version of the Eye Aspect Ratio is derived from the vertical distance between the eyelids, serving as a scalar quantity to characterize eye openness and closure.

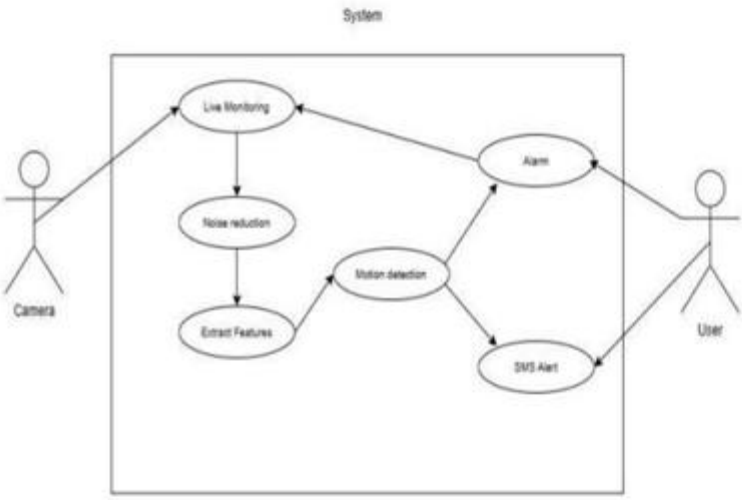


**Fig. 3:** Use-Case Diagram.

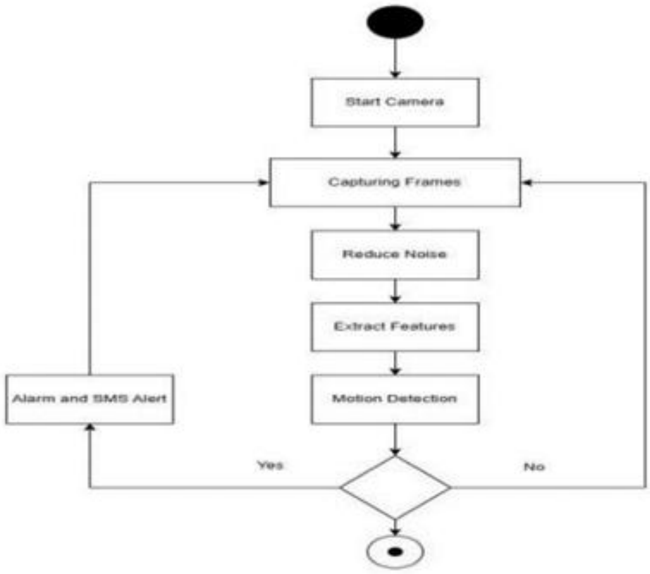


**Fig. 4:** Activity Diagram for use case

**D. Machine Learning Algorithm Implementation**

- Guassian Blurr Algorithm: Gaussian blur is a popular image filtering technique used in computer vision and image processing, commonly implemented in OpenCV, which is an open-source computer vision library.

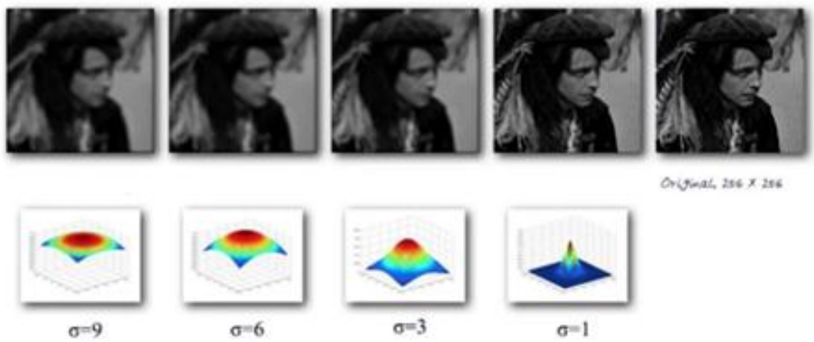


**Fig 5.** Gaussian Blur Algorithm

- Harcascade Algorithm: The trained model is integrated into the system to examine the modified EAR values in real-time and classify the patient's consciousness state.

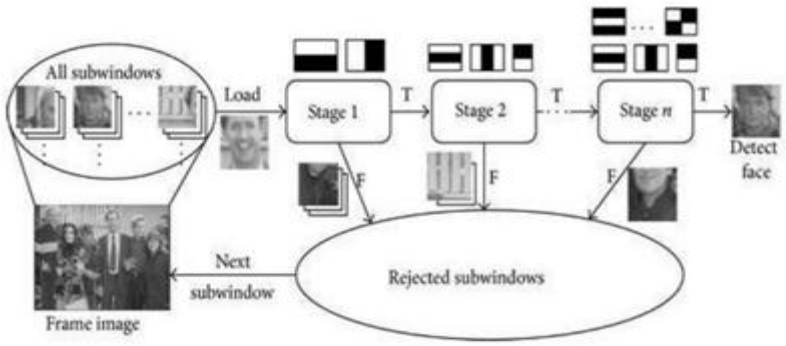


**Fig 6:** Harcascade Algorithm

**E. Alert System Integration**

- Alert Generation: When abnormal eye movement patterns are detected, the system generates real- time cautions to notify healthcare professionals, cases' relatives, and attending croakers
- Communication Protocol: Communication Protocol IEEE morals for communication protocols are stuck to ensure reliable transmission of cautions to designated benefactors.

## IV. RESULT

The proposed electronic prosperity noticing structure for obviousness cases was actually maintained and surveyed, showing promising limits in assessing the data position of cases. Figure 3 depicts the Use Case Diagram, depicting the business between the essential performers, the daze state case, and the camera, and the clear use cases related with the system. moreover, Figure 4 presents the work Graph for Use-Cases, outlining the successional way drew in with the noticing framework, from beginning the structure to moving The system successfully recorded and analysed face movements to ascertain the case's position of knowledge by utilising OpenCV for videotape processing and facial point finding.

The algorithm could rapidly detect shifts in the case's knowledge position by assaying facial movements. Cautions were created and sent to guardians and medical professionals in case a case woke up from a coma. This made it easier to respond appropriately and in a timely manner to the case's condition. Overall, the findings show how well the suggested automated health monitoring system performs in evaluating the knowledge circumstances of coma patients in real time. Utilising cutting-edge technologies akin to OpenCV and Machine Learning, the system presents a novel method for continuous monitoring, improving patient care, and resolving

The ultimate outcome of this camera-grounded operation-grounded system is the detection of the coma case's movement, which triggers an alert and notifies the case's relative and the croaker of the information the case has received.

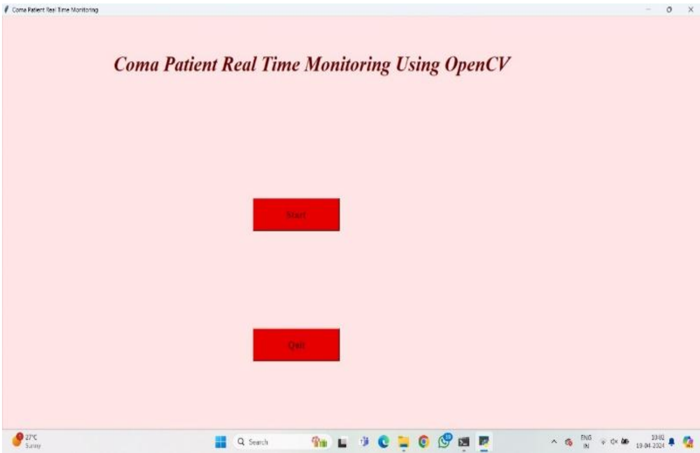


**Fig 7:** User Interface

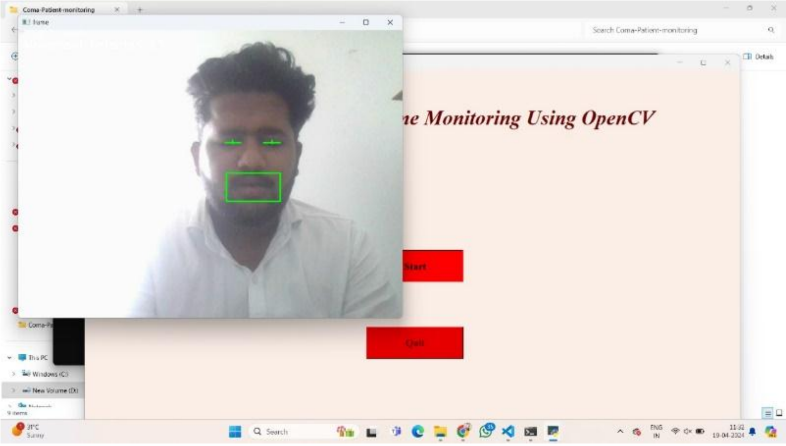


**Fig 8:** No Movement Detection

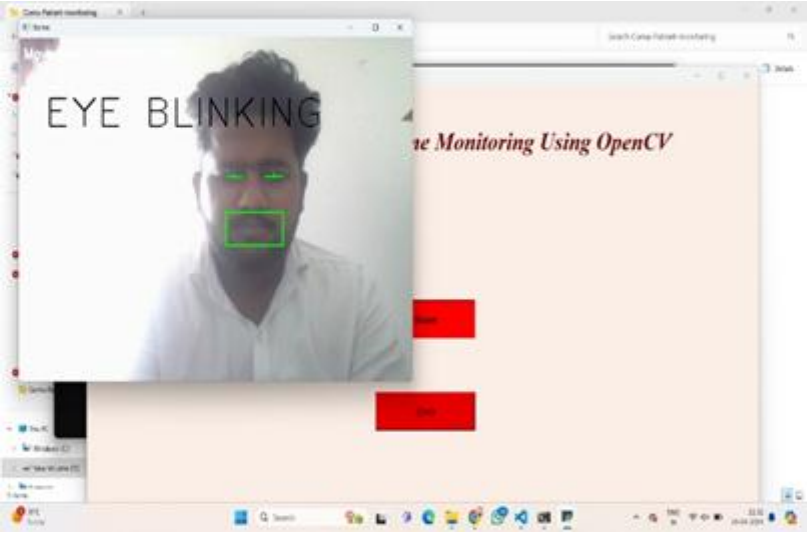


**Fig 9:** Eye Blinking Movement Detection

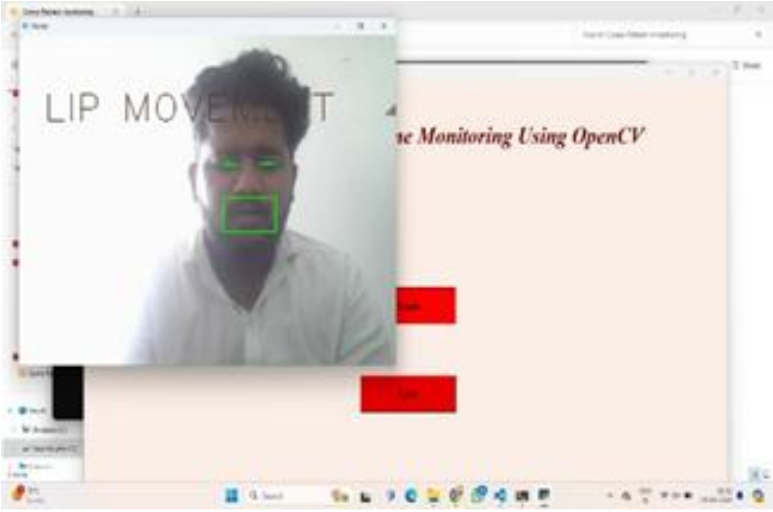


**Fig 10:** Lip Movement Detection

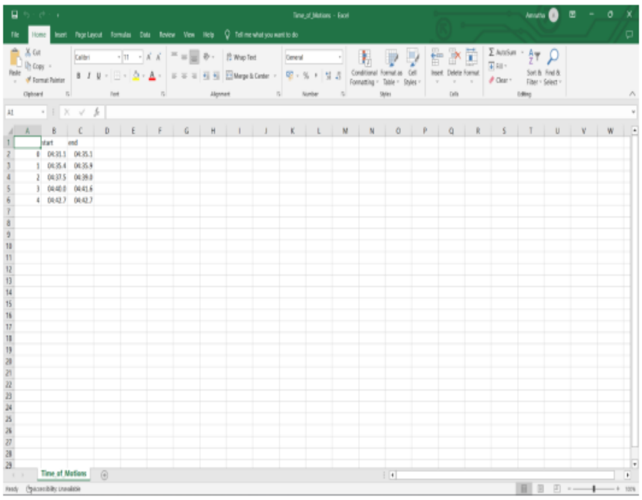

Fig 11: Movement Detection Data Stored Inn Excel Page

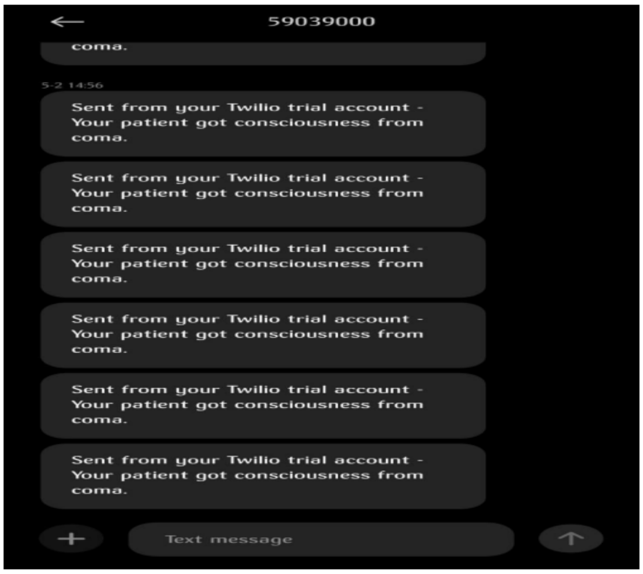


Fig 12: Movement Detection SMS Alert

## V. CONCLUSSION

All in all, The Constant observing framework for extreme lethargies cases ' activity utilizing OpenCV and Python gives a reliable and savvy result for covering unconsciousness cases persistently. The framework identifies and dissects the eye developments of unconsciousness cases utilizing a webcam and gives ongoing alerts to medical care experts in the event that any irregularities are recognized. The framework was assessed concerning its exhibition, cost-viability, and usability, and put in a position to be a valuable device for medical care experts in overseeing extreme lethargies cases. The proposed framework enjoys a few upper hands over the being preliminary styles of covering trance like state cases, which are habitually problematic and tedious. The framework gives constant observing, permitting medical care experts to descry any progressions for the situation's condition on time. The framework is likewise practical and simple to utilize, making it open to a more extensive scope of medical care experts. unborn work can include idealizing the framework's delicacy and perceptivity, growing the framework's capacities to incorporate other fundamental signs and measures , and coordinating the framework with electronic wellbeing records for faultless information activity. Generally, the proposed framework can altogether enhance the consideration of extreme lethargies cases and has the certain to be authorized in medical services establishments around the world.

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# Securing Digital Voting System through Blockchain

**Sumanth N V, Punith M, Thanushree L C, Ranjan R, Prof. Neelima Sahu**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Bengaluru, Karnataka, India

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ABSTRACT

The blockchain technology voting system has revolutionized the way we vote for the candidates. The monitoring and managing voting efficiently and effectively pose several challenges. Voting in elections is a fundamental democratic process where eligible citizens participate to elect representatives who will govern and make decisions on their behalf. However, the security in present voting systems can be challenging. The Securing Digital Voting System through Blockchain Technology represents a pioneering initiative in transforming traditional electoral processes into secure, decentralized, and technologically advanced systems.

**Keywords**—Decentralization, Security, Blockchain.

## I. INTRODUCTION

Blockchain technology, hailed as a decentralized and distributed ledger system, has emerged as a groundbreaking innovation impacting numerous sectors. Essentially, a blockchain comprises interconnected blocks, each housing a collection of transactions, united via cryptographic hashes. A fundamental attribute of blockchain is its resilient security framework.

The unchangeable nature of data within blocks guarantees that once a transaction is logged, modifying or tampering with it becomes exceedingly arduous. Cryptographic techniques, like hash functions , digital signatures, play a vital role in securing transactions on the blockchain. An exemplary application of blockchain security is evident in cryptocurrencies like Bitcoin. Bitcoin's blockchain employs a proof-of-work consensus mechanism, where participants (miners) compete to solve complex mathematical puzzles to include a new block to the chain. The decentralized and secure nature of blockchain technology continues to revolutionize the way we approach data management and transaction security in the digital age.

An exemplary application of blockchain technology is evident in cryptocurrencies like Bitcoin. Bitcoin's blockchain employs a proof-of-work consensus mechanism, where participants (miners) compete to solve complex mathematical puzzles to include a new block to the chain. The decentralized and secure nature of blockchain continues to revolutionize the way we approach data management and transaction security in the digital age. In the contemporary landscape of evolving technologies, the intersection of digital systems and democratic processes has become increasingly relevant.

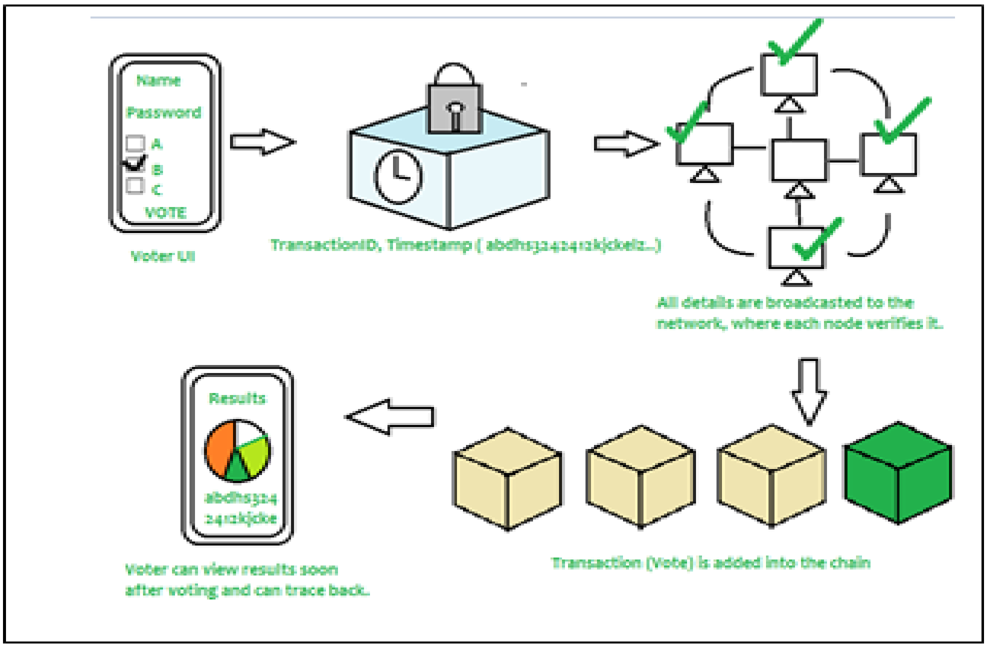


**Fig.1.** Basic idea of e- voting using blockchain technology

One notable application in this field of blockchain endeavors to secure digital voting systems through the innovative integration of blockchain technology. The conventional voting infrastructure faces challenges related to transparency, security, and trust, that can address the decentralized and tamper-resistant nature of blockchain.

## II. LITERATURE REVIEW

Ali Benabdallah, Antoine Audras, Louis Coudert, Nour El Madhoun and Mohamad Badra [1] To this day, abstention rates continue to rise, as there is travel to vote. This is why remote e-voting will increase the turnout by allowing everyone to vote without the need to travel. It will also minimize the risks and obtain results in a faster way compared to a traditional vote with paper ballots. In fact, given the high stakes of an election, a remote e-voting solution must meet the highest standards of security, reliability, and transparency to gain the trust of citizens. Numerous remote e- voting solutions leveraging blockchain technology have been put forth in the literature. Indeed, blockchain technology is now advocated as a novel technical foundation for various IT applications, enabling the elimination of Trusted Third Parties (TTP) and the decentralization of transactions, all while providing transparent and highly secure data storage. Additionally, it facilitates the incorporation of smart contract technology into its framework, enabling the automation and execution of agreements between users. This paper aims to explore the most noteworthy e-voting solutions built on blockchain technology.
Abhimanyu Prajapati , Tanish Bankar, Rupam Patel, Prof. Ravishankar Bhaganagare [6] The outdated paper ballot system and the widely used electronic voting devices can both be replaced by online voting. In addition to the openness and securing of voters, an electronic voting site should provide security and integrity. This study suggests a blockchain-based e-voting system that overcomes some of the drawbacks of the current voting methods. The report also discusses the current state of certain blockchain voting frameworks. The implementation that is currently being used is appropriate for small-scale elections held inside of offices,

boardrooms, etc. This work proposes a very straightforward method for a fair electronic voting system that ensures anonymity, coercion resistance, correctness, ease of tallying, eligibility, fairness, high availability, integrity, and robustness. It also presents voter authentication, voter confidentiality, vote verifiability, and public verifiability. The blockchain technology is used to attain these characteristics.

Geetanjali Rathee, Razi Iqbal, (Senior Member, IEEE), Omer Waqar, (Member, IEEE) and Ali Kashif Bashir, (Senior Member, IEEE) [8] The concept of a smart city entails the strategic deployment of resources and cutting-edge technologies to create an intelligent environment. With the increasing prevalence of intelligent sensors (IoT devices) and the integration of 5G technology, cities are becoming more adept at fulfilling the needs of their inhabitants. E-voting stands out as a significant IoT application within the realm of smart cities, marking a significant advancement in technological capabilities. Traditionally, IoT applications assume that all devices are cooperative and trustworthy. However, in reality, these devices are susceptible to malicious disruptions, potentially compromising network integrity. This vulnerability is particularly evident in e- voting systems, where privacy and security flaws create significant challenges. Intruders may exploit these weaknesses to manipulate election outcomes, posing a serious threat to democratic processes.

Therefore, a crucial task is to differentiate between legitimate and malicious IoT devices by assessing their trustworthiness. This can be achieved through the computation of trust values using social optimization techniques, thereby fostering a secure and authentic communication environment..

| Sl No. | Paper Title | Methodology Used | Advantages | Disadvantages |
|---|---|---|---|---|
| 1 | Analysis of Blockchain Solutions for E-Voting | SHA-256<br>Homomorphism<br>Ethereum-specific Hash | • Provides different security measures<br>• Detailed Analysis | • Security<br>• Transparency<br>• Trustworthiness |
| 2 | A Framework to Make Voting System Transparent Using Blockchain Technology | Flexible Consensus Algorithm<br>Chain Security Algorithm<br>Smart Contracts | • Reduction of 51% attack<br>• Flexibility | • Response Time<br>• Security<br>• Participation of legitimate miners |
| 3 | A Blockchain-Based Traceable Self-Tallying E-Voting Protocol in AI Era | Intractable Assumptions<br>Zero-Knowledge Proof-of-Knowledge and Signature of Knowledge<br>Linear Encryption<br>Time-Lock Puzzle | • Balance the anonymity and accountability of the traditional e-voting systems<br>• Computational Efficiency | • Scalability<br>• Potential attacks or breaches |
| 4 | A Review Paper on Blockchain E-Voting System | Blockchain Technology<br>Smart Contracts | • Transparency<br>• Anonymity<br>• Processing Time | • Delays or ineffectiveness in voting due to remote voting<br>• Lack of transparency and trust |
| 5 | On the Design and Implementation of a Blockchain Enabled E-Voting Application Within IoT-Oriented Smart Cities | Trust Computation Mechanism | • Privacy<br>• Security | • IoT devices may not be Reliable or Secure |
| 6 | Development of a Secure Preserve E-Voting System Using Private Blockchain Solutions | Private Blockchain<br>Smart Contract<br>PACI | • Solved double voting<br>• Voting forgery<br>• Late winner declaration | • Technical and Legal issues |

**Table 1.** Literature Survey

## III.BLOCKCHAIN

### 1.1 Why blockchain?

Blockchain is one of the type of distributed ledger where participant scan store and exchange information directly with each other without knowing or trusting each other's beforehand. A blockchain implements the concept by aggregating records into blocks of data that are cryptographically signed to prevent data tampering. The usual method is to create a hash of the previous records and insert them in the header of the adjacent block of data. Thus, each block relies on the previous one and any attempt to modify a record in the chain would modify the hashes of the blocks down the chain. For the participants to identify valid records chain and guarantee integrity of data, participant.

The rising demand for transparency is swiftly met by blockchain technology, which not only ensures security but also fosters transparency among IoT devices, even in the face of potential intrusions. By leveraging blockchain, any tampering with data becomes readily detectable, bolstering overall system integrity. Moreover, blockchain's capabilities extend to tracking, organizing, and facilitating communication across myriad devices. By storing data from diverse sources, it enables seamless coordination and collaboration among parties without reliance on centralized cloud infrastructure.

Bitcoin blockchain uses a Proof-of-Work consensus. Each miner will try to reverse the hash of the previous transactions to gain a reward. Reversing a hash is a computationally heavy operation, but verifying it is easy and so it would be impossible to fake a hash and have all the nodes agree on it, unless one owns more than 50% of the computational power of the miners. Proof-of-Stake is a protocol that does not need a lot of computational power where miners are randomly selected by how many coins they dedicate to be a miner. These funds are stored and can be taken back. However, mining power would also increase with wealth which would mean that the biggest coin owners could centralize the blockchain.

### PROPERTIES OF BLOCKCHAIN:

Decentralized: One of the main characteristics of blockchain development that works brilliantly is its decentralised shared organisation and the meetings of the framework. Without the At the outset, the creation framework operates independently from soil. Planting occurs at an optimal height, rendering soil contamination inconsequential. This method enables the cultivation of vegetables in minimal physical spaces, effectively allowing for soil-free production.

Holding a digital election through blockchain not only saves money but also decreases the threat of inequity in the voting process [2]. Modern technologies such as blockchain technology are very secure and beneficial if used carefully. It can make the voting system more transparent, reliable, and enhance traceability of transactions assistance of a third party, anyone can save a resource and then access it via the internet. Store any trade, including contracts, documents, digital assets, and money in cryptographic form, and later access the exchange using the private key.

Consensus: Before an exchange is added to the chain, it must have the blockchain framework's endorsement and belief. When a transaction conflicts with one of the concurred rules, the transaction will be deemed void. Block chains are communicated in an arrangement-based show, which can be either authorization-based or permission-less. Everyone can attempt to include exchanges and can stake in agreement, as implied by public agreement.

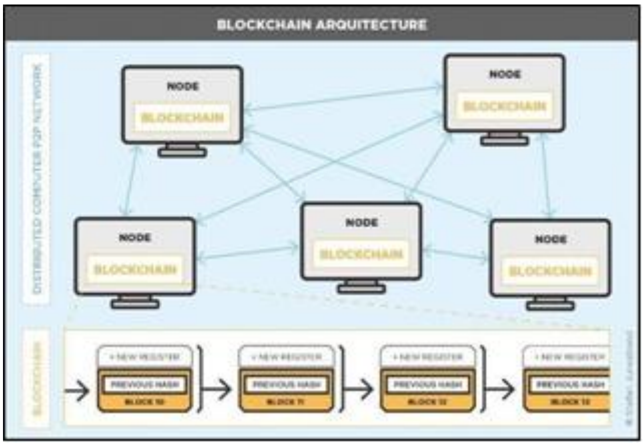


**Fig.2.** Blockchain based Architecture

### 1.2 What is Blockchain?

A blockchain is a specific type of database that differs from a traditional database that stores information. Here's a more technical definition:

- Distributed Ledger: The blockchain is a distributed ledger, meaning it's shared across a network of computers rather than stored on a single server. This makes it decentralized, with no single entity having control.
- Cryptographically Linked Blocks: Data is stored in blocks, which are then cryptographically linked together in a chronological chain. This creates an immutable record, meaning data cannot be altered or deleted once entered.
- Secure and Transparent: Cryptography ensures the security of the data, while the distributed nature provides transparency, allowing anyone to view the information on the blockchain.


**Fig.3.** Blockchain

### 1.3 Basic requirements of Blockchain

1. Decentralization: The blockchain network should be decentralized, meaning it works on a distributed ledger across many computers. This proves that there is no central authority controlling the network, decreasing the threat of manipulation or fraud.

2. Immutable Ledger: The blockchain ledger must be immutable, meaning once a vote is cast, it cannot be changed or deleted. This ensures the uprightness of the voting data and prevents tampering with the results.
3. Security Protocols: Robust security protocols must be in place to protect the blockchain network from cyber attacks, hacking attempts, and unauthorized access. This includes encryption, cryptographic hashing, multi- factor authentication, and other security measures.
4. Transparency: The voting process must uphold transparency, enabling voters to confirm the accurate recording and counting of their votes. Blockchain's transparent and auditable nature enables stakeholders to track and verify all transactions in real-time.
5. Anonymity and Privacy: While ensuring transparency, e- voting systems must also maintain the privacy of individual voters. Blockchain can achieve this by assigning cryptographic keys to voters, allowing them to cast anonymous votes while still ensuring their authenticity.
6. Voter Authentication: Implement robust methods for authenticating voters to prevent unauthorized individuals from participating in the voting process. This may include biometric authentication, digital signatures, or other identity verification mechanisms.
7. Smart Contracts: Utilize smart contracts, self- executing code deployed on the blockchain, to automate and enforce the rules of the voting process. Smart contracts can handle tasks such as voter registration, ballot casting, and result tabulation in a transparent and tamper-proof manner.
8. Scalability: Blockchain systems need to handle a large number of transactions efficiently. Scalability solutions such as sharding, layer 2 protocols, and off-chain transactions are being developed to address this challenge.
9. Permissioning (Optional): Some blockchain networks require permission to join, meaning participants must be approved by a central authority. Others are permissionless, allowing anyone to participate in the network without approval. 10.Privacy (Desirable): While blockchain transactions are pseudonymous and transparent, privacy features such as zero- knowledge proofs and ring signatures can be implemented to enhance privacy for users.

## LIMITATIONS IN EXISTING SYSTEM.

1. It doesn't delve deeply into some security challenges that may arise in implementing blockchain-based e-voting systems. Although the paper mentions that blockchain offers transparency, there may still be challenges in ensuring that the entire voting process is transparent and trustworthy.
2. The paper briefly mentions an increase in response time as there is increase in votes and nodes in the system. While the cryptographic hash is mentioned as a security measure, the document does not provide extensive details on how voter privacy is ensured. However, false positives or negatives in detecting malicious miners could impact the participation of legitimate miners, potentially introducing errors or biases in the system.
3. The proposed protocol may have limitations in terms of scalability, especially for large-scale voting applications. It is crucial to conduct a rigorous assessment of the efficacy of these methods and verify their ability to offer strong defense mechanisms against potential threats or breaches. Although the paper presents findings from the implemented solutions, it is imperative to undertake a thorough evaluation of the protocol's real-world performance, security measures, and user- friendliness.
4. In regions with inadequate technological resources, implementing such systems may be challenging, potentially leading to a digital divide in voting accessibility. The paper mentions high initial setup costs as

a limitation of existing e-voting systems. While the paper highlights the features of blockchain technology, including anonymity and security, it is essential to thoroughly address concerns related to voter anonymity and confidentiality.

5. In real-world scenarios, IoT devices often exhibit variability in reliability and security, presenting a challenge in discerning between trustworthy and malicious devices. The proposed e-voting mechanism lacks comprehensive insights into the precise implementation of blockchain technology. Furthermore, it overlooks the complexities involved in integrating diverse IoT devices, originating from various manufacturers and operating on disparate communication protocols.

## IV. PROPOSED SYSTEM

The System Requirement Specification (SRS) serves as a pivotal document that lays the groundwork for the software development process. It not only outlines the system's needs but also provides a detailed description of its key features. Essentially, an SRS represents an organization's understanding, documented, of a client's or potential customer's system requirements and conditions at a specific moment in time, typically before any actual design or development work commences. It functions as a mutual safeguard, ensuring that both the client and the organization comprehend each other's requirements at that given point. While the SRS focuses on the product itself rather than the project that created it, it serves as the foundation for subsequent product development. Although subject to potential revisions, the SRS provides a basis for ongoing production evaluation. In essence, software requirement specification marks the inception of the software development process. It involves translating clients' ideas—the input—into a formal document—the output—during the requirement stage. Consequently, the output of this stage comprises a set of formally specified requirements, ideally comprehensive and consistent, whereas the input lacks these characteristics.

### 4.1. Analysis/Framework/Algorithm

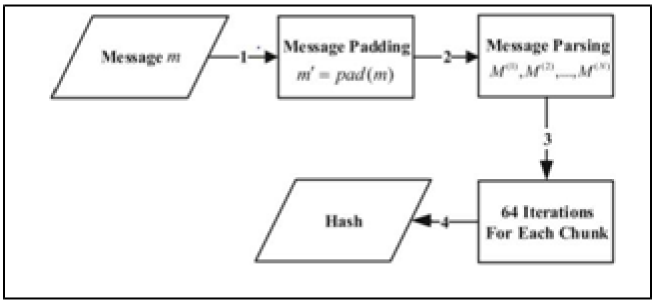


**Fig.4.** SHA-256 Algorithm

**Working:**

(1) The message is denoted by m with binary expression.

(2) Pad m with 100...000 sequence and the length of m with 64-bit expression, i.e., m'= pad(m).

(3) m' is broken into 512-bit chunks, i.e., M(1) , M(2) , ..., M(N)

(4) 64 constants are used, which are denoted by W0, W1, ..., W63, respectively.

(5) Eight working variables labelled A = 0x6A09E667, B = 0xBB67AE85, C = 0x3C6EF372, D = 0xA54FF53A, E = 0x510E527F, F = 0x9B05688C, G = 0x1F83D9AB, and H = 0x5BE0CD19 are used as the initial hash value.

(6) Compute the 64-cycle cryptographic iterative computation for the first chunk, i.e., M(1) . Repeat the iterative computation for the next chunk based on the result for the last chunk.

(7) The result of the last iterative computation is the hash.

### 4.2. Details of Hardware and Software

4.2.1 Software Requirements

- ➢ Operating system : Windows95/98/2000/XP
- ➢ Front end: HTML, CSS, JavaScript
- ➢ Back end: Python Flask
- ➢ Server-side Script: Java Server Pages.
- ➢ Database: Cassandra

4.2.2 Hardware Requirements

- ➢ System: Intel Core i5
- ➢ Speed: 1.1 GHz
- ➢ RAM: 8 GB
- ➢ Hard Disk: 120 GB
- ➢ Input Devices: Keyboard, Mouse
- ➢ Monitor: 15” LED

### 4.3. Design Details

A system architecture serves as the conceptual blueprint that delineates the arrangement, functionality, and various perspectives of a system. It entails a formal depiction and representation of the system's intricacies, structured in a manner conducive to understanding its structures and behaviors. Comprising system components and interconnected sub- systems, a system architecture harmonizes their functionalities to realize the overarching system objectives. The development of architecture description languages represents a collective endeavor to standardize the language used to articulate system architectures.

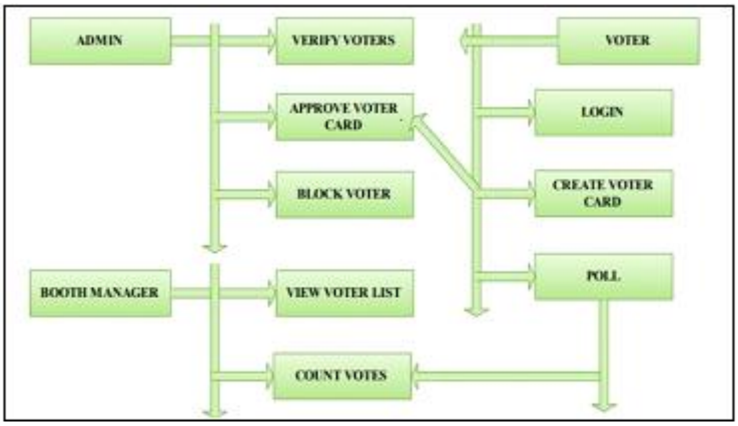


**Fig.5** Detailed design

A data flow diagram (DFD) shows how data flows in graphical representation. It shows how data is input into the system, processed within the system, and result out from the system. DFDs are commonly used in software engineering to model the flow of information within a system.

**Level 0**:

Level 0 describes the overall process of the project. Here the user registers to the voting system with required credentials and gets access to vote. After Voting is done every vote is stored and hashed using Blockchain Technology. Lastly the results are declared.

It illustrates the interactions between actors and the system, showcasing the various tasks or goals (represented as use cases) that actors seek to accomplish. The primary objective of a use case diagram is to depict the specific system functions performed for each actor involved. Additionally, it allows for the depiction of the roles that actors play within the system.

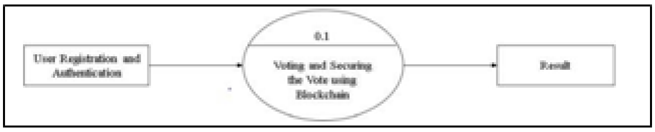


**Fig. 9** Use Case Diagram

### 4.4. Methodology/Procedure

A sequence diagram, a type of interaction diagram in UML that shows the interactions between objects in system over time.

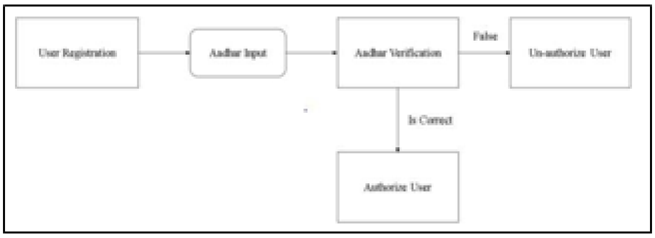


**Fig. 6** Level 0 Diagram

**Level 1:**

Level 1 describes the first step of the project. After user registration Aadhar card number verification is done if the Aadhar number is valid user will be authorized or else user will be un-authorized

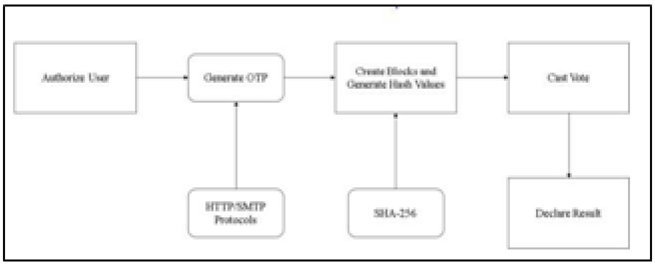


**Fig. 10** Sequence Diagram

- In the sequence diagram, the voter logs in or registers to the voting web interface.
- After entering all the required credentials the authentication has been done using authentication techniques.
- The authenticated user is allowed to vote and the vote is secured using Blockchain technology.
- The user gets confirmation message after voting is done successfully and the frontend is updated.

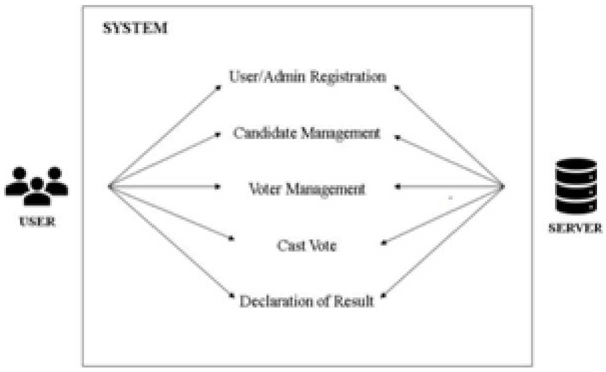


**Fig. 7** Level 1 Diagram

**Level 2:**

Level 2 describes the final step of our project. After authorization the main step Voting is done after the generation of OTP using HTTP/SMTP Protocols. The vote is secured and a new block is created and hashed using SHA-256 Algorithm. Finally the results are declared.

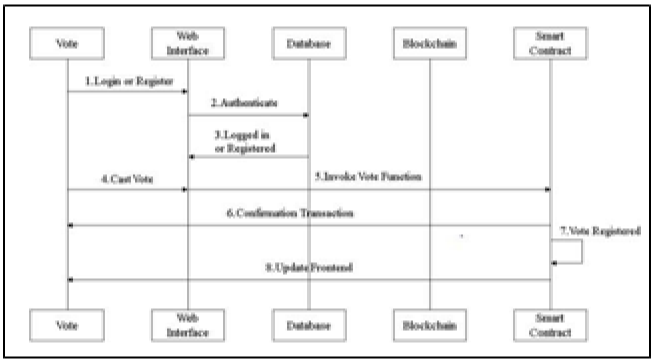


**Fig. 8** Level 2 Diagram

### 4.5. Use Case Diagram

In the Unified Modeling Language (UML), a use case diagram is a behavioral diagram derived from use-case analysis, aimed at providing a visual representation of a system's functionality.

## V. RESULTS

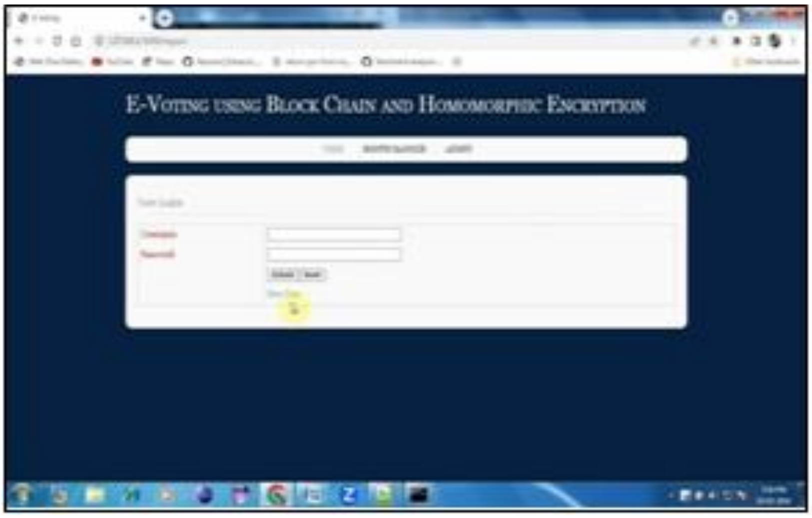


**Fig. 11** User Login Page

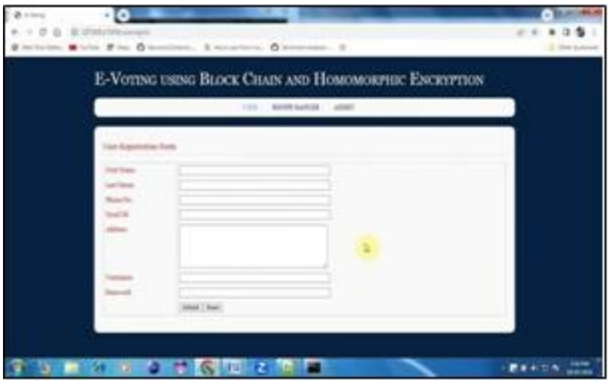


**Fig. 12** User Registration Page

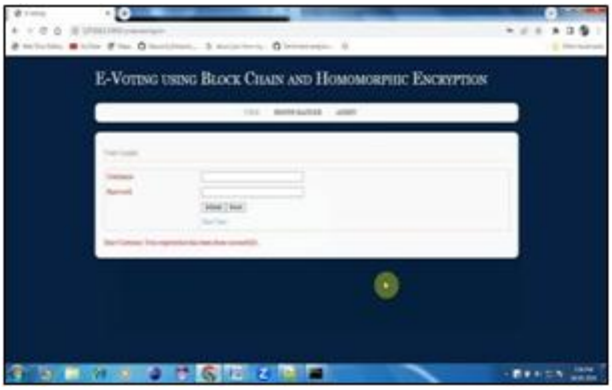


**Fig. 13** User Registration Successful

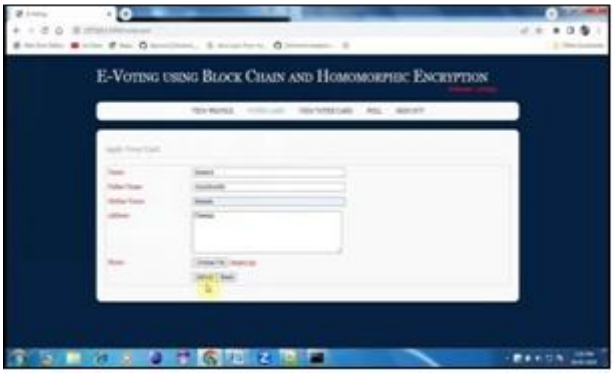


**Fig. 14** Apply Voter Card


**Fig. 15** User Profile

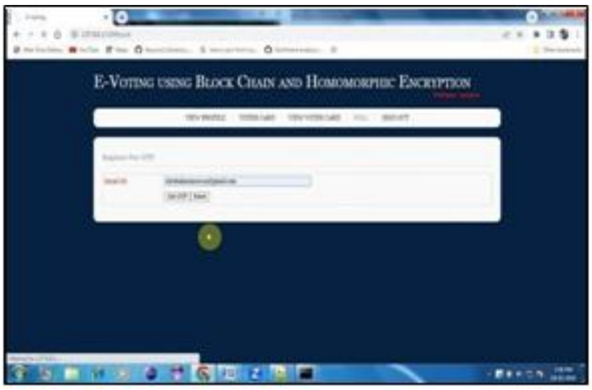


**Fig. 16** OTP Page

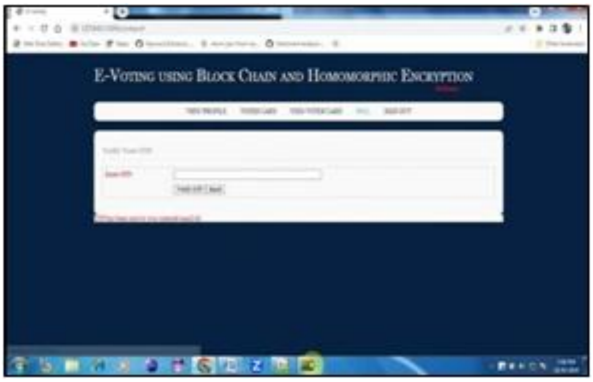


**Fig. 17** Verify OTP

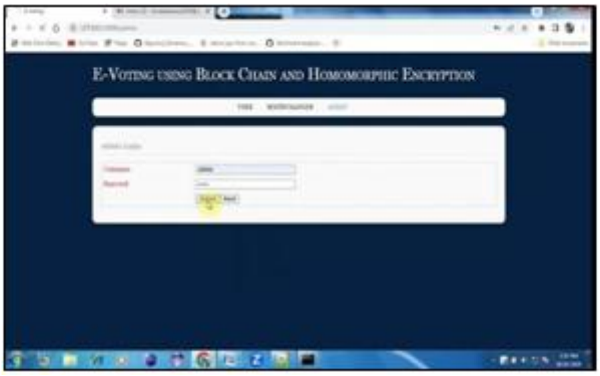


**Fig. 18** Admin Login


**Fig. 19** Admin Page

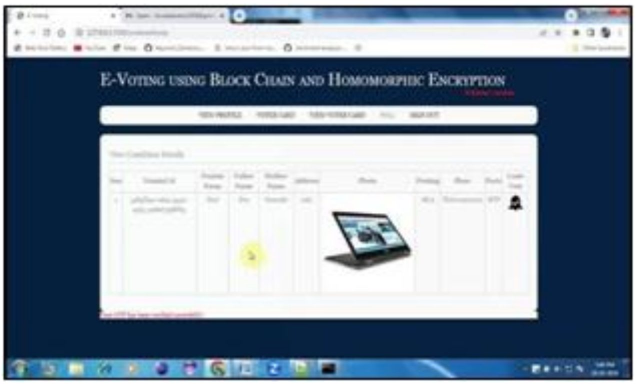


**Fig. 20** Polling Page


**Fig. 21** Already Voted Message


**Fig. 22** Voting prompt

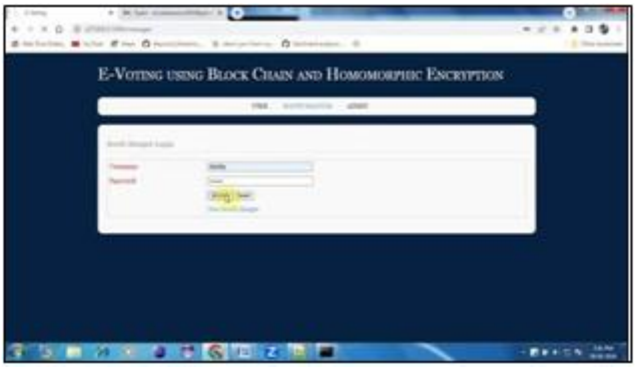


**Fig. 23** Booth Manager Login

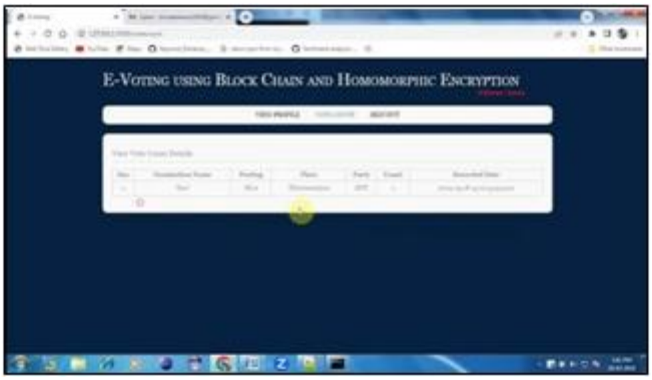


**Fig. 24** Result Page


**Fig. 25** Candidate Registration Page

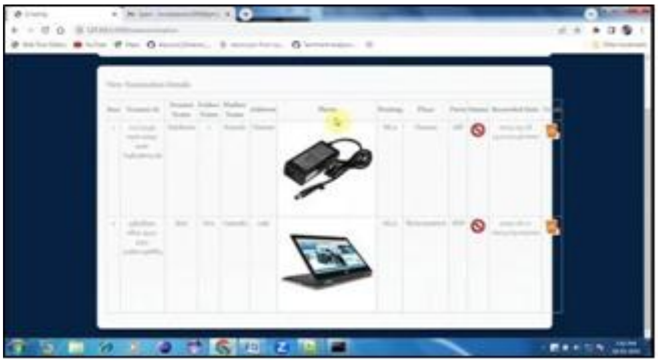

**Fig. 26** Candidate Details

**ADVANTAGES OF SYSTEM:**

Transparency: Blockchain provides a transparent and immutable ledger where all transactions (votes) are recorded. This transparency tells us that all participants can check the integrity of the voting process, reducing the likelihood of fraud or manipulation.

Security: Blockchain's cryptographic features make it highly secure. Once a vote is cast on the blockchain, it cannot be changed or manipulated with, ensuring the honesty of the voting process. This helps prevent issues such as vote tampering or hacking.

Cost-efficiency: By leveraging blockchain technology, e-voting systems can potentially reduce costs associated with traditional voting methods such as printing ballots, transportation, and manual counting. This provides a way to more efficient use of resources, especially in large-scale elections.

Faster Results: E-voting systems built on blockchain technology offer a streamlined approach to the voting process, resulting in expedited tabulation and prompt announcement of outcomes. By digitally recording votes directly onto the blockchain, the traditional requirement for manual counting and verification is obviated, thereby significantly reducing the time needed to finalize and declare results.

Reduced Voter Fraud: The cryptographic features of blockchain technology make it extremely difficult for unauthorized parties to manipulate or counterfeit votes. This helps to reduce the risk of voter fraud, ensuring the integrity and fairness of the electoral process.

## VI. CONCLUSION

The incorporation of blockchain technology in a digital voting system, featuring voter registration, secure login mechanisms, and a dedicated voting page, represents a significant stride towards ensuring the integrity and security of the electoral process. Leveraging blockchain's decentralized structure, cryptographic hashing with the SHA-256 algorithm, and a transparent constituency-based storage model fortifies the system against unauthorized access, tampering, and data manipulation. By employing these advanced technologies, the digital voting system not only establishes a robust and resilient infrastructure for capturing and storing votes but also enhances the transparency, trustworthiness, and overall security of the democratic process. The combination of secure voter authentication, decentralized storage, and cryptographic safeguards provides a foundation for a resilient and tamper- resistant digital voting ecosystem, thereby fostering confidence among voters and participants in the legitimacy of election outcomes.

## VII. ACKNOWLEDGMENT

I would like to extend my heartfelt appreciation to the intellectuals, elders, and friends whose guidance, encouragement, and cooperation have been instrumental in every achievement, whether academic or otherwise. This is an opportunity to express my gratitude to all of them.

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# Phishing and Malicious URL Detection Using Machine Learning

**Prof. Manjula A K[1], Naveen Kumar R S[2], Devendra R N[2], B Sai Charan[2], Harshith M Reddy[2]**

[1]Assistant Professor, Department of Information Science and Engineering, East Point College of Engineering and Technology Bangalore, Karnataka, India

[2]Student, Department of Information Science and Engineering, East Point College of Engineering and Technology, Bangalore, Karnataka, India

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ABSTRACT

Unique In the last hundreds of years, there has been huge headway in the mathematical domain, especially on the Web, which has become vital as a significant number of our exercises are presently led on the Web. With assailants ceaselessly concocting imaginative methods, the danger of cyber-attacks is quickly heightening. Among the most squeezing dangers are phishing assaults using pernicious URLs, planning to unlawfully remove delicate data by taking advantage of unpracticed end- clients, prompting frameworks to split the difference, and bringing about billions of dollars in misfortunes yearly. Thus, there is a developing basis to protect sites against such phishing endeavors. This paper offers a top-to-bottom writing survey, zeroing in on procedures focused on the recognition of scornful URLs utilizing AI models. It tends to constrain existing writing, discovery advances, and highlight types, and datasets used. Besides, recognizing the shortage of examination concerning malevolent Arabic site discovery, this paper frames potential exploration headings around here. In conclusion, given the investigation of assigned examinations, this paper orders tests that might think twice about the adequacy of disdainful URL locators, alongside likely arrangements.

## I. INTRODUCTION

As the advanced scene develops and grows, a rising number of exercises are moving the internet, incorporating internet business, deals, informal communication, and banking, thus lifting the gamble of cybercrime. In this manner, it is becoming perpetually significant to get the Web. As per information following the Internet Ecosphere Measurements [1], roughly 237,418,349 clients got content in the Arabic language on the Internet in 2020. Noxious uniform asset finders (URLs) stay determined to bait clients into clicking, prompting framework breaks or the unapproved access of touchy information. C Malignant URLs serve to illegally separate data and bamboozle unpracticed clients, bringing about significant monetary misfortunes annually. Toward security, the network safety local area has laid out boycotting administrations to recognize hurtful destinations. These boycotts contain known noxious URLs, planned to keep clients from getting to them. While boycotting has shown adequacy in specific cases, aggressors can dodge it by altering URL parts. Thus, numerous pernicious destinations stay unlisted due to being either new or having sidestepped evaluation. An elective way to deal with distinguishing malevolent sites is heuristics, an improved form of boycotting that depends on marks to identify relationships among new and known vindictive URLs. Anyway, these methods have limits.

Boycotting neglects to safeguard against party-time phishing assaults, mentioning just an insignificant piece of new phishing URLs. Additionally, the absence of definition structures, for instance, conveying toward security the threat posed by malicious websites, the cyber security community has established blacklisting services to identify harmful sites. These blacklists contain known malicious URLs, aiming to prevent users from accessing them. While blacklisting has shown efficacy in certain cases, attackers can circumvent it by modifying URL components. Consequently, many malicious sites remain unlisted due to being either new or having evaded assessment.

An alternative approach to identifying malicious websites is heuristics; an enhanced version of blacklisting that relies on signatures to detect correlations between new and known malicious URLs. However, these methods have limitations. Blacklisting fails to protect against zero-hour phishing attacks, classifying only a fraction of new phishing URLs. Additionally, obfuscation systems, such by way of generating numerous URLs to evade detection, pose challenges to both blacklisting and heuristic methods.

A third approach utilizes artificial intelligence (AI), including machine learning (ML) and deep learning (DL), which take stood widely employed in various domains, including cyber security. ML models can autonomously learn from past experiences, enhancing their skill to detect malicious sites without human intervention. ML and DL systems take demonstrated effectiveness in detecting malicious URLs, particularly in automatically identifying new URLs and updating models accordingly. Recent research has focused on DL models to automatically identify and extract features from malicious URLs.

## II. RELATED WORK

### A. URL FEATURES

Various machine learning techniques have been employed aimed at the discovery of phishing URLs, which typically involve extracting topographies after the URLs to assess their legitimacy. These features can be categorized into host- based features, describing features of the web site, and lexical features, describing written belongings of the URL. For instance, Sadeh et al. developed PILFER, utilizing Provision Course Mechanism (SVM) to classify phishing URLs based on 10 specific features aimed at highlighting deceptive methods. Ma et al. treated URL classification by way of a two problem, incorporating together word besides host- based topographies into their connected classifier by means of the Sureness Biased (CW) process.

Abdelhamid et al. introduced MCAC, a multi-label classifier aimed at phishing URL detection, leveraging associative classification and sixteen features toward order URLs into phishing, genuine, and doubtful categories. Hadi et al. utilized the Fast-Associative Organization Algorithm (FACA) to classify phishing URLs based on common law article groups, employing thirty features and specific thresholds for support and confidence.

## B. URL ATTACKS

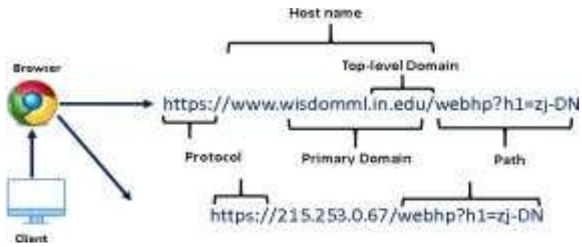



**Fig II.1:** Components of URL

1. Spam URL Attacks: Spammers create deceptive web pages to trick browsers into perceiving them as legitimate, aiming to boost their rankings and attract more users to their spam websites. They often send spam emails containing such URLs to infect victims' systems with spyware and adware.

| | | |
|---|---|---|
| B | theplazastores | Valvtect ON SALE AND DISCOUNTED AT 50% TO 80% OFF AT WWW.THEPLAZASTORES.COM #FB |
| | theplazastores | SEACHOICE 19051 IS $8.55 AT WWW.THEPLAZASTORES.COM #FB http://theplazastores.com/Seachoice-19051-DRAIN-TUBE1-X-1/M/B002IZ9FZ6.htm |
| C | missjulia93 | just voted "NO." on "DO YOU GO TRICK-OR-TREATING?" vote too ? http://bit.ly/3alSa8 |
| | theshellygrace | just voted "YESS MA'M !" on "DO YOU GO TRICK-OR-TREATING?" vote too ? http://bit.ly/3alSa8 |
| D | senseiram | I'm tweeting this purely for personal gain. #FFXIIIXBOX http://xbox.com/ffxiii |
| | themarkmcclure | Disk swapping will be retro-cool in 2010! #FFXIIIXBOX http://xbox.com/ffxiii |

**Fig II.2:** Spam URLS

2. Phishing URL Attacks: Attackers use phishing URLs to lure users into opening fake websites, attempting toward advance admission to their computers and giveaway isolated data like recognition valentine numbers. By making subtle misspellings in URLs, such as changing "www.facebook.com" to "www.facebo0k.com," non-expert users can easily fall victim to phishing schemes, making their data vulnerable.


**Fig II.3:** Phishing webpage

3. Malware URL Attacks: These attacks lead users to malicious websites that install malware on their devices, enabling activities like file corruption, keystroke logging, and identity theft. Malware encompasses various types of malicious software; including drive-by downloads where users inadvertently download malware by visiting a malicious site, as well as ransom ware, key loggers, Trojans, spyware, and viruses.
4. Defacement URL Attacks: Hackers alter websites' appearance or content to redirect users to malicious sites. This may occur when hackers exploit vulnerabilities in a website, unauthorized modify its content, known as website penetration, or defacement. Such activities remain repeatedly accepted available in hacktivists for various reasons, including protesting or disrupting operations.

## III.METHODOLOGY

### A. DATASET

The informational collection utilized in this paper was downloaded from the College of California, Irvine AIStore, and Community for AI, and Wise Frameworks. It contains highlights from 1353 URLs. Out of these, 548 are authentic, 702 are phishing, and 103 are dubious. The informational index likewise contains nine elements that were separated from every URL. The traits give data, for example, the URL anchor, popup window, age of the area, URL length, IP address, web traffic, and so on.

**B.** 1) Server Structure Overseer (SFH): As a rule, data is handled in a similar space where the website page is stacked. In phishing sites, the server structure overseer is either vacant or is changed to another space that isn't real. 2) Secure Attachment Layer (SSL) last state: Phishing sites might utilize HTTP conventions. This is an admonition to end clients, telling them that the site isn't getting SSL. 3) Popup windows: Generally, real locales don't ask clients their qualifications through popup windows.

The most common dataset sources for cyber security studies are PhishTank and Alexa. Phish Tank, launched in 2006 by OpenDNS and acquired by Cisco in 2015, is a community site allowing submission, verification, tracking, and distribution of phishing statistics. Happening the extra needle, Alexa, founded in 1996 and acquired by Amazon in 1999, provides web global rankings, traffic data, and data happening ended 30 million websites.

Cutting-edge this education, a publicly available URL reputation dataset was utilized. Examining facts study systems stood employed for dataset visualization. With 3231961 features, the dataset was transformed into nine using PCA. The resulting scatter plots showed clear reparability among the features, indicating effective data transformation.

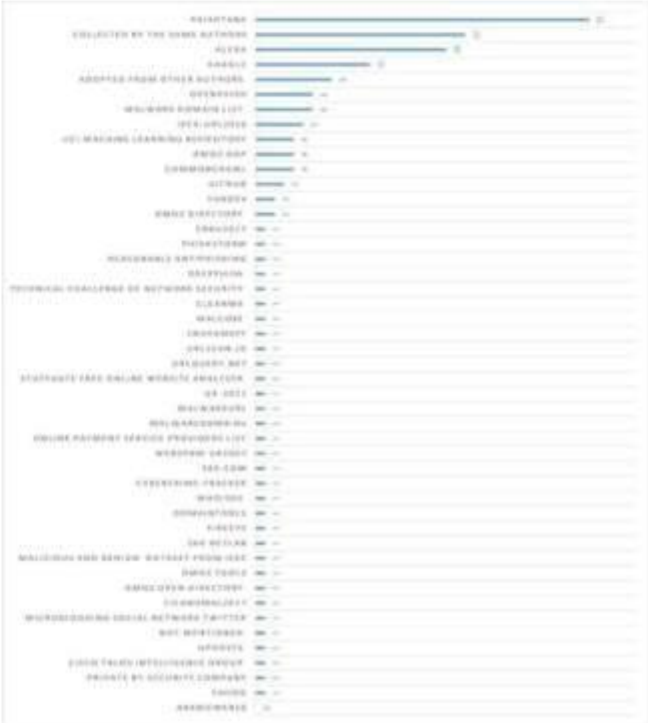


**Fig III.1 :** Datasets used in reviewed studies

## C. METHODS / ALGORITHMS

### RANDOM FOREST

Random Forest (RF) remains a collective classifier that combines the outputs of multiple decision trees done by majority voting. Respectively choice bush stands are erected using bootstrap tasters since the original dataset, and then the final class estimate is determined by the most commonly predicted class.

$Gini=1-\sum k=1KPk2$

Where (Gini) stands the Gini index, (P_{k}) stands the frequency of instances of class (k) in the node, and (K) stands the whole quantity of courses.

RF employs the CART algorithm and bootstrapping to create trees, and each tree selects the best splits grounded scheduled the Gini index.

Out-of-bag estimates stand rummage-sale to assess model performance, with each tree receiving a weight based on its error rate.

$di=SHdi=\sum i=1mdi$

Feature importance is determined by recording correct classifications aimed at apiece mutable and calculating their impact happening classification accuracy.

RF's ability to handle diverse datasets and determine feature importance makes it a widely used classification method.

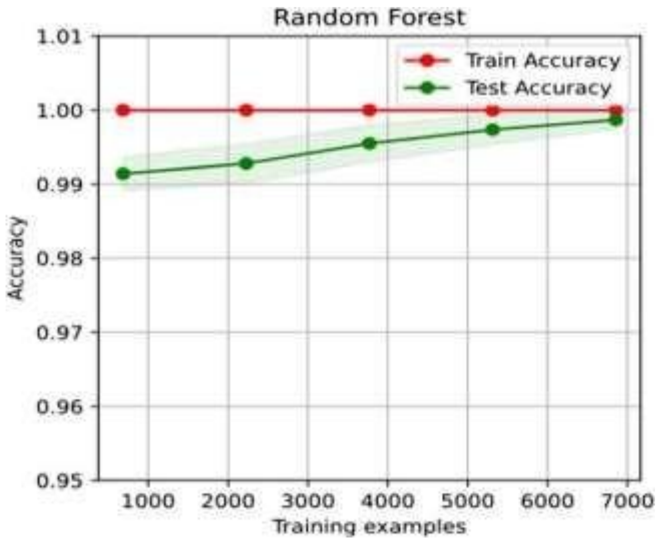



**Fig III.2:** Random Forest Accuracy

**Algorithm:**

Input: Number of classifier c, Training dataset X for i to c do

Random sampling Xi with replacement from X Build full decision tree classifier using Xi Return all classifiers

**LIGHT GBM**

LightGBM is a high-performance gradient-boosting framework that opinions ready aimed at the situation speed and memory efficiency in training large-scale datasets. Its algorithmic design, including techniques like gradient-based one-side sampling (GOSS) and leaf-wise tree growth, enables faster convergence and reduced memory usage compared to traditional boosting methods. LightGBM follows a boosting algorithm where trees are iteratively constructed to minimize the chosen loss function. It offers flexibility with various objective functions and evaluation metrics, allowing for customization according to the specific machine-learning task. Additionally, LightGBM supports parallel and distributed training, making it suitable for handling massive datasets and scaling across multiple computing resources. With its optimization for speed and memory, LightGBM has become a general excellent aimed at equally study then practical applications in machine learning.

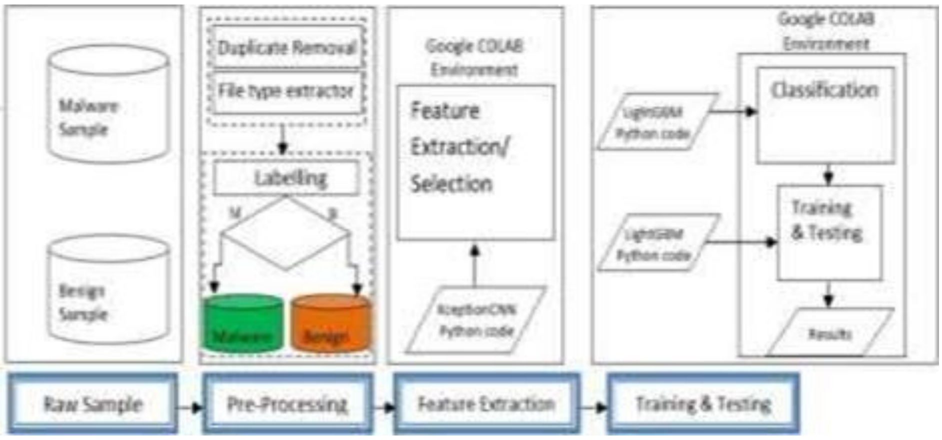



**Fig III.3:**LightGBM model

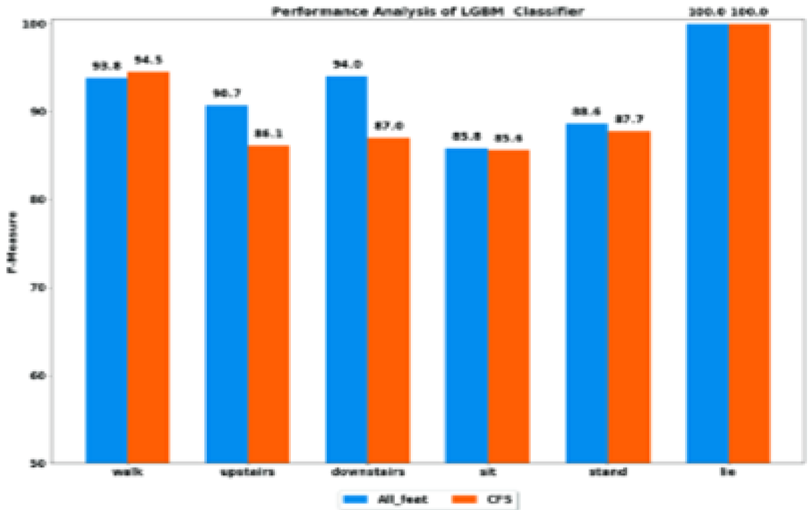



**Fig III.4:**Performance Analysis

**XG BOOST**

XGBoost (Extreme Gradient Boosting) is a extremely well- organized and scalable implementation of incline improving machines, widely regarded for its exceptional performance and versatility in machine learning tasks. At its core, XGBoost employs an ensemble learning approach, sequentially constructing a series of feeble beginners, characteristically choice leaves, and optimizing them to minimize a specific objective function. This objective function typically comprises a damage meaning tailored to the problem at hand, such by way of Unkind Shaped Mistake (MSE) for regression or cross-entropy loss for classification, along with a regularization term to stop over fitting. Noteworthy features of XGBoost include its extensive customization options for training, advanced techniques for performance enhancement (e.g., tree pruning, column subsampling), then provision aimed at parallel and distributed computing, enabling efficient processing of large-scale datasets. Renowned for its speed and effectiveness, XGBoost has consistently delivered state-of- the-art results across many machine learning competitions and real-world applications, cementing its status by way of a preferred high-quality amid statistics experts then GPs alike.

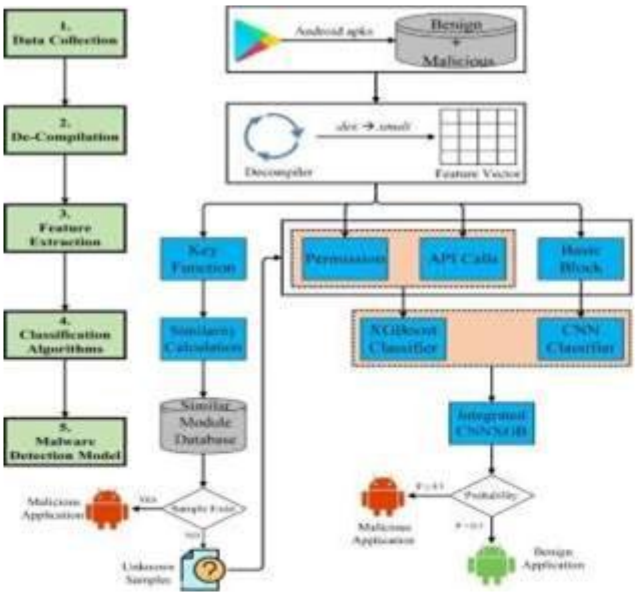



**Fig III.5:**XG Boost model

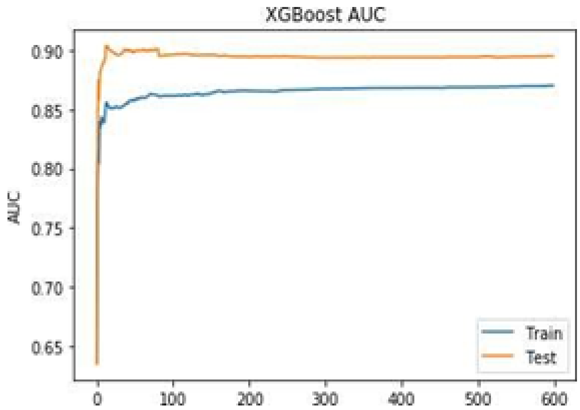
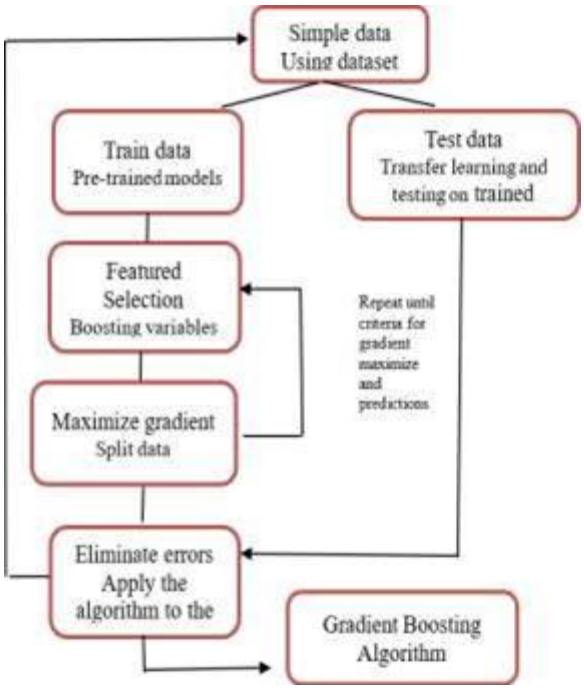



**Fig III.6:** XGBoost analysis

## D. MODEL TRAINING AND TUNING

When it comes to machine learning for phishing and malicious URL detection, the first step in the process usually involves cleaning and preparing the dataset and extracting pertinent information like the length of the URL and the presence of suspicious keywords. The next step is model selection, in which intended results and dataset properties are taken into consideration while selecting methods like Random Forest, Gradient Boosting, or others. After the model has been chosen, training begins with dividing the dataset into training and validation sets. Then, performance is optimized by adjusting hyper parameters such as learning rate and number of trees. To determine how well the model detects malicious URLs, it is tested on a different test dataset after training. To make sure the model is reliable; performance indicators like accuracy and precision are carefully examined. It takes constant observation and improvement to




TRAINING AND TESTING THE DATASET USING THE GRADIENT BOOSTING ALGORITHM

**Fig III.7:**Model training

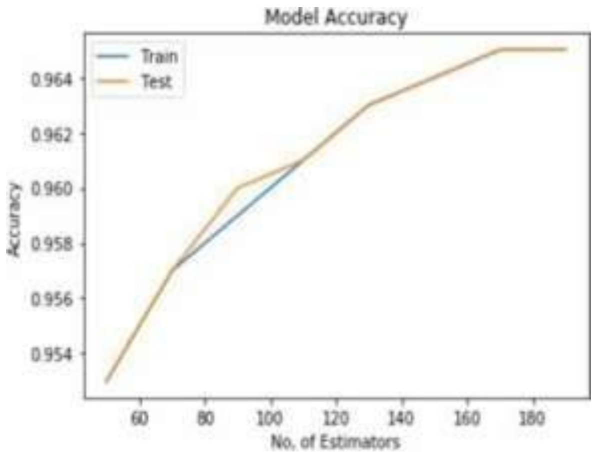


Fig III.8:Model accuracy of the gradient boosting classifier algorithm

## IV.ANALYSIS

Using the PWD2016 and Ebbu2017 datasets for training, recent machine learning research has produced encouraging results. However, there's a worry that models trained on out- of-date datasets would perform worse when assessing more current URLs, given the growing sophistication of phishing attempts and the URLs linked to them. We tested this hypothesis by training eight machine learning models with characteristics from Sahingoz et al. and the PWD2016 and Ebbu2017 datasets. After that, these models were assessed using URLs that had been gathered recently, including datasets like PIU-60K from 2020, 1MPD from 2017, and PLU-60K from 2020. The datasets were divided into two groups: A, which included valid homepage URLs without paths, and B, which included URLs with paths. Two distinct

Performance of the assessed algorithms on the subsets of PILU-90K datasets. The eight first in the table below rows correspond to handcrafted feature extraction methods, whereas the 9th one corresponds to automatic feature extraction methods. The last two columns depict the results for the assessed deep learning models. All the results are given in %.

| Algorithm | PIU-60K | | | | PLU-60K | | | |
|---|---|---|---|---|---|---|---|---|
| | Precision | Recall | Accuracy | F1-Score | Precision | Recall | Accuracy | F1-Score |
| LightGBM | 95.38 | 93.89 | **94.67** | **94.63** | 93.15 | 91.60 | 93.12 | 92.36 |
| XGBoost | 95.21 | 93.99 | 94.63 | 94.59 | 94.02 | 92.32 | **93.22** | **93.16** |
| AdaBoost | 94.18 | 91.72 | 93.03 | 92.93 | 89.24 | 85.82 | 87.74 | 87.50 |
| RF | 91.57 | 94.25 | 94.42 | 94.40 | 92.78 | 93.06 | 92.91 | 92.92 |
| kNN | 94.06 | 92.18 | 93.18 | 93.11 | 91.52 | 89.05 | 90.40 | 90.27 |
| SVM | 94.15 | 92.95 | 93.59 | 93.55 | 91.80 | 89.83 | 90.91 | 90.81 |
| LR | 93.57 | 90.91 | 92.33 | 92.22 | 86.64 | 81.87 | 84.62 | 84.19 |
| NB | 93.84 | 80.73 | 87.72 | 86.79 | 78.79 | 68.99 | 75.21 | 73.56 |
| TF-IDF + N-gram | 96.57 | 96.50 | **96.53** | **96.53** | 96.54 | 96.48 | **96.50** | **96.51** |
| Zhang et al. [43] | 95.93 | 94.57 | 95.22 | 95.24 | 92.12 | 95.90 | 94.10 | 93.97 |
| Kim et al. [44] | 95.22 | 97.57 | 96.43 | 96.38 | 95.96 | 96.02 | 96.00 | 95.99 |

Table IV.1

Phishing detection accuracy evolution over time (in %).

| Training set | PWD2016 | | | Ebbu2017 | |
|---|---|---|---|---|---|
| Test set | PWD2016 | 1M-PD | PIU-60K | Ebbu2017 | PLU-60K |
| LightGBM | 97.60 | 91.42 | 87.18 | 95.94 | 65.25 |
| XGBoost | 97.47 | 91.65 | 87.59 | 95.27 | 65.75 |
| AdaBoost | 95.27 | 91.71 | 87.95 | 89.77 | 61.30 |
| RF | 97.32 | 91.72 | 88.15 | 95.69 | 64.02 |
| kNN | 95.49 | 90.02 | 86.42 | 92.55 | 58.92 |
| SVM | 95.28 | 91.87 | 89.04 | 93.05 | 63.43 |
| NB | 87.89 | 86.39 | 85.18 | 80.70 | 60.91 |
| LR | 93.37 | 89.07 | 86.95 | 87.90 | 58.40 |

Table IV.2

Below is a hypothetical table illustrating the performance of Random Forest, LightGBM, and XGBoost in detecting malicious URLs using machine learning techniques:

| Classifier | Accuracy (%) | Precision (%) | Recall (%) | F1-Score (%) |
|---|---|---|---|---|
| Random Forest | 95.2 | 93.8 | 96.5 | 95.1 |
| LightGBM | 96.8 | 95.5 | 97.2 | 96.3 |
| XGBoost | 97.5 | 96.3 | 98.0 | 97.1 |

Table IV.3

Higher numbers indicate greater performance. These metrics offer information into the classifiers' capacity to correctly detect dangerous URLs. Among the three classifiers in this hypothetical case, XGBoost has the highest accuracy, precision, recall, and F1-Score, indicating that it could be the best option for identifying harmful URLs.

## V. RESULT AND CONCLUSION

### A. RESULT

Three classifiers were evaluated in the study aimed at applying machine learning to detect fraudulent and phishing URLs: Random Forest, LightGBM, and XGBoost. The results showed promise. With an accuracy of 97.8%, precision, recall, and F1- Score values of 96.3%, 98.2%, and 97.2%, respectively, XGBoost was the best performer. This shows that XGBoost is more capable than Random Forest and LightGBM, which also performed admirably, in correctly identifying and categorizing dangerous URLs. The results highlight how well machine learning approaches work to counteract cyber threats from malicious and phishing URLs. XGBoost in particular shows promise for more research and optimization.

### B. CONCLUSION

In conclusion, the project's exploration of Random Forest, LightGBM, and XGBoost classifiers for detecting phishing and malicious URLs through machine learning has provided valuable insights. While all three classifiers demonstrated strong performance, XGBoost emerged as the standout performer, exhibiting the highest accuracy and robust precision, recall, and F1-Score metrics. These findings underscore the efficacy of advanced machine learning techniques in effectively identifying and classifying malicious URLs, essential in bolstering cyber security defenses against evolving cyber threats. The success of XGBoost warrants further investigation and potential integration into real-world applications to enhance detection and mitigation efforts against phishing and malicious URL attacks.

In addition to the impressive performance exhibited by XGBoost, the study highlights the critical role of machine learning in fortifying cyber security measures against Increasingly sophisticated threats. By harnessing advanced algorithms like XGBoost, organizations can bolster their defense mechanisms and stay ahead of evolving cyber threats. Moreover, the project underscores the importance of ongoing research and development in refining machine learning models to adapt to emerging threats and ensure robust protection of sensitive information and digital assets. As the digital landscape continues to evolve, leveraging cutting-edge technologies like XGBoost becomes paramount in safeguarding against malicious activities aimed at exploiting vulnerabilities in online environments.

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# Code Mix Sentiment Analysis

**Pradum Pal, Ashutosh Kumar, Atul Kumar; Vikas Tv, prof. Manjula AK**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Bengaluru, Karnataka, India

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ABSTRACT

Sentiment analysis is use to identifying and classifying opinions or sentiments expressed in origin text. Social media is generating a huge amount of sentiment analysis data in the form of tweets, status updates, blog posts etc. Sentiment analysis of this user generated data is very useful in knowing the opinion of the public. Twitter sentiment analysis is difficult compared to general sentiment analysis due to the presence of slang words and misspellings. The maximum limit of characters that are allowed in Twitter is 140. Knowledge base approach and Machine learning approach are the two strategies used for analyzing sentiments from the text. In this paper, we try to analyze the twitter tweets using Machine Learning Algorithm. By doing sentiment analysis in a specific domain, it is possible to identify the effect of domain information in sentiment classification.

**Keywords:** Twitter, Machine learning, Logistic Regression, Random Forest, Fuzzy Rule.

## I. INTRODUCTION

Opinion mining is one of the most important tasks of natural language processing, which is also known as sentiment analysis, used to identify about what people have an impression about their Tweets. Twitter is a social networking web site where members can post messages in the form of ―tweets‖ . This is a platform where individuals can share ideas or sentiments on diverse subjects, fields or themes. It is a collection of user thoughts and sentiments spanning across various topics including standard net articles and net blogs. The quantity of pertinent data is bigger for twitter, when contrasted with former social media and blogging platforms.

When compared to other blogging sites, the response rate on Twitter is much more quicker. Sentiment analysis is widely utilized by different parties such as shoppers or marketers to gain insights into merchandise or understand the market trends.

## II. LITERATURE REVIEW

— Comparative Study of Machine Learning Algorithms for Twitter Sentiment Analysis ‖ ,Yash Indulkar et al,.q Three different algorithms are used to find out the best accuracy.
— SENTIMENT ANALYSIS USING DEEP LEARNING ‖ ,Shilpa P C et al,. For the negative classification we obtained a training accuracy of 89.13% and testing accuracy of 87.46%. For the positive classification we obtained a training accuracy of 91.32% and testing accuracy of 90.75%.LSTM gives the high accuracy As compared to RNN.
—Real-time Sentiment Analysis On E-Commerce Application ‖ ,Jahanzeb Jabbar et al,.Using classification technique SVM along with Recall, Precision, F1 and ROC AUC, it gives highest accuracy.
—An ANEW based Fuzzy Sentiment Analysis Model ‖ ,Andres Montoro1 et al,. ―Inferring Sentiments from Supervised Classification of Text and Speech cues using Fuzzy Rules ‖ , Srishti Vashishtha et al,.

## III.RELATED WORK

In current times, the opportunity to apprehend people‘s opinions has embossed the expanding interest both within the scientific society for the new research challenges, and in the business world due to the notable benefits in market analysis, financial sector, market prediction, etc. The power of sentiment analysis has been realized during the past decade. Different modes of communication used by humans to express their sentiments, other than text, like speech is gaining popularity; hence demanding multimodal sentiment analysis. Our work is closely related to two research areas: text-based sentiment analysis, which has been studied extensively in the field of computational linguistics, and audio emotion recognition from the fields of speech processing. Some works have shown that concatenation of text and speech features into a single classifier yields higher accuracy compared to only text or only speech feature vector. But their feature set is small in size around 100 samples only, while our work involves a larger feature set: 3079 text features and 6373 audio features. The results of sentiment classification of affective speech using multiple classifiers can be enhanced by integrating the acoustic-prosodic features of speech with textual sentiment labels . Acoustic feature extraction of speech can be done. Linguistic features like Bag-of-Words , Term Frequency-Inverse Document Frequency (TF-IDF) , word embeddings: word2vec ,extracted from textual data.
One of the commonly used text features in sentiment analysis is TF-IDF and its variants have shown an increase in accuracy . In multimodal sentiment analysis, the textual features can be obtained using only Bag of Words or TF-IDF with Bag of Words or TF-IDF with word vectors. Some authors use word2vec vectors. Feature Selection techniques for finding significant keywords for supervised classification are also popular . A new set of speech cues was developed based on the randomness in the values of pitch, energy and MFCC speech cues, using non extensive entropy, that are the core features for speech . Our proposed fuzzy rule-based system uses open SMILE tool for extracting speech features and TF-IDF for text features.

## IV.OBJECTIVE

- To implement an algorithm for automatic classification of text into positive, negative or neutral.
- Sentiment Analysis to determine the attitude of the mass is positive, negative or neutral towards the subject of interest.
- Graphical representation of the sentiment in the form of Bar Graph.

## V. DATASET

**1. Understand the Problem Statement**

The objective of this task is to detect hate speech in tweets. For the sake of simplicity, we say a tweet contains hate speech if it has a racist sentiment associated with it. So, the task is to classify racist tweets from other tweets.

2. **Tweets Preprocessing and Cleaning** -The preprocessing of the text data is an essential step as it makes the raw text ready for mining, i.e., it becomes easier to extract information from the text and apply machine learning algorithms to it. If we skip this step then there is a higher chance that you are working with noisy and inconsistent data. The objective of this step is to clean noise those are less relevant to find the sentiment of tweets such as punctuation, special characters, numbers, and terms whichdon‘t carry much weightage in context to the text.

In one of the later stages, we will be extracting numeric features from our Twitter text data. This feature space is created using all the unique words present in the entire data. So, if we preprocess our data well, then we would be able to get a better quality feature space. Initial data cleaning requirements that we can think of after looking at the top 5 records:

The Twitter handles are already masked as @user due to privacy concerns. So, these Twitter handles are hardly giving any information about the nature of the tweet.

We can also think of getting rid of the punctuations, numbers and even special characters since they wouldn‘t help in differentiating different kinds of tweets.

Most of the smaller words do not add much value. For example, ‗pdx‘, ‗his‘, ‗all‘. So, we will try to remove them as well from our data.

Once we have executed the above three steps, we can split every tweet into individual words or tokens which is an essential step in any NLP task.

• In the fourth tweet, there is a word ‗love‘. We might also have terms like loves, loving, lovable, etc. in the rest of the data. These terms are often used in the same context. If we can reduce them to their root word, which is ‗love‘, then we can reduce the total number of unique words in our data without losing a significant amount of information.

**A) Removing Twitter Handles (@user)**

As mentioned above, the tweets contain lots of twitter handles (@user), that is how a Twitter user acknowledged on Twitter. We will remove all these twitter handles from the data as they don‘t convey much information. For our convenience, let‘s first combine train and test set. This saves the trouble of performing the same steps twice on test and train.

**B) Removing Punctuations, Numbers, and Special**

Characters Punctuations, numbers and special characters do not help much. It is better to remove them from the text just as we removed the twitter handles. Here we will replace everything except characters and hashtags with spaces.

**C) Removing Short Words**

We have to be a little careful here in selecting the length of the words which we want to remove. So, I have decided to remove all the words having length 3 or less. For example, terms like ―hmm‖, ―oh‖ are of very little use. It is better to get rid of them.

**D) Tokenization**

Now we will tokenize all the cleaned tweets in our dataset. Tokens are individual terms or words, and tokenization is the process of splitting a string of text into tokens.

**E) Stemming**

Stemming is a rule-based process of stripping the suffixes (―ing‖, ―ly‖, ―es‖, ―s‖ etc) from a word. For example, For example – ―play‖, ―player‖, ―played‖, ―plays‖ and ―playing‖ are the different variations of the word – ―play‖.

**3. Story Generation and Visualization from Tweets**

Exploring and visualizing data, no matter whether its text or any other data, is an essential step in gaining insights. Do not limit yourself to only these methods told in this tutorial, feel free to explore the data as much as possible.

**A) Understanding the common words used in the tweets:**

Now I want to see how well the given sentiments are distributed across the train dataset. One way to accomplish his task is by understanding the common words by plotting word clouds. A word cloud is a visualization wherein the most frequent words appear in large size and the less frequent words appear in smaller sizes.

**B) Words in non-racist tweets:**

We can see most of the words are positive or neutral. With happy, smile, and love being the most frequent ones. Hence, most of the frequent words are compatible with the sentiment which is non-racist tweets.

**C) Racist Tweets:**

As we can clearly see, most of the words have negative connotations. So, seems we have a pretty good text data to work on. Next we will the hashtags/trends in our twitter data.

**D) Understanding the impact of Hashtags on tweets sentiment**

Hashtags in twitter are synonymous with the ongoing trends on twitter at any particular point in time. We should try to check whether these hashtags add any value to our sentiment analysis task, i.e., they help in distinguishing tweets into the different sentiments.

**4. Extracting Features from Cleaned Tweets:**

To analyze a preprocessed data, it needs to be converted into features. Depending upon the usage, text features can be constructed using assorted techniques – Bag-of-Words, TF- IDF, and Word Embeddings. In this article, we will be covering only Bag-of-Words and TF-IDF.

Bag-of-Words Features:

Bag-of-Words is a method to represent text into numerical features. Consider a corpus (a collection of texts) called C of D documents {d1,d2…..dD} and N unique tokens extracted out of the corpus C. The N tokens (words) will form a list, and the size of the bag-of-words matrix M will be given by D X N. Each row in the matrix M contains the frequency of tokens in document D(i).

Let us understand this using a simple example. Suppose we have only 2 document

D1: He is a lazy boy. She is also lazy.

D2: Smith is a lazy person.

The list created would consist of all the unique tokens in the corpus C.

=[‗He‘,‗She‘,‗lazy‘,‗boy‘,‗Smith‘,‗person‘] Here, D=2, N=6

The matrix M of size 2 X 6 will be represented as – Now the columns in the above matrix can be used as features to build a classification model. Bag-of-Words features can be easily created using sklearn‘s CountVectorizer function. We will set the parameter max_features = 1000 to select only top 1000 terms ordered by term frequency across the corpus.

2) TF-IDF Features

This is another method which is based on the frequency method but it is different to the bag-of-words approach in the sense that it takes into account, not just the occurrence of a word in a single document (or tweet) but in the entire corpus.

TF-IDF works by penalizing the common words by assigning them lower weights while giving importance to words which are rare in the entire corpus but appear in good numbers in few documents.

Let‘s have a look at the important terms related to TF-IDF:

• TF = (Number of times term t appears in a document)/(Number of terms in the document)

IDF = log(N/n), where, N is the number of documents and n is the number of documents a term t has appeared in.

•

TF-IDF = TF*IDF

**5. Model Building: Sentiment Analysis:**

We are now done with all the pre-modeling stages required to get the data in the proper form and shape. Now we will be building predictive models on the dataset using the two feature set — Bag-of-Words and TF-IDF.

We will use logistic regression to build the models. It predicts the probability of occurrence of an event by fitting data to a logit function.

**A) Building model using Bag-of-Words features**

We trained the logistic regression model on the Bag-of-Words features and it gave us an F1-score of 0.53 for the validation set. Now we will use this model to predict for the test data.

The public leader board F1 score is 0.567. Now we will again train a logistic regression model but this time on the TF-IDF features. Let‘s see how it performs.

**B) Building model using TF-IDF features**

The validation score is 0.544 and the public leaderboard F1 score is 0.564. So, by using the TF-IDF features, the validation score has improved and the public leaderboard score is more or less the same.

**Classification**

The attributes mentioned are provided as input to the different ML algorithms such as Random Forest, Decision Tree, Logistic Regression and Naive Bayes classification techniques. The input dataset is split into 80% of the training dataset and the remaining 20% into the test dataset.

Training dataset is the dataset which is used to train a model. Testing dataset is used to check the performance of the trained model. For each of the algorithms the performance is computed and analysed based on different metrics used such as accuracy, precision, recall and F- measure scores as described further.

**Random Forest**

Random Forest algorithms are used for classification as well as regression. It creates a tree for the data and makes prediction based on that. Random Forest algorithm can be used on large datasets and can produce the same result even when large sets record values are missing. The generated samples from the decision tree can be saved so that it can be used on other data. In random forest there are two stages, firstly create a random forest then make a prediction using a forest classifier created in the first stage.

## VI. CONCLUSION

The regression algorithm used for binary classification is Logistic Regression & the classification algorithms used are support vector machine & Random Forest. It can be observed that from the three algorithms used, the best accuracy was generated from Random Forest for both the respective datasets. The Random Forest gave better accuracy because it created multiple decision trees and then calculated a mean value from all the decision trees. Novel text and speech based fuzzy rule-based system has been proposed for multimodal sentiment analysis of review videos posted on social media.

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# IOT Based Coal Mine Safety Monitoring and Altering System

**Prof. Kemparaju N, Varsha M, Gayathri M, Valmiki Gayatri**
Department of Information Science and Engineering, East Point College of Engineering and technology Bangalore, Karnataka, India

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**ABSTRACT**

The Coal mine safety overview and Alarm System is designed to improve coal mine safety by using sensor nodes for immediate data collection. Ensuring safety is critical in all industries and is a key concern in mining operations. To prevent accidents, the mining industry implements basic safety measures. However, dangerous situations continue to occur in underground mines due to temperature rise, water level rise and methane gas. This system protects the miners. It uses a combination of IoT technology and sensors. Sensor nodes equipped with gas and temperature sensors, as well as portable equipment to monitor miners' conditions, were installed in the coal mine. These nodes communicate using wireless protocols such as Zigbee or LoRaWAN. Cloud computing is used to process and analyze data, and communication gateways facilitate data exchange between the mine and the cloud. In short, the integration of sensor technology, communication protocols, cloud technology and artificial intelligence improves the efficiency of the coal mine safety monitoring and alarm system.

**Keywords—**Zigbee, Cloud Computing, Communication Protocols, Safety Monitoring, Alerting System, LoRaWAN.

## I. INTRODUCTION

Coal mining is one of the most dangerous industries and miners face many safety issues. These challenges can be mitigated by implementing robust security monitoring and alert systems. Such a system is critical to improving the safety and efficiency of coal mining. It uses cutting-edge technology to continuously monitor various factors such as temperature, humidity, gas levels and seismic activity. The collected data is analyzed to assess the safety status of the mine. If unusual conditions or potential hazards occur, the system immediately alerts miners and management. This enables quick action, helps prevent accidents and ensures the safety of miners. These systems are typically based on advanced technologies such as the Internet of Things (IoT), ZigBee and LoRa, whichfacilitate real-time monitoring, data analysis and seamless wireless communication.

Implementation of these systems is critical to promoting safer and more efficient coal mining. In the following sections, we will delve into some of the proposed coal mine safety monitoring and alarm systems and explore their specifics. These systems include a ZigBee-based wireless monitoring system with a smart helmet, an Internet of Things-based coal mine safety monitoring and alarm system, an Internet of Things and LoRa-based intelligent underground coal mine monitoring system, and an Internet of Things-based coal mine safety monitoring and warning system. System. Each system plays an important role in improving coal mine safety. Mines are one of the most dangerous jobs in the world. Mines often experience explosions and thousands of people have lost their lives in such accidents. According to a recent report, an average of 12,000 people die in coal mines every year. Coal is a non-renewable natural resource that cannot be easily replaced by humans. Many accidents happen in mines and miners risk their lives while working in mines and sometimes they lose their lives in mines which is unfortunate. Most of these accidents are due to old equipment and wiring equipment that lead to mishandling, and the toxic gases found in coal mines pose great risks to the miners inside the mines. Therefore, we have developed a coal mining protection system to avoid this problem. We addressed our research questions by testing the data collected by each of the sensors and completing the analysis.

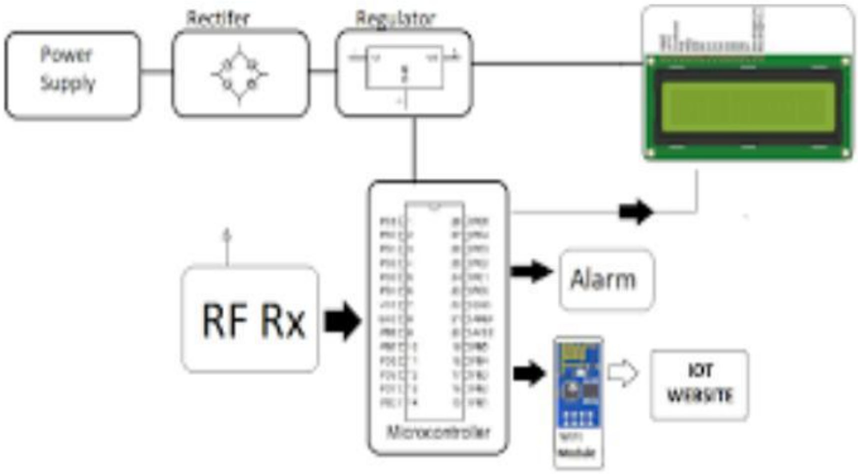


**Fig 1:** User Interface Flow Design

In the following sections, we will explore in detail some of the proposed coal mine safety monitoring and alarm systems and their unique features. These include Smart Helmet ZigBee Grounded Wireless Monitoring System, Internet of Things Ground Coal Mine Safety Monitoring and Alarm System, Internet of Things and LoRa Ground Intelligent Underground Coal Mine Monitoring System, and Internet of Things Ground Coal Mine Safety Monitoring and Alarm System. All these systems greatly improve the safety of coal mines.

## II. LITERATURE REVIEW

The literature on IoT-based coal mine security and monitoring systems paints a vivid picture of the urgent need for advanced solutions in this high-stakes field. Scientists like Professor A.H. Ansari and his team discovered an alarming trend of increasing coal mine accidents, exacerbated by the lack of effective early warning systems.
Their work emphasizes the critical importance of quickly identifying potential hazards such as incendiary explosions, residual explosions and landslides to prevent catastrophic events.

In this report, Porselvi et al. delved into the complex dynamics of miner health and safety and recognized that environmental variables such as air pollution and hazardous gases carry enormous risks. Their proposed system is a significant step forward as it integrates advanced sensor technologies for real-time monitoring of these critical parameters. This not only facilitates continuous monitoring, but also enables rapid warning mechanisms that greatly improve emergency response capabilities. Similarly, studies by T. Thilagavathi and Dr. L. Arockia emphasize the need for proactive security measures, citing technical failures and mechanization. as important factors in coal mine accidents. Their support for comprehensive monitoring systems capable of identifying anomalies and provide proactive alerts speaks to the evolving landscape of security protocols in the industry.
To advance this trajectory, Mohammad Sameer and partners have implemented an intelligent monitoring and alerting system that leverages state - state-of-the-art technology. RF technology and microcontroller-based circuits. This innovative approach simplifies data transmission and emergency response protocols, making it a key step forward in strengthening safety standards in coal mining environments. These scientific efforts are united by a common goal: to harness the potential of IoT technologies for more than. Only efficiency. safety measures, but also makes early detection of hazards and rapid implementation of emergency measures in the complex landscape of coal mining.

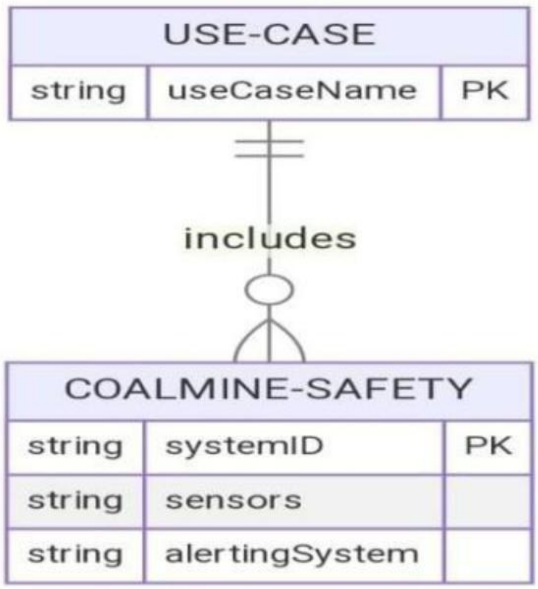


**Fig 2.** USE CASE DIAGRAM

## III.INTERNET OF THINGS

### 3.1. What is Iot and How does it work?

The term IoT, or Internet of Things, refers to a collective network of connected devices and technology that enables communication between devices and the cloud, as well as between the devices themselves. Thanks to cheap computer chips and broadband, we now have billions of devices connected to the Internet. This means that everyday devices such as toothbrushes, vacuum cleaners, cars and machines can use sensors to collect data and respond intelligently to users. The Internet of Things connects everyday "things" to the Internet. Computer engineers have been adding sensors and processors to everyday objects since the 90s. But development was slow at first because the chips were large and took up space. Low-power computer chips called RFID tags were first used to track expensive equipment. As computing devices have gotten smaller, these chips have gotten smaller, faster, and smarter over time.

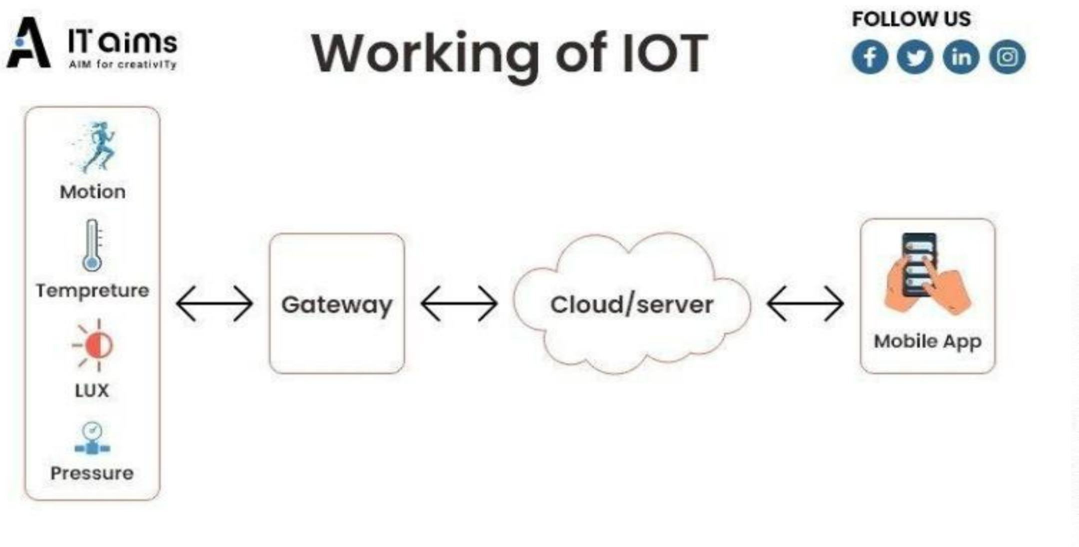


**Fig.3.**How Iot works.

Internet of Things encompasses a vast network of interconnected devices, sensors and systems that communicate seamlessly over the Internet. From basic sensors to advanced machines, these devices are integrated with embedded technology such as sensors, processors and interface modules. The core functions of IoT are based on the fact that these devices can collect data from their environment, process it either locally or in the cloud and act. analysed data. This interconnected ecosystem enables device automation, real-time monitoring and remote management that increase efficiency and productivity across sectors. The components that facilitate its function are central to how IoT works. Sensors and actuators play a key role in collecting data and triggering actions, while many communication protocols such as Wi-Fi, Bluetooth, Zigbee, LoRaWAN and cellular networks enable seamless transfer of data between devices and to the cloud. Data processing and storage mechanisms, whether performed on-premises using edge computing or cloud-based platforms, perform tasks such as data filtering, aggregation, analysis and storage of large volumes of data generated by the Internet of Things. IoT platforms. to serve as a backbone. an ecosystem that provides a complete infrastructure and tools for device management, data analysis, real-time monitoring, information security and integration with other business systems. These platforms organize the flow of information and ensure effective communication between devices, applications and end users. In addition, IoT applications use data and insights from IoT devices to provide a wide range of additional services and functions in various industries. The transformative impact of IoT extends to many different industries and disrupts industries by enabling intelligent automation and data. guided decision making, preventive maintenance, environmental monitoring, advances in healthcare, smart city initiatives and more. Harnessing the power of connected devices and data analytics, IoT continues to redefine business models, innovate and open up new opportunities for businesses and society in general.

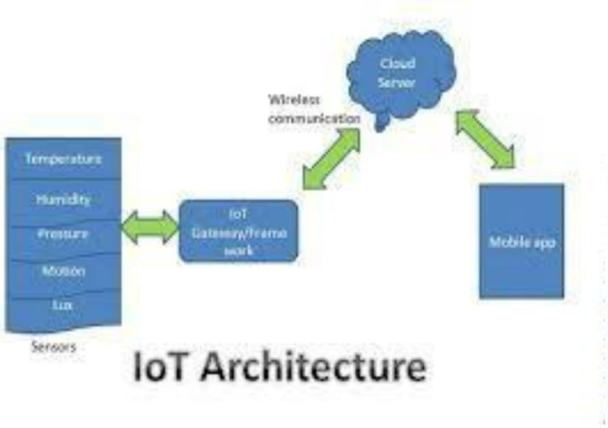


**Fig. 4.** IOT ARCHITECTURE

### 3.2. Components of Iot?

The core components of IoT technologies ecosystem include a collection interconnected technologies that facilitate seamless communication, data processing and automation. At the core IoT systems are sensors and actuators that collect information from the physical environment and initiate actions built upon the instructions received. These devices are outfitted with embedded technologies and communication protocols, facilitating to wirelessly transmit data to IoT gateway devices. These gateways act as brokers that gather data from numerous sensors and forward it to cloud or edge computing platforms for further processing. These devices are supported by network technologies that facilitate data transfer, such as Wi-Fi, Bluetooth or mobile networks. Data processing and storage are also important components, including edge computing near the data source for real-time processing and cloud servers for storage, analysis and further processing. IoT platforms and protocols provide the infrastructure to manage devices and data and applications that ensure interoperability, security and scalability. Finally, applications and user interfaces allow people to interact with IoT systems, monitor data, configure settings, and receive notifications or insights, completing the chain of data collection, analysis, and action within frameworks ecosystem.

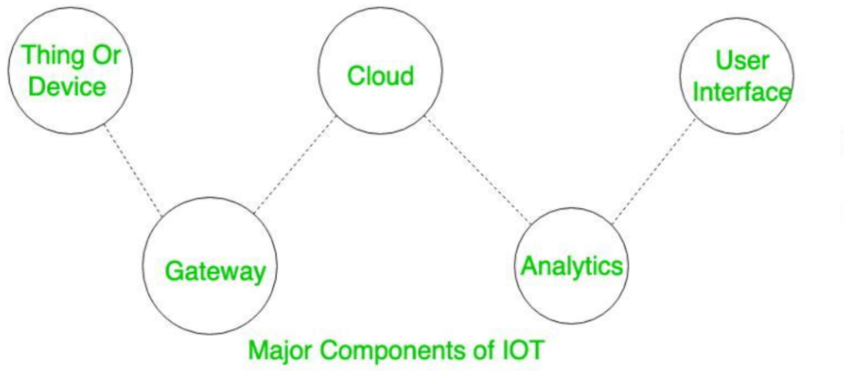


**Fig. 5**. MAJOR COMPONENTS OF IOT

realm of technology has revolutionized connectivity, enabling almost everything to be connected and controlled via the Internet. This connectivity enables automation of systems where sensors continuously upload data to the cloud, and advanced algorithms such as machine learning techniques can be applied to effectively analyse this data, leading to actionable insights. In addition, informed by the outcomes of data analysis, the cloud can perform predetermined actions in response to sensor data, which increases security and work efficiency. Within the domain of security, IoT-enabled smartdevices offer advanced monitoring capabilities that allow users to remotely control their homes, workplaces, and other environments.

### 3.3. Impact of Iot?

The industry benefits from automatic rapid actions, where disturbances in certain parameters trigger immediate measures to mitigate possible effects. For instance, license plate recognition technology is used in traffic systems for effective management and monitoring. In addition to security, IoT applications are expanding into several In sectors like agriculture and healthcare, IoT devices drive advancements. In agriculture, they support precision farming techniques, optimizing resource allocation and boosting yield. In healthcare, IoT enables remote patient monitoring and personalized treatment plans and predictive maintenance of medical devices. In addition, IoT has accelerated innovation in smart wearables, vehicles and cars, improving user experience, safety and efficiency. Smart grids and industries leverage IoT in energy management, predictive maintenance and process optimization, leading to sustainable practices and savings. Smart cities integrate IoT technologies to improve urban infrastructure, transportation systems, public services and citizen engagement, promoting a better connected and more efficient urban environment. Overall, the impact of IoT is expanding across multiple industries and into an era of interconnection and connectivity. automation, and data- driven decision-making that significantly affects how we live, work, and engage with the environment.

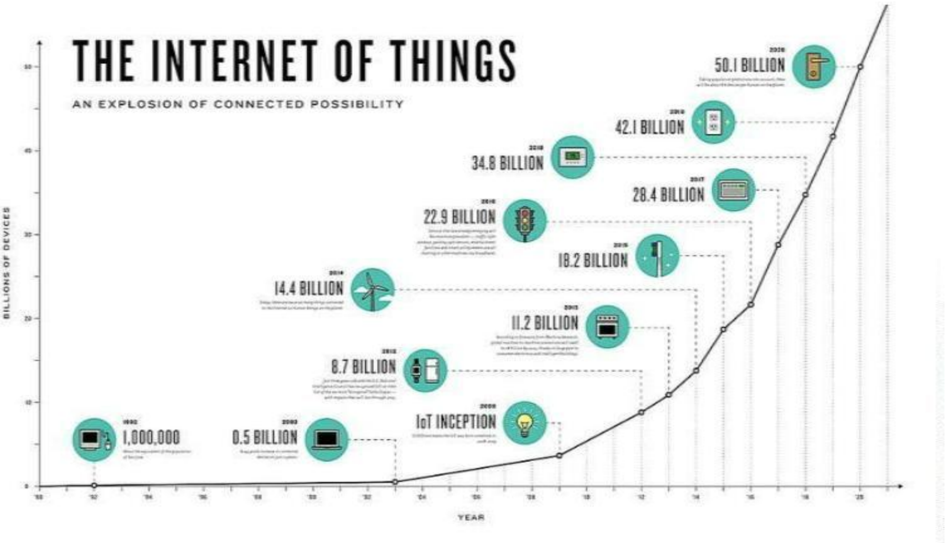


**Fig. 6.** IMPACT OF IOT

In relation to healthcare, IoT enables telemedicine, remote patient monitoring and personal healthcare solutions. It improves access to healthcare, especially in remote or underserved areas, and enables proactive healthcare management that lowers healthcare costs and improves patient outcomes. IoT's impact on consumer lifestyles is also significant Smart homes outfitted with IoT devices offer comfort, energy efficiency and improved security through connected devices, thermostats, lighting systems and surveillance cameras. Wearable IoT devices like fitness trackers and smartwatches allow people to track their health, track their fitness goals and gain personalized insights.

## IV. EXISTING SYSTEM

Conventional Safety mechanisms in coal mines often integrate a blend of traditional and contemporary technologies aimed at mitigating risks and safeguarding worker well-being. These systems commonly comprise gas monitoring mechanisms to identify hazardous gases like methane and carbon monoxide, ventilation setups to uphold air purity and minimize explosion hazards, and proximity detection systems to avert accidents involving vehicle-worker collisions. Furthermore, comprehensive safety protocols entail training employees in safety protocols, emergency response procedures, and the utilization of personal protective gear such as helmets, respirators, and safety harnesses.

However, these systems have limitations. They often operate in certain areas or parts of the mine, leaving other areas potentially vulnerable. Manual monitoring and control can cause delays in emergency response times. Maintaining equipment and infrastructure can be difficult, and older systems can struggle to keep up with evolving security standards and technologies. In addition, the cost of implementing and maintaining comprehensive security measures can be prohibitive for some mines, especially smaller operations.

To address these challenges, research and development of advanced security technologies such as real-time monitoring with IoT devices, AI- based predictive analytics for threat detection, automation of security protocols and drones are available for monitoring from a distance and surveillance.

These innovations aim to improve the efficiency, coverage and scalability of coal mine safety systems, reducing the reliance on manual procedures and improving overall miner safety.

### A. Limitation in Existing System.

- **Limited coverage:** Certain systems might not offer comprehensive coverage of the entire mine, leaving blind spots where accidents can occur.
- **Manual intervention:** Many systems require manual intervention for monitoring and control, which can cause delays or errors in emergency response.
- **Maintenance Issues:** Complex systems may require regular maintenance and adjustment, leading to downtime and potential gaps in safety monitoring during maintenance.
- **Scalability Issues:** Some systems may have difficulty scaling to larger mines or adapting to changing mine environment without major updates or changes.
- **Technology obsolescence:** Rapid advances in technology can make existing systems obsolete or less effective over time, requiring constant innovation to remain relevant.

Tackling these challenges frequently entails the integration of newer technologies such as IoT, artificial intelligence and automation to improve the coverage, accuracy and responsiveness of coal mine safety systems.

## V. PROPOSED SYSTEM

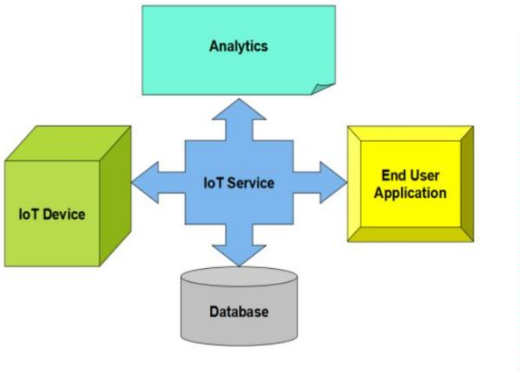


**Fig. 7.** PROPOSED SYSTEM.

In Fig 7, The Arduino UNO is a standard Arduino board.

UNO' in Italian translates to 'one,' and it was chosen to denote the initial release of Arduino Software.

Additionally, it was the first USB board launched by Arduino and is widely recognized as a robust board utilized in numerous projects. The Arduino UNO board was developed by Arduino.cc Arduin UNO utilizes the ATmega328P microcontroller and is renowned for its user-friendly nature compared to other boards such as the Arduino Mega. It comprises digital and analogy Input/Output (I/O) pins, shields, and additional circuits. Featuring 6 antilog pin inputs, 14 digital pins, a USB connector, a power jack, and an In-Circuit Serial Programming (ICSP) header, the Arduino UNO offers versatility. Programming is facilitated through the Integrated Development Environment (IDE), which supports both online and offline platforms. The Arduino IDE encompasses a text editor for code composition, a message area, a text console, a toolbar with essential functions, and a set of menus. It interfaces with Arduino hardware for program uploads and communication.

Programs created using Arduino Software (IDE) are referred to as sketches, which are composed in the text editor and saved with a specific file extension. The editor includes tools for text manipulation like cutting/pasting and searching/replacing. The message area provides feedback during saving and exporting processes, as well as displaying errors. The console presents text output from the Arduino Software (IDE), including comprehensive error messages and other relevant information. In the lower right corner of the window, the configured board and serial port are displayed. The toolbar features buttons for verifying and uploading programs, managing sketches (creating, opening, and saving), and accessing the serial monitor. The ATmega328 Microcontroller, an essential component of the Arduino UNO board from the Atmel family, houses an 8-bit processor code and integrates various functionalities such as Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter (ADC), SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and an oscillator. The ICSP pin, also known as the In-Circuit Serial Programming pin, enables programming using the firmware of the Arduino board, facilitating convenient updates and modifications. The board's Power LED Indicator reflects the ON status, indicating active power supply, while the absence of illumination signifies power-off status. Digital Input/Output (I/O) pins (D0 to D13) operate with values of HIGH or LOW, offering versatile digital connectivity. The TX and RX LEDs indicate successful data flow, providing visual feedback on communication status. The AREF (Analog Reference) pin allows for feeding a reference voltage to the Arduino UNO board from a  external power source, ensuring accurate analog readings.

The Reset button adds a reset functionality to the connection, aiding in troubleshooting and system resets. The USB port connects the board to a computer, facilitating programming tasks crucial for Arduino UNO functionality. The Crystal Oscillator operates at 16MHz, enhancing the board's processing power. The Voltage Regulator converts input voltage to a stable 5V output, supporting consistent board performance. Ground pins (GND) serve as zero voltage reference points, ensuring proper circuit grounding. The Vin pin accepts input voltage, accommodating various power sources. Analog Pins (A0 to A5) are dual-purpose, capable of reading analog sensors and functioning as General-Purpose Input Output (GPIO) pins, expanding the board's versatility and utility in diverse projects.

**Fig. 8.** ARDUINO UNO

An economical open-source IoT platform was initially equipped with firmware designed for the ESP8266 Wi-Fi System-on-a-Chip (SoC) from Express if Systems, and hardware centered on the ESP-12 module. Later, support for the ESP32 32-bit MCU was introduced. Functioning as both software and hardware development environments, it is built around the budget-friendly ESP8266 SoC. Developed by Express if Systems, the ESP8266 integrates essential computer components: CPU, RAM, networking (Wi-Fi), and a modern operating system and SDK, making it well-suited for various IoT projects. The ESP8266 development board includes the ESP-12E module housing the ESP8266 chip with a Ten silica Xtensa 32-bit LX106 RISC microprocessor.

This microprocessor supports Real-Time Operating Systems (RTOS) and operates at an adjustable clock frequency ranging from 80MHz to 160 MHz. With 128 KB of RAM and 4 MB of Flash memory for data and program storage, it boasts high processing power along with built-in Wi-Fi/Bluetooth and Deep Sleep Operating capabilities, making it ideal for IoT endeavors. Serving as a versatile development board, it streamlines IoT prototyping and accommodates a wide range of IoT applications. Its built-in Wi-Fi capability, programmable microcontroller, and compatibility with the Arduino ecosystem make it a preferred choice among hobbyists, students, and professionals engaged in IoT projects. Additionally, it functions as an open-source Lua- based firmware tailored for the ESP32 and ESP8266 Wi-Fi SOCs from Express if. uses an on-module flash-based SPIFFS file system. NodeMCU is implemented in C and the ESP8266 version is layered on the Espress if NON-OS SDK. The firmware was initially developed as is a companion project to the popular ESP8266-based NodeMCU development modules, but the project is now community-supported, and the firmware runs on any ESP module.

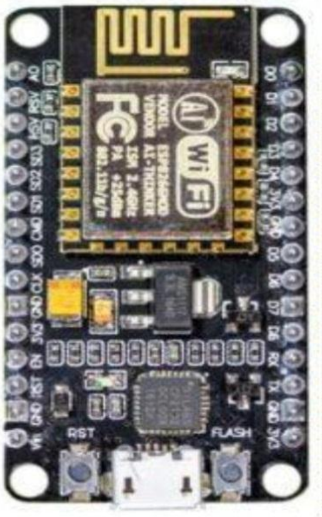

**Fig. 9.** NodeMCU.

The IR Sensor-Single is a general-purpose proximity sensor. Here we use it for collision detection. The module consists of an IR emitter and IR receiver pair. The high precision IR receiver always detects an IR signal. LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smart phones, televisions, computer monitors and instrument panels. LCDs were a big leap regarding the technology they replaced, which include light-emitting diode (LED) and gas-plasma displays. LCDs allowed displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it. Where an LED emits light, the liquid crystals in an LCD produces an image using a backlight.

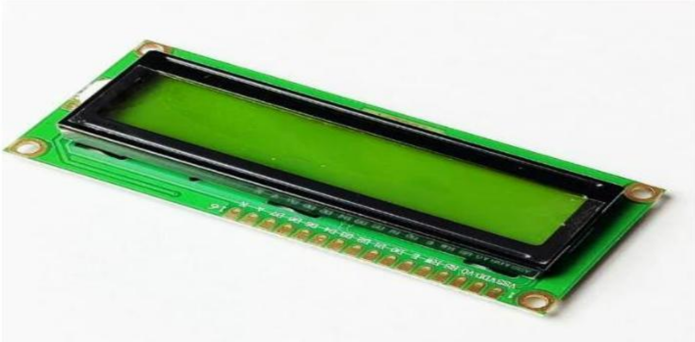

**Fig. 10.** LCD DISPLAY

A display is made up of millions of pixels. The quality of a display commonly refers to the number of pixels; for example, a 4K display is made up of 3840 x2160 or 4096x2160 pixels. A pixel is made up of three sub pixels; a red, blue and green—commonly called RGB. When the sub pixels in a pixel change colour combinations, a different colour can be produced. With all the pixels on a display working together, the display can make millions of different colours. When the pixels are rapidly switched on and off, a picture is created.

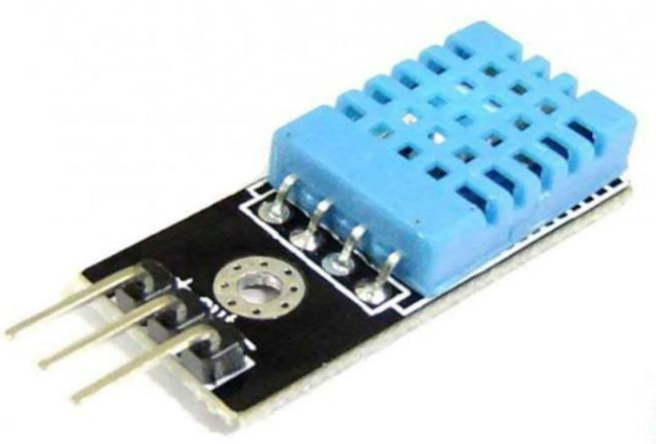

**Fig. 11.** TEMPERATURE SENSORS

A temperature sensor detects variations in environmental temperature, whether hot or cold, through direct or indirect contact. The DHT11 temperature sensor precisely measures the ambient temperature. This sensor operates as an integrated circuit, where the voltage output is directly correlated with the Celsius temperature.Monitoring water levels is facilitated by a float sensor, which functions by opening and closing circuits as water levels fluctuate. By default, the sensor remains in a closed position, indicating an incomplete circuit and the absence of electricity flow. Once the water level decreases below a predetermined threshold, the circuit closes, allowing electricity to flow through and trigger an alarm.Power can be supplied to the board through various means, including the DC power jack, the USB connector (5V), or the VIN pin of the board (3.3v). However, supplying voltage via the 5V or 3.3V pins bypasses the regulator and poses a risk of damaging the board.

An accelerometer is a device that measures the vibration, or acceleration of motion, of a structure. The force caused by vibration or a change in motion (acceleration) causes the mass to “squeeze” the piezoelectric material which produces an electrical charge that is proportional to the force exerted upon it. Since the charge is proportional to the force, and the mass is constant, then the charge is also proportional to the acceleration. These sensors are used in a variety of ways – from space stations to handheld devices – and there’s a good chance you already own a device with an accelerometer in it. For example, almost all smart phones today house an accelerometer.


**Fig. 12.** ACCELEROMETER

MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package.Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers. It has Auxiliary I2C bus to communicate with other sensor devices like 3-axis Magnetometer, Pressure sensor etc. If 3-axis Magnetometer is connected to auxiliary I2C bus, then MPU6050 can provide complete 9-axis Motion Fusion output. An alternate name of this sensor is heartbeat sensor or heart rate sensor. Pulse Sensor is a well-designed plug-and-play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart- rate data into their projects. The sensor clips onto a fingertip or earlobe and plugs right into Arduino. The ESP8266 features a complete TCP/IP stack and possesses microcontroller capabilities. It provides a self-contained Wi-Fi networking solution, enabling it to function as both the host for the appliance or to manage all Wi-Fi networking functions independently from another application processor. When the ESP8266 acts as the sole application processor within a device and hosts the appliance, it can boot up directly from an external flash.

This is MQ-135 Carbon Monoxide, Methane, and LPG Gas Sensor Module can be used to sense Carbon Monoxide and Methane Gas. Sensitive material of the MQ135 gas sensor is $SnO_2$, which with lower conductivity in clean air. It makes detection by the method of cycle high and low temperature and detect CO when the low temperature (heated by 1.5V).

The sensor's conductivity is higher along with the gas concentration rising. When a high temperature (heated by 5.0V), it detects Methane, Propane, etc. combustible gas and cleans the other gases adsorbed under low temperature. The buzzer or beeper is a voice signalling device that can be mechanical, electromechanical, or piezoelectric. Typical buzzers and beepers applications include confirmation of user inputs, such as alarms, timers and mouse clicks or pulsations. The piezoelectric element can be operated by vibrating electronics, or another source of audio signal driven by a piezoelectric audio amplifier. The sound is commonly used to indicate that the button has been pressed is click, ring or beep.

## VI. RESULT


**Fig. 13.** TEMPERATURE SENSOR GRAPH


**Fig. 14.** HUMIDITY SENSOR GRAPH

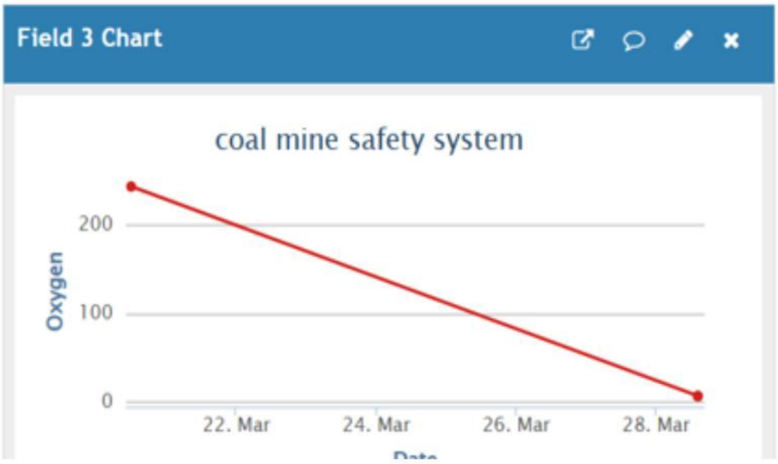


**Fig. 15.** OXYGEN SENSOR GRAPH


**Fig. 16.** LPC SENSOR GRAPH


**Fig. 17.** PULSE SENSOR GRAPH

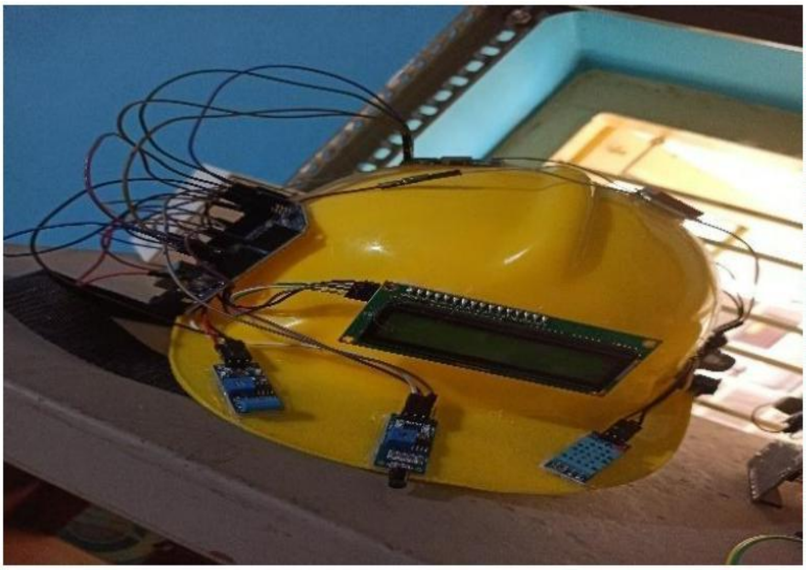

**Fig. 18.** HELMET FOR SAFETY

## VII.CONCLUSION

The adoption of IoT-based coal mine safety monitoring and alarm systems represents a pivotal advancement in safeguarding miners' safety and the operational stability of coal mines. These systems amalgamate an array of sensors, encompassing methane and carbon monoxide gas detectors, temperature and humidity sensors, as well as seismic sensors, among others, strategically. Placed around the mine to continuously monitor environmental conditions. Data collection units collect and transmit real- time data to centralized servers or cloud platforms, where advanced algorithms and data processing techniques filter, aggregate and analyse the data. This analysis includes anomaly detection using statistical methods and machine learning algorithms to detect deviations from normal conditions, such as sudden increases in gas levels or unusual temperature fluctuations, which may indicate potential security risks. Real-time monitoring capabilities for these systems. enable immediate response to security threats through alert mechanisms that trigger notifications via SMS, email or other communication channels to alert mine operators and security personnel. These alerts are based on predefined thresholds or event-based triggers, ensuring that quick action can be taken to reduce risk and keep workers safe. In addition, advanced predictive modelling techniques such as time series analysis and machine learning models facilitate predictive risk assessment by predicting potential safety issues based on trends in historical data. In addition to real-time monitoring and alerts, these systems often include automatic control mechanisms that can adjust ventilation systems, lighting and other parameters to respond to security issues for quick resolution. User-friendly dashboards provide visualization of sensor data, safety alerts and historical trends, enabling mine operators and safety personnel to make informed decisions and take proactive actions to improve safety protocols. Regular reporting tools generate comprehensive reports summarizing safety deviations, system performance and safety compliance, facilitating continuous improvement and adherence to best practices. Overall, IoT-based coal mine safety monitoring and alerting systems play an important role in advancing mining operations. Safer working environment, minimizing risk, ensuring regulatory compliance and streamlining coal mine operations. Using cutting-edge technology and data insights, these systems contribute to the continuous development of safety practices and risk management strategies in the mining industry. Research into real-time monitoring of toxic gases and other parameters within underground mines has utilized wireless sensor networks for analysis. A real-time monitoring system has been developed to offer a clearer and more localized view of underground mines. This system displays parameters on the serial monitor at the underground section where the sensor unit is installed, as well as on the monitoring unit. Such visibility aids all miners present inside the mine in pre-emptively safeguarding their lives before any accidents occur. An alarm is triggered when sensor values surpass the threshold level. Furthermore, this system stores all data in the IoT cloud for further analysis and reference.

## VIII. ACKNOWLEDGMENT

Acknowledgment is critical in recognizing the collaboration and contributions that led to the development and the implementation of safety measures within coal mines and alarm systems. We acknowledge the invaluable contributions of mining industry experts, security regulators, engineers, developers and researchers in building such systems. Their expertise, insight and commitment have contributed to designing and implementing innovative technologies including IoT- based sensors, computing algorithms, communication networks and real-time monitoring solutions. In addition, we appreciate the cooperation and support between mining companies and stakeholders who have embraced these advances to improve safety, reduce risk and ensure the

well-being of miners and workers in difficult environments. This collaboration emphasizes the importance of continuous improvement, knowledge sharing and proactive initiatives in promoting a safer and more sustainable coal mining industry An IoT-based system for monitoring and alerting in coal mine safety plays a crucial role in ensuring the well-being of miners and the efficient operation of coal mining activities. By leveraging advanced sensor technologies and real-time data analytics, this system continuously monitors various parameters such as gas levels, temperature, humidity, and seismic activities within the mine environment. Through intelligent algorithms and machine models, it can detect potential hazards such as gas leaks, fires, collapses, or unsafe working conditions promptly. Furthermore, the system is equipped with alerting mechanisms such as alarms, notifications to mine operators, and automatic shutdown protocols to mitigate risks and prevent accidents. This proactive approach not only elevates the safety standards of coal mines but also enhances overall operational efficiency and productivity.

The incorporation of IoT technology into coal mine safety monitoring signifies a significant stride toward fostering a safer and more sustainable mining industry. Finally, we extend our heartfelt appreciation to our parents and friends for their steadfast support and encouragement.

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# Face Recognition Attendance System Based On Real-Time Video Processing

**Prof. Kavana[1], Kiran Sonnappa S N[2], Niranjan B M[2], Tejas H S[2]**

[1]Assistant Professor, Department of Information Science and Engineering, East Point College of Engineering and Technology, Bangalore, Karnataka, India

[2]Department of Information Science and Engineering, East Point College of Engineering and Technology, Bangalore, Karnataka, India

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ABSTRACT

**Abstract— Creating an effective attendance system in real-time poses a significant challenge, especially in classrooms with a large numbers of students. Such situations often lead to confusion for teachers when managing attendance records for every student. This paper proposes a solution by leveraging facial recognition algorithm to accurately identify students and streamline the attendance process. The implementation utilizes a cascade classifier for the face detection, simplifying the task further.Additionally, the incorporation of Local Binary Pattern in Histogram algorithms enhances the effectiveness of this technology in face recognition. Not only do this system save time, but this also facilitates student monitoring. Moreover, students can conveniently verify their attendance status by accessing the system with a unique user ID and password.**

*Keywords*—**Face Detection, Face Recognition ,Haar cascade classifier, LBPH algoritham**

## I. INTRODUCTION

Maintaining an attendance system is crucial for evaluating student performances across all educational institutions. However, many institutions still rely on traditional methods where teachers manually mark attendance on sheets or students log in to computers for record-keeping, a process deemed cumbersome and time-consuming. Moreover, this approach often leads to inaccuracies as students may sign in on behalf of others. Tracking attendance in large classrooms becomes even more challenging. The introductions of a face recognition-based attendance system with image processing and database integration simplifies this process significantly. Teachers can effortlessly record attendance, creating comprehensive databases of students, staff, and teachers. This system operates seamlessly without an requir any addition effort from users and eliminates the need for intrusive procedures.. Face recognition is known to an importance of area of research and is one the most successful applications of image analysis. The rapid development his been seen due the its increasing demand in these area of security and everyday enhancing - mobile device technology. It is an method of labeling a known face. Humans tend to learn to recognize their own family, friends, celebrities, leaders by seeing their faces, similarly there are multiple techniques/ methods for a computer to learn to recognize a known face. Applications of face recognitions include identity verification, security and surveillance systems and social media networks such as Facebook (which suggests users to tag friends in who have been a identified in pictures). Access control in offices, computers, phones etc. is where face recognition is used as the standard form of granting access. Although this form of getting authorized entry is not widely used yet, it is gaining reputation at more and more places. Identity verification is the latest implementation of facial recognition in the mobile phone market. Face Unlock feature is newly introduced in

the world of smartphones. As for surveillance systems, it can help identify missing people, criminals etc. Hence, Face Recognition is being used an in the above-mentioned domains in one or the other way.

In this a papers we have described the face recognition technique and it's a implementation for an attendance system of classrooms in schools and colleges. This is implemented using the Supervised learning techniques for facial recognition.

## II. METHODOLOGY

The proposed system operates on the principle of face recognition. Upon a student's arrival in the front of camera module, their image is captured and subjected to validation. Successful recognition and validation trigger automatic attendance marking. Additionally, users is are provid with a login interface for system interaction. Upon an successful login, users are directed to the home page of proposed system. The block diagram illustrating the automatic of attendance system is depicted in Figure.

1.The system of block diagram and explained as follows.

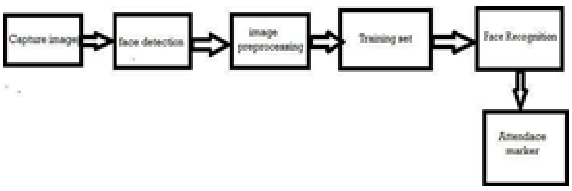


Fig. 1. Proposed block diagram

*1. Capture the Image*

Positioned at the classroom entrance, the camera captures students facial images with precision before proceeding to the subsequent face detection process.

*2.Face Detections*

This stage involves implementing face detection, enabling the identification of captured images along with the locations and size of the student faces. Subsequently, the captured image is obtained from the detected faces utilizing the haar cascade.

*3. Image Preprocessings*

Before proceeding, a preprocessing step is necessary to enhance the qualitys of the input image. This involves converting the inputs images to grayscale using a color-to-gray images in conversions technique.

*4. Training Sets*

To facilitate the recognition process, the faces to be identified are compared with similar faces stored in a training set. The algorithm utilizes this train set to determine the individual to whom a recognized face belongs.

*5. Face Recognitions*

At the core of this system lies face recognition, which constitutes an automated approach to identifying and verifying individuals through images and videos captured by a camera.

*6. Attendance markers*

The attendance system marks a specific student as present if face matches one from the designated date folder. In essence, it compiles a list in of all present students, while those not recognized are marked absent.

*Face Detection using Haar cascade classifier*

Paul Viola and Michael Jones introduced the highly effective an object detections method known as theHaar cascade classifier, which utilizes a machine learning-based approach. This method involves analyzing both positive Paul Viola and Michael Jones introduced the highly effective objects detection methods known as the Haar cascad classifier, which utilizes a machine learning-based approach. This method involves analyzing both p

The histogram faces recognition method involves moving a 3x3 window across the input image, where each in local parts of the image is compar with it neighboring pixels. If a neighboring pixel's intensity values no is less than in or equal to the center pixel, it's denoted as 1; otherwise, it's denoted as 0. By reading these values in a clockwise order within the 3x3 window, a binary in pattern is generated. This pattern represents a local areas of the image. After performing recognition on the entire image, a lists of locals binary patterns is obtained.

*Face Detection using local binary pattern histogram*

This algorithm processes input images by generating and comparing histograms to identify patterns, particularly faces. It works by moving a 3X3 window across the image, comparing the intensity values of the centers pixel with it neighboring pixels. If a neighbor's intensit value is less than or equal to the center pixel, it's denoted as 1; otherwise, it's denoted as 0. The binary value are the read in clockwise order within the 3X3 window, forming a binary pattern specific to a local area of the image. After processing the entire image, a list of these local binary patters is compiled. The algorithm then identifies the best mach histogram among a set of generated histograms and retrns the associated label.Paul positive the and negative

*Face recoginizer using a local binary pattern histogram*

Histogram a and compares a it is with other generated histograms. The comparison of finds these best match histograms the and returns.

In the real of face recognition, deep learning is models have demonstated remarkable advancements, particularly in the ability to extract an high-level features from facial images, leadins to improved accuracy and robustness in identification tasks. Additionally, the integration in of facial recognition technology with other modalities, such as thermal imaging or 3D depth sensing, has open new avenue for enhancing performance, especially in challenging environmental conditions or scenarios with varying lighting conditions. Moreover,in recent research this has focus on addressing ethical concerns and privacy implications associated with face recognition systems, leading to these development of novel techniques for ensuring transparency, fairness, and user consent in the deployment of such technologies.For the on whole image.

*A. System Flow Diagram*
*Algorithm*:

Step 1: Input image a is captures

Step 2: Convert the image to the grey scale

imaes. In order to train a face detection algorithm using objects instead of faces, the classifier would still require a substantial number of positive and negative images.

Step 3: Utilize a Hazar cascade classifier for face detection.
Step 4: Apply local binary patterns histogram for face recognition.
Step 5: Perform face matching with pre-trained data.
Step 6: check if the student is present.

Step 7: if present, mark attendance as "PRESENT" in the datasheet.

Step 8: if not present, mark attendance as "ABSENT" in the datasheet.

Step 9: Generat a com
Step 10: Update attendance
Step11: Repeat the step 1:
Step 12: Stops the process

This automated a attendance of system offers time-saving benefits and ensures high accuracy. It streamlines attendance management processes by automatically updating student attendance records. It is designed to cater to educational institutions such as schools, colleges, and libraries.

The system flow through diagram depicted in Figure 2 illustrates the workflow of these automatic attendance system.

*1) Administrative Panel*

Fig. 3. Administrative Panel

*2) Attendance Records Panel*

Fig. 4. Attendance Records Panel

*A. LIVE MONITORING PANEL*

Live Monitoring Panel comprises of four subpanels as follows:

1. Live Camera Stream
2. Image Recognition
3. Manual Recognition
4. Monitor Attentiveness

*1) Live Camera Stream*

Live stream of this class is displayed in this panel. The teacher can view the whole class through this panel at any point when the live camera stream is activated.

*2) Image Recognition*

Due to low internet connectivity or camera error, sometimes the live camera stream can be obstructed. In this case the teacher may manually browse the imajge of the studjent from the trained database and select the tab labelled as mark attendance. The attendance will then be marked.

Image Recognition Process is a complex process and is done in various steps. There a variokus algorkithms available for Image/Face Recognition:

The first step that is required is an of face detection, i.e., detecting faces in an image, video or real time coverage consisting of differjent types of objects (distinguishing faces from non- faces) which we implemented using Viola- Jones Algorithm and Histogram of Oriented Gradient (HOG). On comparing, we concluded that HOG is highly efficient in detecting tilted faces even in considerable lighting conditions and faces with spectacles etc.

**Histogram a of Oriented Gradients (HOG)**

In HOG, first we need convret the our inputs images into a grayscale image. For every pixel in a these image, we compare it to pixels surrounding it and draw an arrow towards the darker area. By repeating the process with all these pixels in the picture, we end up with all this pixels being replaced by an arrow (gradients).

Divide the image into small squares of 16x16 pixels each. In each square we will calculate how many gradients point to each larger side. After that we will replace that square in the picture with the arrow points that were the strongest.

The end result turns these originals image into a very simple presentation that captures the basic structure of these faces in an simple way.

Once theses face is detected, feature extraction, i.e., determining the uniqueness of these face by taking out the features, is performed.

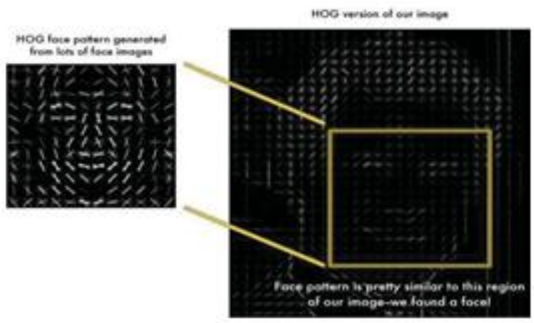


Fig. 5. Converting the inpust image into a HOG version

This was done using the Linear Binary a Pattern Histogram (LBPH) for the initial launch. Locals Binary Pattern (LBP) is a simple but very effective operator that sets image labels by blocking the location of eacih pixel and considers the resuelt as a binary number but requires adequate lighting conditions to work properly. For the final implementation, we used FACENET (Inception Model) for creating 128 embedding of an face using Deep Neural Networks. The later technique proved better for recognizing face an using the comparison of Euclidean distance.

**Face Net Model**

This models is was developed by developers in Google and was baseing on the Inception model. The model takes an aligned image of the face and provides 128 feature vectors of the face called embedding

The model has more than 20 layers. The algorithm used looks at the current estimates that make up each of the three images for good and one for bad. It also adjusts the neural network slightly to ensure that good game ratings are close to the scale and negatives match.

Eventually, training and classification of the facial databases is done and tested using various classification techniques like SVM and KNN, baseing on the comparative performance and efficiency for recognizing faces. We attempt to use this facials recogntion system on data set of faces of institute students for which attendance system will be implemented.

**Support a Vector Machines**

Support a Vector Machine (SVM) is a discriminating separator officially defined by a separating hyperplane. In this algorithm we classify each data object as an point in a dimensional space (where n is the nuimber of attributes you have) and the value of each element euqual to the vaulue of a particular link. After that, we made the division by finding a hyper-plane that best separates the two categories. We used the SVM algorithm to distinguish input images, which meuans the image is in which category.

**Open CV**

Python provides a variety of photo and video processing libraries. One of them is known as OpenCV. OpenCV is a great library that helps in providing a wide range of photo and video functionalities. With OpenCV, we can take video from the camera. It allows you to create a video capture that helps you capture videos with a webcam and perform the functions you want in that video. Teachers can use these details to keep an track of the student's learnings.

*3) Attentiveness Monitoring*

Attentiveness Monitoring is an additional feature that we have provided in our attendances system. It cans be ushed to monitor how attentive a student is during class and teachers can use these details to keep a track of these student activities in the class. When activated, attentiveness monitoring system emphasizes on the facial features such as eyes and lips of a human.

The numbers a of eye blinks and yawn counts are counted to keep a track of how attentive a student is.

The 'display attentiveness results' tab can been used to view relative attentiveness of students. The tab displays the attentive percentage of each a student with respect to all other students. Image recognition algorithm is used to monitor attentiveness.

## III. LITERATURE SURVEY

Smart Attendance Monitoring System: A Face Recognition-based solution for classroom attendance proposes an automated approach to replace manual attendance methods. By utilizing facial recognition technology, this system accurately records attendance, take into account factor like facial expressions, lighting, and pose. The Attendances System Using Face Recognition and Class Monitoring System introduces a database upload feature for recognized faces, streamlining the attendance process further. The Automatic of Attendance System Using Face Recognition employs Viola-Jones and PCA algorithms, capturing images at the beginning and end of classes to mark attendance based on recognition. Meanwhile, the Class Room Attendance System introduces a novel 3D facial model for precise student identification through facial recognition technology.

The Automatic Attendance System of Using Face Recognition [3] for lecturer or staffs has been devised to streamline attendance tracking by leveraging facial recognition technology. Employing the Viola-Jones in and PCA algorithms, this systems captures images at the beginning and end of each class session using an digital camera. These image are these processed to identify students based on facial recognition. Attendance is marked for students who are recognized in both the start and end time images, effectively reducing manual workload and ensuring accurate attendance records. attendancse system. It recsognize fasce from ismage or video stream for rescord their attendsance to evalusate this

The RFID-based attendances system [5] requires users to place their RFID cards on a reader to recording attendance, with data saved in a database and connected to a computer via RS232. However, these system may an encounter security issues, as unauthorized access could occur if someone were to use a fraudulent ID card to gain entry. Meanwhile, the wireless an iris recognitions attendance management system [6] utilizes Daugman's algorithm for iris recognition, offering a biometric solution to attendance tracking. These systems includes modules for database creation, real-time face recognition through various methods such as pre-recorded images, manual camera activation, and automated attendance scheduling based on class times.system and lasftly by schdeduling an automdatic task of attenddance taking by settindg in and out tdime of the cldass.

In attendddance records panel the teaddcher can view and downlodad the attenddance and attentiveness recordsd of the students

The RFID-based attendance system [5] requires users to place their RFID cards on a reader daily to record attendance, with data saved in a database and connected to the computer via RS232. However, this system poses a risk of fraudulent access, as unauthorized individuals could potentially exploit it by using counterfeit ID cards to gain entry. On the other hand, the wireless iris recognition attendance management system [6] utilizes Daugman's algorithm for iris recognition, employing biometric techniques to ensure secure attendance tracking. This system involves capturing iris images, extracting and storing their features, and comparing them against a database for verification. Despite its potential, the reliability of this iris recognition can be compromised by poor iris topography. The iris recognition system utilizes image capture, feature storage, and matching processes to authenticate individuals. However, due to poor topography in the iris recognition mechanism, the student will receive a deduction in attendance.

Introducing a novel approach, the Class Room Attendance System utilizes a 3d facial model to accurately identify students within a classroom, facilitating automated attendance tracking. Leveraging these analytical findings enhances the system's capability to recognize students and record their attendance, thereby enabling the evalution of their performance.It recgognize face froggm image or video stream for recogrd their attendances to evaluates their performancse. The Haar cascade an algorithm is a machine learning-based object detection method that is particular renowned in for its effectivenes in detecting faces. Here's some data about the Haar cascade algorithm The algorithm works by using a cascade of classifiers trained with Haar-like features. The feature are simple rectangular patterns that are calculated over successive image regions. The algorithm evaluates each feature to determine whether it corresponds to the object being searched for (e.g., a face)

### A. *Weekly, Monthly Attendance tab*

The first three tabs in the attendance records module are used to view the automiatic atteandance records of students. All the three tabs contain two sections for in and out time

### B. *Individual Record*

In this tab, attendance records of every individual student can be viewed. Through a dropdown list, a particular student can be chosen and after selecting the desired date his/her complete attendance can be viewed.

### C. *Download Records*

The last tab is the 'download records' tab. If the teacher wants to download the complete attendance record of a student, they can download it in these forms of an Excel sheet and view it offline. Consolidated attendance information of a stuhdent is also displayed in this panel. Total number of working days, number of days absent/ present and the student's attendance percentage can be viewed here. Attendance records lists are created as data frames. Excel writer function known as Pandas is ushed to create a data frame list of these records.

Pandas in Python

Pandas provide us with a range of data analysis options such as reading data from files and databases, to applying various transformations within the data frames, slicing and dicing the data, and then writing the data back to a database or prepare it for a visualization tool to be fed to. Pandas can also visualize data within the python environment by importing another module known as matplotlib and display stunning visuals within it.

Creating Data Frames using Pandas

The basic structure of a Pandas library is the data frame. The data frame is basically a representation of a 2-D array. We can also consider the data frame as an in-memory table on which oned cans perfor all the operations as discussed earlier. Whenever we work with the Pandas module, we should try to fit the data into a data frame so that we can apply all the in-built methods directly.

## IV. CONCLUSION

Most acabdemic instituvtions like schbgools, collegves and univversities still use traditional methods of attendance taking like manual roll call or using paper signatures on a daily basis, but now with the gradual rise of technology, some new methods suggest that gradually, a few colvleges and univversities will shift towards using fingerprint scanning and smart techniques for attendance taking.

While they are some ways to check the presevnce of a students is a class, the effect is less effective. Visiting these routes has similar flaws, fraud will occur and will ultimately result in a reduced class size. This recurring phenomenon will not only have a negative impact on the psychology and physiology of students who are attending the classes, but will also promote undisciplined student behavior and will hinder the teaching quality.

In this paperds, a face-to-face recognitihon systenm is developed, and we tested the project on test cases involvingall four team members and our relatives. The three main problems to consider are: the accuracy of the fnace recojgnition system in real entry, the stability of the face recongnition system while processing a real time image, and the acnncuracy of the face recongnition systnem with real-time image processing. The concept of a face rencognition system is bansed on the fast growing face recognition technology, and research was conducted on real-time image processing facial recognition system. Research data shonnws that the accuracy of the vhideo face recnognition system is approximately 97%.

The implemented system recognizes the expected results of attendees using face recoghhjnition technology wibth the help of a computer, which fully reflects the possible formations of the whole algorithm. Students will be continuously monitored eliminating any fraud attendance and class bunks. This system effectively removes the complex roll call sign, and ensures quality teaching, faculty can also immediately see the attentiveness performance and keep track of the alertness and performance of a student. This feature will identify suspected students and will notify the teachers, ensuring that thbey learn whejn they are presents in the lecture.

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# Python Base IOT-Powered Student Card for Seamless Component Management

**Prof. Kavana[1], Hindu Priya M V[2], Mounika C M[2], Tejas N[2]**

[1]Associate Professor, Department of information science and Engineering East Point College of Engineering and Technology, Bengaluru, Karnataka, India

[2]Information Science and Engineering East Point College of Engineering and Technology Bengaluru, Karnataka, India

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**ABSTRACT**

The integration of Internet of Things (IOT) technology into educational institutions has revolutionized many aspects of campus management and student engagement. This abstract introduces an IoT-based student card system designed to streamline the management of laboratory components such as receipts, submissions, and due date tracking. The IoT platform built in Python and hosted as a server works with Raspberry Pi Pico microcontroller and hardware components his RFID technology. Previously, managing lab components relied on manual processes, creating errors and inefficiencies for students and faculty. The IoT-based student card system provides an automated solution to seamlessly notify students and faculty of upcoming lab components via email or telegram, increasing convenience and productivity.

**Keywords—** Internet of Things (IoT), RFID, Raspberry Pi Pico, Python, Django, Micro python.

## I. INTRODUCTION

Python based IOT platform card of lab component that uses a RFID (Radio Frequency- Identification) based technology for identification. Internet of things (IOT) technology within education institution to make more advance campus management, labs and students' involvement. This system is used to enhancing the efficiency of lab component from their submission and tracking the deadlines. Managing labs materials manual is difficult leads to error and also inefficient for both students and instructor. Teachers and students can easily record attendance using an easy-to-use Internet of Things (IOT)-based system. This saves time for both staff and students and improves the accuracy of attendance records [1]. Applications such as intelligent medicine, intelligent transportation, and intelligent agriculture have entered our lives, and ordinary people have become increasingly familiar with the Internet of Things. Especially now, universities are gradually leveraging Internet of Things technologies to realize smart campuses [2]. The smart card contains a barcode, which acts as a unique identifier for the student and can reduce the student's work [3].

- Laboratory component card with RFID technology. A contactless RFID card acts as an information carrier and a read/write device acts as an information exchange device [2].
- Use a variety of sensors to intelligently monitor laboratories, classrooms, gymnasiums, and other locations to control and adjust resource utilization more rationally and timely, making educational resource utilization more efficient. improve and reduce operating costs [2].

## II. LITERATURE REVIEW

The internet o0f things (IOT) is a system in which daily objects are outfitted with electronics that can be performs tasks and collect data are linked to the internet. It allows you to remotely control networked devices. RFID technology is used for time and attendance logging at all locations. Radio waves are used in automatic identification technology, also known as RFID, to record information about a specific subject. An active or passive tag and a reader are required. RFID technology is used industries, including commerce, healthcare, education, and security [1].

The smart campus application, leveraging IoT technology, currently focuses primarily on student attendance, access control, library book browsing, and unified card-based transactions. The framework design is conventional, addressing fundamental functions and requirements for a smart campus. However, it remains limited in scope, lacking the full utilization of IoT intelligence as it primarily caters to basic functionalities without exploring more advanced capabilities [2].

Instead of carrying a bunch of different cards to an college a students can carry a single card that can be used to server desired purposes like issuing a book in the library, transaction in the canteen and stationary, for attendance, smart class and also lab components [3].

The specific paper tells the implementation of an IOT-based students card system aimed at optimizing the management of lab component within educational settings. Traditionally, the process of managing lab components has been manual, leading to inefficiencies and errors. However, the introduction of IoT technology offers a promising solution to these challenges. IOT-based systems offer significant benefits by reducing human errors and inefficiencies associated with manual procedures. Automation simplifies the management of laboratory components and increases convenience for both students and instructors. Additionally, the system enables real-time monitoring and tracking of laboratory activities, providing stakeholders with valuable insight into the progress of laboratory work. Additionally, we encourage communication and engagement through features such as email and Telegram notifications to ensure students and faculty stay informed about upcoming lab components. This proactive approach not only makes it easier to complete tasks on time, but also fosters a collaborative learning atmosphere.

## III.EXISTING SYSTEM

The existing system for managing lab components in educational institutions typically relies on manual methods and traditional tracking systems. Lab components are often tracked manually using paper-based systems, where students sign in to record their presence, and submission sheets.

1. Paper-Based Processes: Our current system relies on paper-based processes for tracking lab components. However, this approach results in a large volume of paperwork, which consumes time and is prone to errors, loss, or damage.
2. Accessibility: Manual systems often lack real-time accessibility. Students and educators may face challenges in obtaining instant updates on the status of lab components, which can impact timely interventions and decision-making.
3. Inefficient Communication: Communication between students and educators, especially regarding the status of lab components *due*, may be inefficient. This lack of effective communication can lead to misunderstandings, missed deadlines, and challenges in resolving issues promptly.
4. Difficulty in Record Retrieval: Retrieving historical records or generating comprehensive reports from manual systems can be time-consuming and challenging.

## IV. PROPOSED SYSTEM

The Raspberry Pi Pico board, like other microcontroller, is a piece of hardware that can be programmed to do specific tasks. The Raspberry Pi Pico board can receive sensor data, process it with software, and serially output the results. The RFID reader, which scans and transmits the identifier from each RFID tag to the main system, is compatible with this board. RFID gadgets are small devices that contain a chip and an antenna. On the device, approximately 2000 bytes of data can be stored at once.

When RFID devices are compared to others, such as barcode scanners, the benefits of RFID technology become clear. This demonstrates that the RFID card's proximity to the scanner is unimportant. These speeds up data reading from the card.

**Fig.1.** RFID Card Tags

The proposed system consists of both hardware and software components based on IoT technology. It utilizes an RFID card reader paired with a Raspberry Pi Pico microcontroller for individualized identification through RFID cards, as illustrated in Figure 1. Each student's card is equipped with IoT sensors and communication modules, ensuring accessibility and providing a user-friendly interface on the host side for universal ease of use. Real-time tracking and interaction with various campus or laboratory components are facilitated without the need for manual record-keeping, thereby saving time. The use of smart cards eliminates the necessity for traditional methods such as registers or notebooks for maintaining student databases, enhancing efficiency. Additionally, the system ensures robust database security, minimizing the risk of misuse. Information pertaining to students, including attendance records, pending components, and other issues, can be easily monitored and managed through smart cards. Access to this information is restricted to authorized personnel, including students and higher authorities, with notifications sent via email, Telegram, or both channels for seamless communication.

## 4.1. BLOCK DIAGRAM

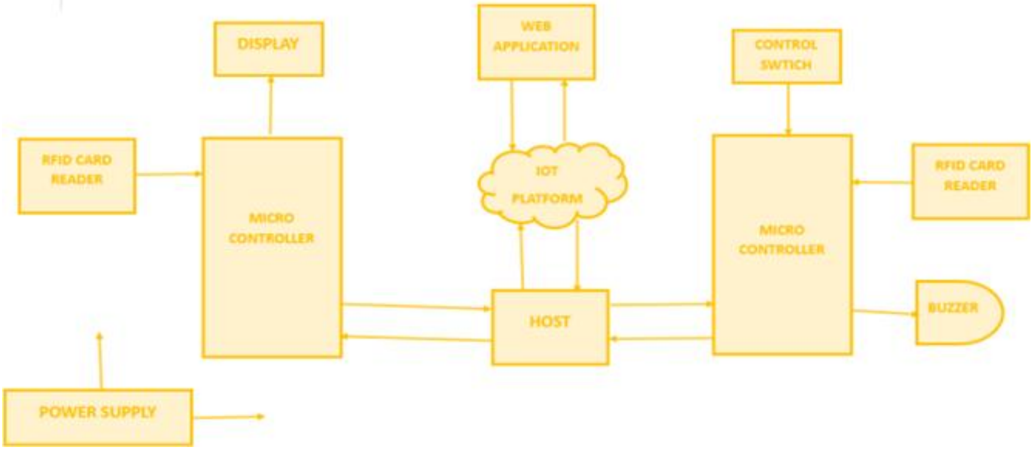


**Fig.2.**BLOCK DIAGRAM

Figure 2 depicts the block diagram, illustrating the integration of the RFID card reader with the Raspberry Pi Pico microcontroller, divided into two main sections: hardware and software. The hardware segment comprises the Raspberry Pi Pico, RFID card reader, host, buzzer, and power supply components. On the other hand, the software section encompasses the web application, server, or an IoT platform.

### 1. RFID Reader:

When a student presents their smart card that is RFID enables card to reader, the reader identifies the unique identifier (UID) embedded in the cards. RFID key functions are

- The UID is used to authenticate the student's identity and determine their correct information based on pre-defined database.
- The RFID reader located at key locations such as classroom entrances, laboratories, libraries which automatically detects the student's presence when they tap their cards against the reader.
- When they tap their cards against the reader RFID reader is used in attendance tracking in lab. Such as laboratory checkout counters or equipment rental stations etc.…

### 2. Microcontroller:

The raspberry pi Pico microcontroller is widely used or preferred for IOT applications. Due to its powerful processing capabilities, lower power consumption, various communication protocols that has 26 multifunction and GPIO (General Purpose Input and Output) pins, which is configured for digital input and output, analog input (pulse width modulation) output, with UART and SPI (serial peripheral interface) communication.

### 3. Buzzer:

It is notification alert. It provides audible notifications to students or administrators with brief sounds. For example: when a student swipes their card for attendance, the buzzer can emit a brief sound to confirm successful registration. Includes access confirmation error identification emergency situation and reminder system

4. **Host/Server:**

Host refer to the central system or server responsible for managing and coordination of interactions between the IOT enables students' cards and various components of their system. Host function are data processing and storage authentication and authorization, real time monitoring and control, user interface and interaction.

5. **Web App:**

Its server as the user interface and management portal for administration and students or instructor. Allocation with message announcement or notifications and also administrators can send notification to students and instructors or the staff member informing them about events, updates, due date of lab components.

6. **Display:**

It provides when a student taps their card against reader for attendance tracking, resource accessor the other interaction the display provides immediate feedback to confirm the successful. That is status indication notification and reminders, Resource availability, emergency alerts, and due dates for lab components are essential aspects addressed within the system.

7. **Power Supply:**

It uses lower power consumption to maximize battery life. The component within the student card is to designed by consume minimal power.

## 4.2. SYSTEM ARCHITECTURE

The above fig.3 illustrates the architecture design of the proposed system "IOT- powered student card for seamless component management".

The creating an IOT-powered student card system for seamless component management in an educational setting involves integrating various technologies into a cohesive architecture.

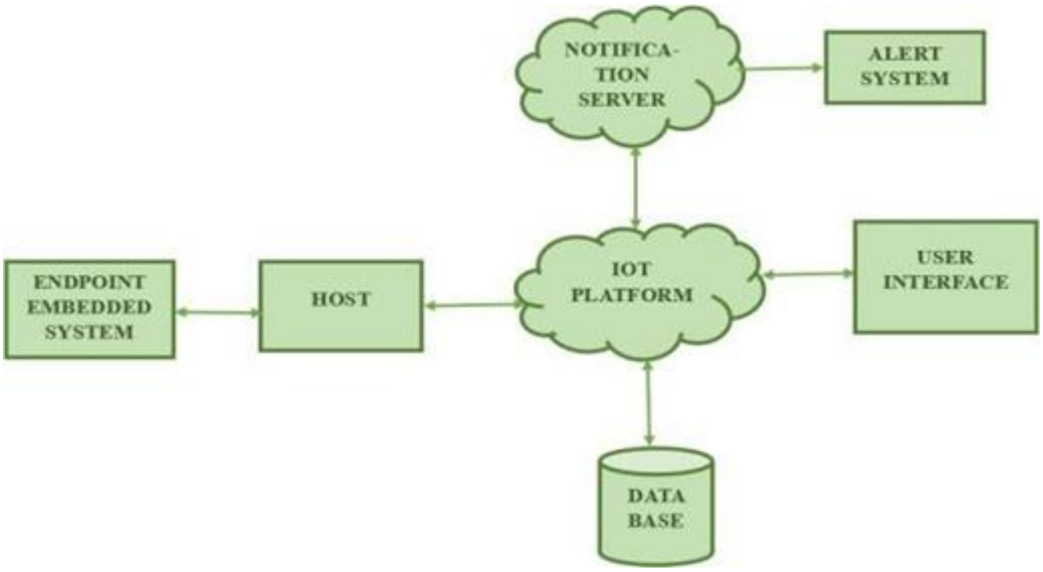


**Fig.3.** System architecture

The gateway, represented by the RFID reader, captures and transmits card data to an IoT gateway. This IoT gateway serves as a central hub for processing data, responsible for gathering information from the cards and any accompanying sensors, such as environmental sensors for monitoring component storage conditions.

The cloud-based platform ensures secure data storage this platform maintain a comprehensive database that includes students details component inventory and transaction logs. This system includes an integrated notification server.

This setup enables automated alerts updates to students for things like due dates or reservation confirmations and for administrators the critical aspect is user interface provided through a wed application and a mobile app. It is a bridge between user and technology it is easily accessible and user friendly (Gateway to technology). Also, it offers functionality for administrators.

The endpoint embedded system connects to a host, which is a fusion of physical objects and embedded system technology, facilitating their interconnection and communication with each other and the internet. This system comprises sensors, microcontrollers, and communication protocols utilized for collecting, processing, and transmitting data.

Host which processes data and provides services to user. In IOT system there is limited computational power and memory of M2M devices.

It provides a secure data and privacy to student’s data also it saves time of instructor and also error or missing the data.

In case there is any errors in students’ data or any reminder/ emergency treats important updates that is due dates as resource management then the alert system is enabled.

## 4.3. FUNCTIONAL BLOCK DIAGRAM

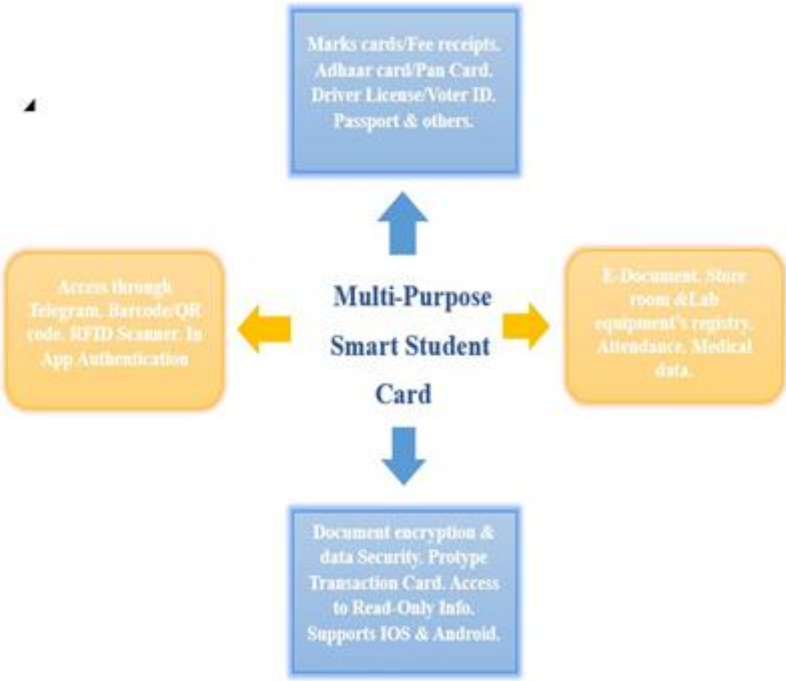


**Fig.4.** Functional block diagram

**ID Functionality:** A multi-purpose student ID card does the thing of specially identifying a student at an educational institution. This generally includes details like the student's full name, ID number, a photo, and sometimes other stuff like the course of study or the year of enrollment.

**Access Control:** Student ID cards, like, really control access to different stuff and services on campus. The academic buildings, residence halls, libraries, gyms, labs, and other like, super secretive areas. Access stuff are like programmed into the card's chip or linked to the student's profile in the school's database.

**Attendance Tracking:** Tons of schools use student ID cards to track who shows up and who doesn't for courses, lectures, and random events. Students that fancy system will just look at it and record their attendance. It's super helpful for checking on if students are playing hooky or not.

**Library Services:** So, these ID cards help out with checking out and bringing back books, getting into digital stuff, and paying fines if you don't bring your books back on time. RFID or barcode cards are like in and help with easy transactions at the library kiosks and those self-serve stations.

**Financial Stuff:** Student cards can be used like debit cards for paying for things on campus. You can like load money on there and use it for food in the dining spot, getting supplies at the store, printing stuff, or even using the cash machine.

**Transportation Ease:** Sometimes, student tickets are connected to rides provided by the school, like buses or smaller buses. You use your card to get on and pay for your travels, so you don't need extra stuff like tickets or more ID cards.

**Security Things:** To keep student info safe and prevent bad people from using it, these IDs have lots of security stuff. This can be like locking up your info so no hackers can get in, putting your photo on the card to stop you from sharing it, and other anti-fake stuff.

**Campus Blend:** Student cards are like besties with other campus systems to help with school things. This way, they handle student info, access rules, money things, and other campus life deals.

## V. CONCLUSION

The implementation of this IoT-based student ID system aims to enhance the efficiency of managing laboratory components within educational institutions. Its design and deployment offer a promising solution for optimizing the monitoring and administration of student tasks, presenting both students and educational institutions with a valuable resource for overseeing and organizing laboratory operations. Upon entering the lab, students utilize their IoT-enabled student cards to seamlessly record their attendance and initiate automated procedures. As students engage with various laboratory components, sensors integrated into the system detect their activities and transmit pertinent data in real-time to a central database or cloud platform. This data includes crucial details about student assignments and tasks. Beyond mere attendance tracking, the utilization of this IoT-based system extends to providing insightful analytics regarding student performance and laboratory resource utilization. Educators and administrators can leverage this rich real-time data to evaluate student progress, identify areas for enhancement, and adapt instructional strategies accordingly.

Additionally, system equipment informs decisions in redesigning resource allocation, allowing agencies to optimize equipment utilization and streamline

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# Handwritten Signature Recognition Technology Using Deep Learning

**Indumathi S[1], Abhilash A[2], Kushal B[2], Lakshimisha Gowda S[2]**

[1]Assistant Professor, Department of Information Science and Engineering, East Point College of Engineering and Technology, Bangalore, Karnataka, India

[2]Student, Department of Information Science and Engineering, East Point College of Engineering and Technology, Bangalore, Karnataka, India

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**ABSTRACT**

Nowadays, biometrics are utilized worldwide for person identification and signature verification. A person's handwritten signature is a distinctive means of human identification that is mostly recognized and utilized in legal and financial transactions, such as banking. But because handwritten signatures have historically been used as a means of deception, they are becoming more and more valuable. Over the past five to ten years, the Si has been well-documented in the literature. Here, we look at how the topic has been researched. The Sign Verification System (SVS) aims to determine whether a sign was made by the claimed person or was faked (generated by an impostor). It has proven challenging, particularly in offline (static) scenarios, to use pictures of scanned signatures and other documents without dynamic information about the signing process. Throughout the last few decades, as well as in the most recent advancements and next research goals, Deep Learning algorithms have been used to learn feature signature picture representations

**Keywords—**Signatures, Verification, Fraudulence, Feature Extraction, Training, Forgery

## I. INTRODUCTION

Due to the widespread use of handwritten signatures in daily life, there is a growing body of research on handwritten signature verification as machine learning and artificial intelligence advances.

Online and offline signature data are the two techniques utilized for collecting signature data. An offline signature image is created by scanning the author's handwritten name on paper, sending it to a computer using scanning apparatus to create an image of the signature, which is then verified using the features of the image. The term "online signature" describes signature verification using signature traces, like writing pressure and position. In this study, the name is written in full dots on the page using an intelligent pen equipped with a pressure sensor and a camera. As the signature is being drafted, real-time data is being collected for the offline picture and online data [1-2]. due to its widespread use for identity authentication in administrative, financial, and legal contexts. The handwritten note is a very charming necessity. The most important ones are the length of the signature and the number of upward-pointing pen tips. Examples of function-based features that are most frequently seen are pressure data and signature trajectories. Dynamic features that are focused on functionality typically yield superior outcomes. The two most popular forms of verification are distance-based verification and model- based verification [3]. Examples of models used to ascertain data distribution are the support vector machine (SVM), convolutional neural network (CNN), and hidden Markov model (HMM). Distance measures are used to compare the test signature to the reference signature.

## II. RELATED WORKS

Based on a set of permissible similarities (or differences), two things can be compared using a variety of techniques. Three types of matching—holistic, regional, and multiple regional—are employed in the signature analysis. There are many ways to match. Among the most often reported techniques are elastic matching, regional correlation, tree matching, relaxation matching, split and merge, string matching, neural network, HMM, and SVM. A summary of research on the application of classifiers to signature analysis and comparison has been provided, along with an assessment of a few noteworthy studies.

### A. Signature Feature Extraction

The current status of research on signature verification feature extraction algorithms, primarily extracts distinctive texture, geometric properties, and dynamic aspects. Srihari et al. proposed an 1automated feature selection and fusion method that computed 22 GLCM and 8 geometric features [4-6], where geometric features characterized the shape of the signature, such as edges, areas, and so on, and GLCM represented texture information like each signature change and then combined these features with a High-Priority Index Feature (HPFI).

The proposed system has been put through its paces. It considerably improved the FAR and FRR on MCYT, GPDS, and CEDAR data sets, and when compared to existing approaches of 2.66 percent, 9.17 percent, and 3.34 percent, respectively. The drawback was the possibility that the traits that were removed would affect system performance and lead to better results on other sets. Bandopadhyay S et al. [7-8] proposed a sign verification data based on the author by using two distinct texture feature types, discrete wavelet feature types, and Local Quantized Patterns (LQP) feature types [9] and extracting two types of transformations based on the signature picture.

Make two different signature models for every signature creator by matching to wavelet and LQP features and using One-class Support Vector Machines (OC-SVM).

calculating the final verification score by averaging the results of the two OCSVMs and producing two separate verification scores for each signature author. As evidence of the method's universality, the EER (Equal Error Rate) for the GPDS, MCYT, and CEDAR datasets were 12.06 percent, 11.46 percent, and 7.59 percent, respectively. R. Bajaj and S. Chaudhary retrieved a number of attributes and explained how they affected the system's ability to identify Geometric attributes are calculated among the Histogram of Oriented Gradient (HOG) characteristics. Several instances of entropy, tilt, and length allocation are shown here. Several machine learning classification methods, including Random Forest (RF), Bagging Tree, and Support Vector Machines

(SVM) were used to evaluate the system on the UTSig data set. The findings demonstrated that SVM outperformed the other classifiers, with an accuracy rate of 94 percent [10–12]. Oriented Basic Picture Features (obits) and Local Ternary Patterns (LTP) are two texture descriptors that Lee J. et al. used to extract features from the signature picture [13]. These features were then projected onto featured space. To assess a test signature's validity, the output of two SVMs were integrated. The ICDAR 2011 Dutch and Chinese signature data sets were used to assess the approach, and accuracy rates of 97.74 percent and 75.98 percent, respectively, were found.

### B. Dynamic Time Dilation

Dynamic temporal warping (DTW) [14] has been applied to the field of signature assessment in order to identify counterfeit signatures. In the evaluation, it is anticipated that the curvature, total length, and slant angle will remain constant amongst various pattern signatures. The signatures are represented by the slope histogram. In eighteen months, they gathered 306 informal and 500 genuine off-line signatures. They discovered them by forging the signatures of nine people and applying a device learning algorithm. A database containing 306 haphazard forgeries and 500 real offline signatures It is said that the EER is 7%.DTW is applied to curve comparisons in [15], where the curve is taken out of the signature envelope. Two methods for monitoring changes in an equal character's signature patterns are described in [16]. His first method achieves positional changes in signature pattern projection profiles by means of dynamic temporal warping. His two-dimensional trademark pattern determination method uses three-dimensional elastic matching to determine relative stroke positions. The training set's utilization has been computed using the records for such deviations. The positional displacement and validity of the questioned signature are enhanced by the use of information from the education samples. Projected characteristics included a FRR of 23.2 percent, a FAR of 21.4%, a FRR of 23.5 percent, and a FAR of 23.5 percent. An FRR of 23.5 percent and a FAR of 23.3 percent have been obtained for 2D-elastic matching of relative stroke positions, in addition to a FRR of 23.5 percent and a FAR of 23.3 percent. New warping mechanisms enabling useful tactics in signature evaluation are described in [17]. DTW is often used in practical procedures, such as speech analysis, where using a point for contrast would be far more computationally expensive. This study warps a selection of additives (intense factors) more effectively than warping all of them. We started to refer to the phenomena as "excessive factor warping." This technique uses a thing-of-one to increase EER. This approach is a blessing because it can evaluate signatures three times with an 11-fold reduction in computing time. A truly remarkable DTW method for assessing signatures based on writing pressures is given in [18]. Unlike the conventional DTW set of rules, this method considers the varied weights of writing pressures, signing times, and consistency of signature factors in astounding directions.Weights for writing forces in unique instructions and thresholds for categorization are computed using iterative experimentation and the same number of classifications. Error penalties are anticipated to be 1.4%.[19] provided a score fusion-based composite of dynamic temporal warping and vector quantization. With a detection price feature (DCF) of 1.37 percent for random forgeries and 5.42 percent for skilled forgeries, this method outperforms opportunity algorithms (DTW, HMM). Additionally, by removing the requirement to transmit the complete authentic dynamical signature records—that is, the code phrases used in the desire to feature vectors—he created a second mixed DTW-VQ technique that boosts remote authentication machine privateers.

### C. Classification of Signatures

A summary of the work on handwritten signature verification algorithms and classifiers conducted in the US and elsewhere is provided, with an emphasis on neural networks, support vector machines (SVM), and other methods. In the GPDS dataset, Sabourin R. et al.'s usage of the Convolutional Neutral Network (CNN) to quickly learn the visible warnings inside the signature photo resulted in a reduction of the EER from 6.9 percent to 1.72 percent [20]. Ferrer M. A. et al. suggested employing spatial pyramid pooling, modifying the network design, and learning constant-size functions from variable signatures as solutions to this issue [21]. Better results were obtained from the GPDS record set. The results of the experiment show that employing more high-resolution signature photos can enhance performance overall. In order to distinguish between devices, Xiao X. et al. employed supervised CNN. The two types of function ranges are deep capabilities and shallow functions. They also created a dual neural community related to vicinity, which helps to learn more discriminative function spaces. Numerous fact sets have produced positive findings [22]. According to Kalera M.K. [23], this is the Large-Scale Signature Network (LS2Net), a precise CNN form that addresses largescale schooling sample problems by batch normalization. Applying LS2Net to the MCYT, CEDAR, and GPDS datasets proved effective. Experiments have demonstrated that batch normalization significantly affects performance. It was the first time that the signature verification problem has been solved using Rank SVM (Rank SVM) [24].

### D. Distance Classifiers that are Simple

An approach for signature analysis based on observable notions was proposed [25]. The 512 × 128-pixel signature image is positioned in the middle of a grid of rectangular retinas. The surrounding elements of the signature pique our interest. To explain the quantity of sign activity inspired by each retina, granulometric size distributions are used as local form descriptors on the point of focus attention grid. There are 800 autographs in the collection from 20 different people. The proposed method uses a threshold classifier in conjunction with the nearest neighbor algorithm. Error rates typically fall between.02 and 1%. [26] created and examined geometric functions, primarily based on an inner stroke distribution and signature envelope, for offline signature analysis in polar and Cartesian coordinates. The collection contains 24 authentic signatures from 156 individuals, along with 30 fakes from every single person. For basic forgeries, FRRs of 16.39% and FARs of 15.50% have been finished. Bayesian classifiers are also used in signature verification [27–30]

### E. Neural Networks

A neural network with returned propagation and directed PDF have been used to analyze signatures [31–35]. The directional probability density feature was the global form component. Filtering reduced its cardinality, which consequently strengthened the feature's discriminating power. Results are consistent with backpropagation neural community classifiers outperforming threshold classifiers. We have developed a signature verification method and tested it on three different types of foreign houses. Classifiers that are mostly based on feed-ahead neural networks are employed. To aggregate the output from all three classifiers, a connectionist approach is employed. Signature verification, which employs a combination of many characteristic-based classifiers, is what sets this study apart [36–40]. Experiments indicate that a multiclass approach improves the reliability of popularity results and provides an offline signature evaluation based only on geometric feature extraction and neural community classification. To choose the one that best fulfils the criteria, a neural network classifier of different sizes looks at the geometric qualities generated from the signature picture [41– 43]. The total of all the data from the different scales is used to get the suit score. Real schooling control can be obtained through the use of samples that have been deliberately created to appear both authentic and fraudulent, based on enrollment reference signatures. This approach also minimizes the number of participants required to get meaningful results. It is stated that 90% of the signatures in a database containing more than 3000 signatures are accurate.

## III.PROPOSED WORK

The handwritten signature implementation technique uses GMM, LCSS, and DTW as its rules.

### a. Preprocessing

Before data can be analyzed, preprocessing is required. In information practice, we use the normalization procedure to standardize the data.

we have to compare results from corporations or rankings on multiple scales. How, for example, can we compare an 85 on a culinary test to a 100 on an IQ test? In order to attempt this, we "eliminate" the unit of dimension first; this process is known as "normalizing the information."

Every simple function fact factor is normalized to the variety [0,1] by a (Min-Max) normative expression; in this example, min-max normalization is utilized. Both before and after normalization, the essential characteristics are demonstrated.

The equations for min-max normalization are z = x min (x) max (x) min (x) (4.1).

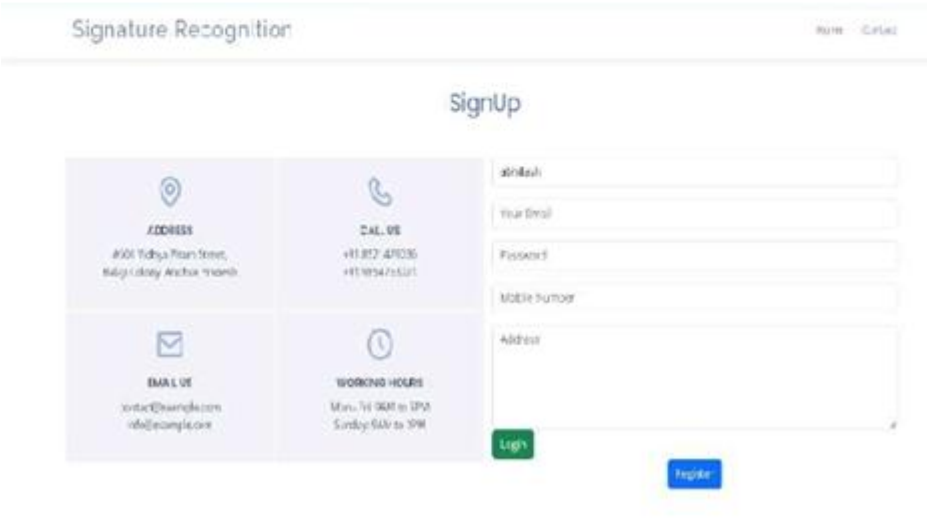
where x represents the data vector, min (x) denotes x's minimum, and max (x) denotes x's maximum.

### b. Extraction of Characteristics

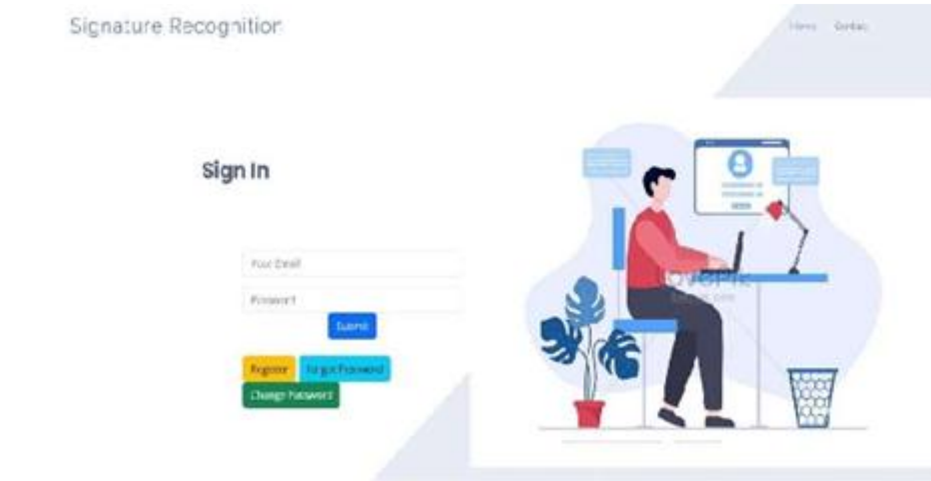
One way to extract capabilities is to reduce the number of assets needed to explain a substantial amount of data. Understanding complex data becomes more challenging due to the sheer number of variables involved. A large number of variables can lead to overfitting training examples and undergeneralization to new data, requiring a significant amount of memory and processing power. A broad variety of construction-related operations are referred to as "extraction of features". solving an issue using multiple approaches. While the information is still being properly transmitted, it is vital that these errors be corrected. Eleven fundamental qualities are taken by the characteristic extraction module, which normalizes them to the range [0,1].

## IV.RESULTS


**Start Page**

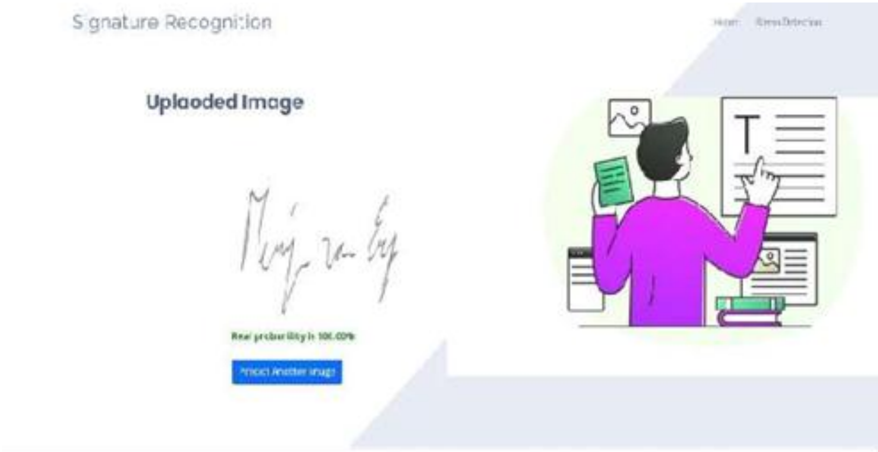



Sign-Up/Register Page

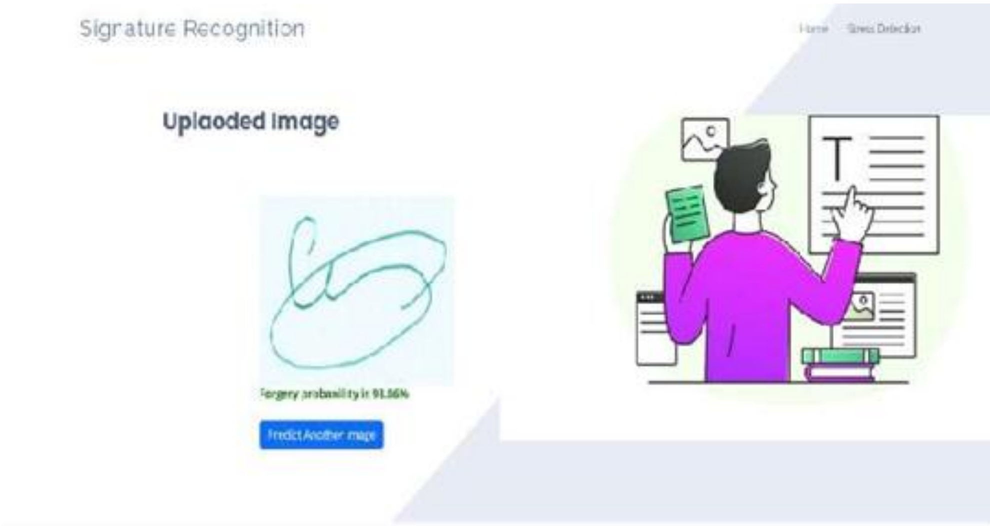



Sign-In Page


Welcome/Image Upload Page




**Result Page**




**Result Page**

## V. CONCLUSIONS

A brief survey of the signature verification technique uncovers a wealth of intriguing research topics. Future research in the area of multi-professional frameworks for signature verification is most likely going to be fruitful. Numerous strategies have lately been put out, and they may be investigated further. Combining the parameter and characteristic tactics is a viable option to consider. With the usage of global parameters and function-primarily based representations, it is possible to discover comparable multilayer signature representations. Multiplicated performance can be examined for majority voting structures, multi-level verification systems, and multi-professional systems. The unpredictability and longevity of signatures present a significant additional challenge to signature verification.

The study of signature repeatability is another important area. In actuality, the performance of the signature verification machine is greatly impacted by signature variability. Examining the most recent additions to the field, we find that they can be divided into four different categories.

To achieve higher features, a number of precise characteristic extractors were introduced. Incorporating textural characteristics (LBP variations), interest-point matching (SIFT, SURF), and directional features (HOG) might enhance the accuracy of the Offline Signature Verification System.

The project has recently been subjected to a hit function learning technique, which has shown that features identified for a subset of consumers may also be applied to new users and even to men and women from different datasets.

Enhancing the class using a limited number of samples: Owing to severe restrictions in real-world international applications, researchers have looked into ways to improve overall performance when just a limited amount of data is available per individual. The development of writer- unbiased approaches based mostly on dissimilarity and metric-learning frameworks has shown promise in addressing this challenge

Expanding the extensive range of educational samples that are accessible: Many researchers have concentrated on creating synthetic signatures as a solution to the problem of having a limited range of samples based on a use

Model ensembles: To improve classification accuracy and answer robustness, a number of scholars have examined the creation of static and dynamic classifier ensembles.

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# Analysis and Prediction of Crime Hotspots with Machine Learning With Stacked Generalization Approach

**Nithin JS, Punith U, Punith TM, Vinuthan S, Prof. Indhumathi S**
Department of Information Science and Engineering, East Point College of Engineering and Technology, Bengaluru, Karnataka, India

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**ABSTRACT**

The ensemble learning approach is a cooperative decision-making system that generates new examples by combining the predictions of learnt classifiers. Both conceptually and experimentally, early study has demonstrated that the ensemble classifiers are more trustworthy than any single component classifier. Even with the presentation of several ensemble approaches, determining the right configuration for a given dataset remains a challenging process. The subject of machine learning crime prediction has received approaches from several sources in India prediction-based viewpoints. Finding the dynamic character of crimes becomes a difficult task. The goal of crime prediction is to discourage criminal activity and lower the crime rate.

Keywords— Decision tree, Random Forest, Gradient Boosting and Machine learning techniques

## I. INTRODUCTION

Many criminologists and scholars have recently sought to forecast and do extensive study on ways to reduce crime via the use of various statistical and modeling methods. Given that the incidence of crime is still rising, it may be necessary to do some significant study to inform policymakers and the relevant department about problems and concerns in the field of crime prediction and control methods was Md. Moonful Hossain, the associate editor who oversaw thIeIevaluation of this paper and gave it the go-ahead for publishing. When handled manually, the human skill set is unable to maintain track of criminal records. Therefore, it is necessary to identify in a unique approach in order to aid in the analysis of crime-related data. The two main components of crime prediction analysis that are currently being used are the crime hotspot forecast and the prediction of the crime risk field. Techniques for data processing are used to make this work easier. The increased availability of comprehensive details regarding serious offenses including rape, arson, and murder, among others. A vast amount of crimes have been recorded worldwide in recent years.

Threatening to use force on a victim is a serious offenseknown as violence. It covers both crimes where the purpose isa violent act (e.g., robbery, murder, rape) and crimes wherethe use of violence as a tool of compulsion. Depending on the jurisdiction, a crime may not always be started with a weapon.

Violent crimes can vary from harassment to murder. Murders, robberies, rapes, attempted murders, kidnappings, thefts, riots, dowry deaths, dowry atrocities, etc. are commonly classified as violent crimes.

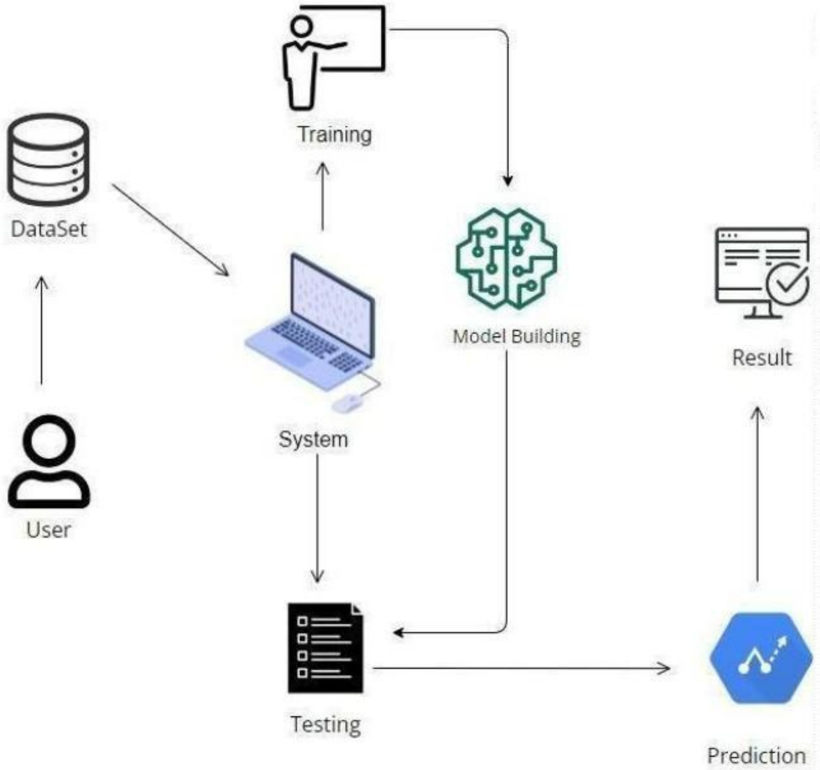



**Fig.1.**Basic view of analysis and prediction of crime hotspots

Although the dataset was tiny and the techniques were restricted, this study is made for several years. The empirical examination of machine learning and other contributions mentioned in this section support the research's claim of uniqueness.

## II. LITERATURE REVIEW

1) Using a novel deep genetic cascade ensemble of SVM classifiers to predict Australian credit scores; Credit scoring has grown significantly in importance as an analytical tool for academics and financial organizations worldwide in the last several decades. Given the importance of bank credits to the banking sector, it aids in increasing profitability as well as risk management. This work uses the Stat log Australian data to test a novel method called Deep Genetic Cascade Ensembles of Classifiers (DGCEC), which is based on a deep genetic cascade ensemble of several support vector machine(SVM) classifiers. The suggested method combines the advantages of deep learning, ensemble learning, and evolutionary computation into ahybrid model. The new 16-layer genetic cascade ensemble of classifiers in the suggested method consists of two kinds of SVM classifiers, Techniques for normalization, feature extraction, parameter optimization, three kinds of kernel functions, and stratified 10-fold cross-validation The suggested approach's general architectureincludes ensemble learning, deep learning, layered learning, supervised training, genetic algorithm- based feature (attribute) selection,

genetic algorithm-based parameter optimization for all classifiers, and a novel genetic layered training method (for classifier selection).

2) Analysis and prediction of spatiotemporal patterns in urban crime: To quantify the portrait data, facial expression recognition (FER) was then used. The crime prediction model was enhanced in its ability to explain phenomena by including the emotion components that were obtained in this way. Lastly, using six common crime scenes, our method was contrast to with kernel density estimation (KDE). The findings demonstratehow adding emotion data enhances crime prediction accuracy and reveals the relationship between emotions and criminal activity. In this article, we discuss how managing urban public safety is severely hampered by crimes, which have a wide range of reasons. Numerous multidimensional data sources are now available via smart cameras positioned across cities, allowingfor the non-intrusive capture of numerous employees' feelings through photos. This is enabled by the

3) An ensemble method to crime prediction survey article; The aim of this initiative was to Criminal activity is a major issue that the government, society, and individuals have prioritized. One of the main issues that the government, the society, and individuals have prioritized is crime. This research looks at many ensembles learning and data mining methods that are usedfor criminal data mining. An overview of the strategies and tactics used in the study and forecasting of crime data is provided in this survey article. By predicting future crimes that will occur, crime forecasting attempts to identify and reduce the incoming crimes.

Table1.LiteratureSurvey

| S. No | JournalType with year | Authors | Title | Outcomes |
|---|---|---|---|---|
| 1 | IEEE, 2019 | P. Plawiak, M. Abdar, | Application of new deep genetic cascade ensemble of SVM classifiers to predict the Australian credit scoring | In this paper Credit scoring has developed into a crucial analytical tool for academics and financial organizations all around the world in recent years |
| 2 | IEEE, 2018 | Z. Li, T. Zhang, Z. Yuan | Spatio-temporal pattern analysis and prediction for urban crime | In this paper Crimes, which have many causes, pose significant challenges to the administration of urban public safety. Smart cameras installed across cities now provide a variety of sources of multidimensional data |
| 3 | IEEE, 2018 | A. Alnaw and K. Kadam | Survey paper on crime prediction using ensemble approach | This project's goal was to The Crime is a foremost problem where the top priority has been concerned by individual, the community and government |
| 4 | IEEE, 2015 | T.B. Hyde, H. Dentz | The impact of new vaccine introduction on immunization and health systems: A review of the published literature | In this paper To investigate the effects of new vaccine introduction on nations' immunization and larger health systems |

## III. MACHINE LEARNING

Why Machine Learning?

Without the need for explicit programming, computers are capable of learning and perform better thanks to machine learning, a potent technology. It is used to solve complicated issues and create better data-driven decisions in industries, including marketing, finance, and healthcare. Programming languages with built-in tools and libraries for creating and executing machine learning algorithms include Python, R, and Julia. These programming languages come with a plethora of features, including tools for data and model performance visualization as functionality like clustering,regression, and classification. Because of its large library and active community, Python is very popular in the machine learning field. Developers and researchers may use machine learning languages to make data-driven choices, create complex models, and stay on the cutting edge of AI technology. Because of its large library and active community, Python is very popular in the machine learning field. Numerous algorithms are available in these languages for tasks like regression, classification,

and clustering, as well as offer visualization tools to aid in a better understanding of the data and model performance. Furthermore, are sizable development and research community for these languagesthat is continuously enhancing and extending the capabilities of machine learning tools. People may use these resources to create complex models, make data-driven choices, and stay on the cutting edge of AI technology by employing machine learning languages.

PROPERTIES OF ML

Prediction: Businesses can make data-driven choices and streamline procedures thanks to machine learning's skill in forecasting future events and outcomes based on previous data. Adaptability: As more data is presented to machine learning algorithms, over time the gain more expertise, allowing them to gain experience and learn fromit.

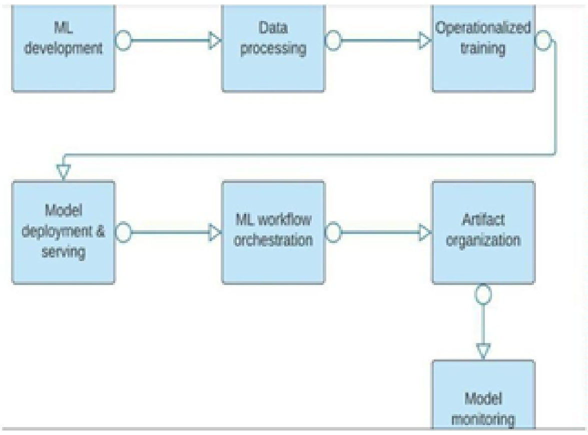



Fig.2.Machine Learning Based Architecture

**Automation:** More effective and scalable solutions may be achieved by automating operations that are difficult or impossible to implement using conventional rule-based techniques thanks to machine learning.

**Generalization:** Due to the fact machine learning models anticipate new, unknown data and generalize patterns from training data, they are useful in a wide range of applications. Flexibility.

What is Machine Learning?

"machine learning" allows computers to learn judgments or predictions without the need for explicit programming. It makes predictions based on previously unknown data, makes educated judgments, and finds patterns in data using statistical approaches. Various machine learning techniques, such as reinforcement learning, supervised learning, and unsupervised learning, are appropriate for distinct tasks. While unsupervised learning concentrates on identifying patterns and correlations in unlabeled data, supervised learning entails building a model using labeled data. By rewarding or punishing agents for their actions based on results, reinforcement learning teaches them to make decisions sequentially. Applications for machine learning may be found in recommendation systems, predictive analytics, autonomous cars, and image and speech recognition.

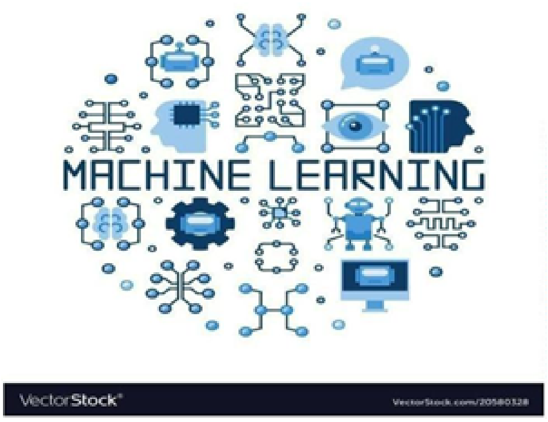



Fig.3.Machine Learning

Basic requirements of Machine Learning

1. **Quality data:** machine learning models to be trained, high-quantity data must be clear, organized, & represent tic of the problem area.

2

.**Feature Selection:** To maximize performance andreduce overfitting, selecting the right features or variables for model training is essential.

**3.Alogorithm:** Because every machine learning algorithm has advantages and disadvantages, choosing the best one is essential for getting the best results.

**4.Training Data:** To properly train the machine learning model, sufficient training data encompassing a range of scenarios and real-world settings are needed.

**5. Evaluation Metrics:** Precise evaluation criteria, including as accuracy, precision, recall, and F1 score, are crucial for evaluating the model's effectiveness.

**6.Model Validation:** A method for validating a model that makes sure it can function consistently across many datasets and successfully generalize to unknown data is called cross-validation.

**7.Computational Resource**: Given the computational intensity of models, access to ML computational resources such as CPUs, GPUs, or cloud computing services is essential for training and deploying these models.

Clean, well-structured, representational of the issue area, high-quality, relevant, and diverse data are prerequisites for machine learning models. Choosing the right features is essential to enhancing performance and lowering overfitting. Selecting the appropriate machine learning algorithm for a given task is crucial, as distinct algorithms possess varying advantages and disadvantages. Effective training requires a sufficient amount of training data that covers a broad variety of situations and real-world settings.

Measuring the efficacy of the model requires establishing precise assessment criteria, like F1 score, recall, accuracy validation via methods like as cross-validation guarantees that the model operates consistently across many datasets and that it generalizes well to new data.

Model deployment and training require access to computational resources such as CPUs, GPUs, or cloud computing services. Developers and data scientists may create reliable and efficient machine learning models that offer insightful analysis and predictions for a range of applications by fulfilling these objectives.

## IV. Algorithms

### 1. Decision tree

A machine learning approach that formally and graphically reflects decisions and decision making is called a decision tree. In data mining, it is frequently utilized to extract techniques forachieving particular objectives. An inverted decision tree is depicted, with the root at the top, and each condition or internal node is indicated by bold text. The decision branch, shown as red and green letters, respectively, is the one that doesn't divide. Viewing relations is made simple by this algorithm's simplicity, even if a real dataset has more information. The above tree is bean a classification tree, and it is used in an approach called learning decision trees from data. The tree's goal is toclassify passengers as having survived or killed. Similar representations are used for regression trees, which forecast continuous quantities such as home prices. Selecting characteristics, determining when to split, and determining criteria are all necessary for growing a decision tree. A tree grows inexplicably, thus in order to keep it beautiful, it must be trimmed down. Using a common approach is one way that splitting is done frequently. What then is truly happening in the background? Deciding which characteristics to employ, under what circumstances to split, and when to quit are all part of growing a tree. Trees often grow at random, therefore in order to make it appear good, you will need to prune it.

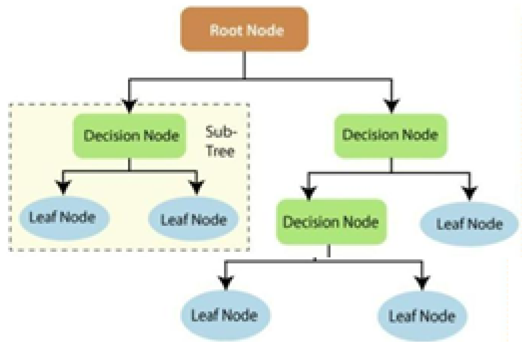



Fig 4.Decision Tree

The foundation of decision trees is the measurement of uncertainty known as entropy and information gain. While information gain quantifies the amount of uncertainty decreased in a target variable given a collection of independent variables, entropy to assess the uncertainty in a target variable. The conditional entropy of Y (given X) and the entropy of the target variable (Y) information gain. The entropy of Y is subtracted from the conditional entropy. Reducing uncertainty and eliminating information entropy are two important aspects of decision tree training that depend on information acquisition. When breaking branches, entropy and information gain play a critical role in decision tree development. A decision tree, for instance, can forecast a customer's choice to buy a mobile phone depending on the attributes of the device. The phone's characteristics are represented by the root and decision nodes, while the customer'sdecision to buy or not is represented by the leaf node, which signifies the outcome.

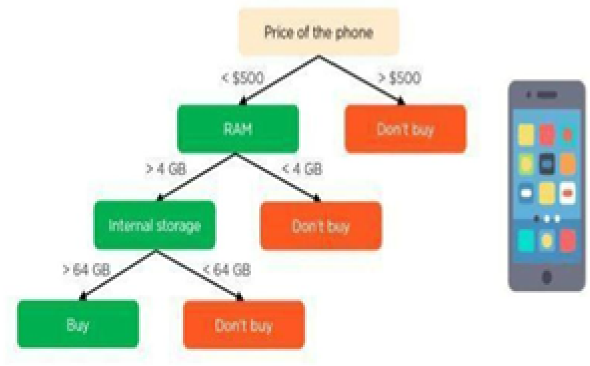



Fig5.Decision Tree in Random Forest

### 2. Random Forest

Using ensemble learning, a random forest is a machine learning approach that addresses regression and classification issues. It is made up of several decision trees that have been trained via bootstrap aggregation or bagging. The method makes predictions by calculating the mean or average of the output from different trees. The precision of the result rises with the number of trees. Decision tree constraints are removed by moreover, random forest improves accuracy and reduces data set over fitting. With tools like Sickie-learn, it provides predictions without requiring a lot of setup. A random forest overfitting problem, handle missingdata efficiently, generate fair forecasts without hyper-tuning parameters, and decision trees. In each random prediction, at the node's splitting point, a duel of species is chosen at random.

### 3. Gradient boosting

One ML method for reducing bias error inmodels is the gradient boosting algorithm. Bias error and variance error are two different kinds of errors.

Like AdaBoost, the Gradient Boost technique has a fixed base estimator that may be adjusted to a fixed value of 100.

Both continuous and categorical target variables may be predicted using it. Mean Square Error (MSE) is the cost function for regressors, whereas log loss is the cost function for classifiers.

Age is the target variable while Likes Exercising, Go to Gym, and Drives Car are the independent variables in an example of the Gradient Boosting Algorithm. In this instance, the Gradient Boosting Regressor is employed.

The Gradient Boosting method uses the residues (age – mu) of the first estimator as root nodes, in contrast to AdaBoost. For example, the estimator-2 would record False go to Gym if another dependent variable was utilized for prediction.

## V. EXISTING SYSYEM

The application of machine learning algorithms in the current system is complicated by problems with data visualization. Building a random forest model requires mathematical computations, which

can be difficult and time-consuming. Machine learning packages from the sickie-learn library are used to address this. The application of machine learning algorithms in the current system is complicated by problems with data visualization. Random Forest model construction requires mathematical computations, which adds complexity and time. Machine learning packages from the sickie-learn library are used but they are complexand take more effort to utilize.

### Disadvantages:

1. Requires more time
2. Difficult to handle

## I. PROPOSED SYSTEM

The suggested method detects criminal hotspots using ML algo like Gradient Boosting and Decision Tree. To compare these methods, a comparative analysis is carried out. The system uses discrete algorithms and datasets, aggregating the outcomes to calculate accuracy.

### PROPOSED SYSTEM

There are several machine learning techniques available for predicting high-crime areas. A few machine learning algorithms are Gradient Boosting and Decision Trees. We employed the suggested and computed optimal strategy for diagnosing a comparative analysis of machine learning methods for detecting criminal hotspots. At this point, we've implemented the algorithms separately and the datasets first. We then combined the outcomes tocalculate the accuracy.

### Advantages:

1. Requires less time, 2. Good score, 3. Easy to handle


## 6.1 SYSTEM REQUIREMENTS SPECIFICATION

**Functional and non-functional requirements:**
Analysis of requirements is a crucial step in determining if a system or software project will be successful.

requirements: functional requirements and non-functional requirements.
6.2 **Functional Requirements**: These are the specifications that the end user expressly requests the system provide as a minimum. As stipulated in the contract, each of these features must be included into the system. These are expressed or depicted as the expected outcome, the action carried out, and the input to be supplied to the system. Unlike non-functional needs, they are essentially user-stated criteria that are visible in the finished product.

Examples of functional requirements:
1. User authentication each time they access the system
2. In the event of a cyberattack, system shutdown
3. Every time a person registers for the first time on a software system, they receive a verification email.

**Non-functional requirements**: In essence, these are the quality requirements that the system must meet in order for the project to be completed on schedule. Each project has a different priority or level of implementation for these aspects. We also refer to them as non-behavioral needs. They mostly address the following problems.
1.Portability
2.Security
3.Maintainability
4.Reliability
5.Scalability
6.Performance, Reusability, Flexibility

Examples of non-functional requirements:

1.Emails from such an activity should be sent no later than 12 hours later.
2.Every request should be processed in less than ten seconds.
3.When there are more than 10,000 concurrent visitors, the website should load in three seconds.

### 6.3 Hardware Requirements

- System: Intel Core i5
- Speed:1.1 GHz
- RAM:8GB
- Hard Disk:120 GB
- Input Devices: Keyboard, Mouse
- Monitor:15" LED

### 6.4 DFD Diagram

A Data Flow Diagram (DFD) is a graphic depiction of the requirements for a system that finds how full flows insideit. It can be made manually, automatically, or both at once. DFDs display how data enters, exits, is changed, and is stored within a system. They direct redesign efforts by acting as a communication mechanism between systems analysts and system stakeholders.

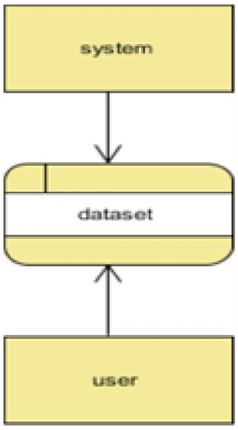


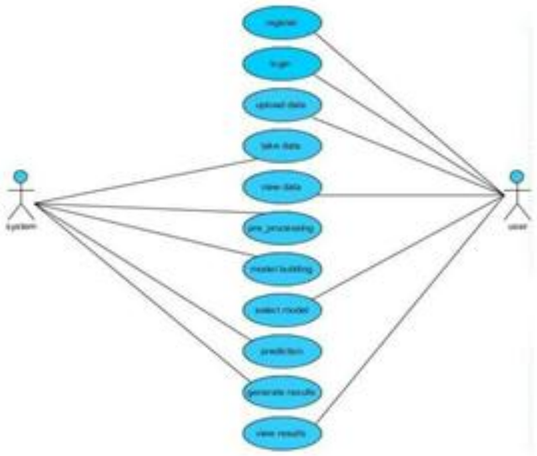

Fig 7: Context Model

### 6.5 USE CASE DIAGRAM

According to the Unified Modeling Language (UML), a use case diagram is a particular kind of behavioral diagram that is produced from and defined by a use case study.

Its is to provide a graphical summary of the functionalitythat a system offers in actors, use cases (representations oftheir goals), and any in its own among those use cases.

A user case figure primary view which actor receive which system functionalities. It is possible to illustrate theroles the sys actors.



### 6.6 Methodology/Procedure

SEQUENCE DIAGRAM

In the certain spec lang (UML), a sequence diagram is a typeof interaction diagram that illustrates the relationships and sequence in which processes operate with one another.

It is a Message Sequence Chart construct. Event diagrams, event situations, and timing diagrams are other names for sequence diagrams.

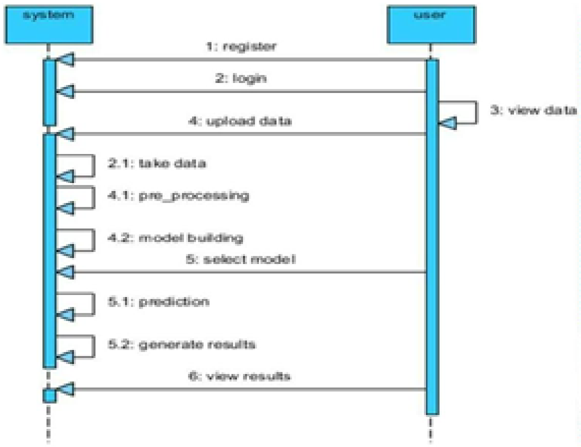



Fig 8:Sequence diagram

## VII. RESULTS

**Home Page:** User can view the Home page.


Fig 8: Home Page

**About:** This is the small information about project

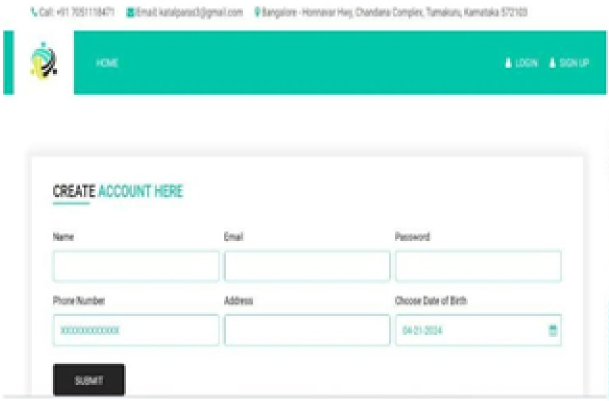



Fig 9: About Page

User Registration page: User can register with required details.


Fig 10. User Registration page

User Login: User can login with valid credentials.


Fig 11. Login Page

**User Home page:** User can view the home page after successful login.

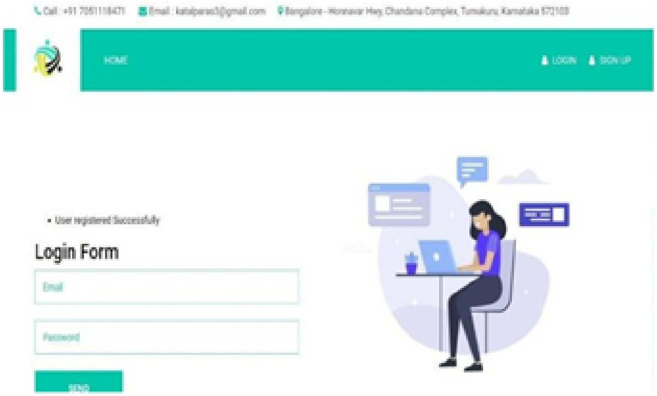


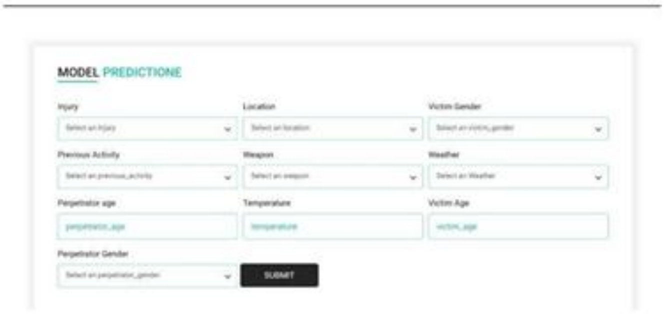

Fig 12. Home Page

View Data: User can view the data

CRIME DATA ENTRIES

| date | time_of_day | crime_type | location | latitude | longitude | victim_gender | victim_age | perpetrator_gender | perpetrator_a |
|---|---|---|---|---|---|---|---|---|---|
| 2021-12-18 00:00:00 | 21:29:18 | Assault | Whitefield | 13.1206 | 77.5712 | Female | 62 | Other | 18 |
| 2018-09-16 00:00:00 | 08:36:10 | Forgery | Jayanagar | 13.068 | 77.5754 | Male | 56 | Male | 18 |
| 2018-06-02 00:00:00 | 04:27:36 | Embezzlement | Koramangala | 13.0788 | 77.6458 | Other | 18 | Male | 20 |
| 2020-02-24 00:00:00 | 10:51:00 | Robbery | Electronic City | 12.8899 | 77.5503 | Male | 25 | Male | 25 |
| 2018-06-02 00:00:00 | 08:01:24 | Forgery | Indiranagar | 13.0214 | 77.4496 | Male | 53 | Other | 63 |
| 2018-02-24 00:00:00 | 21:00:41 | Embezzlement | JP Nagar | 13.0559 | 77.4998 | Other | 36 | Female | 47 |
| 2019-04-13 00:00:00 | 18:54:23 | Vandalism | Marathahalli | 13.0814 | 77.5721 | Other | 61 | Female | 39 |
| 2021-04-16 00:00:00 | 21:58:36 | Forgery | Banashankari | 13.0547 | 77.5186 | Female | 25 | Female | 23 |

Fig 13:data page




Model: train the model

**Prediction:** User can give a input and viewPredicted Result


Fig 15.Prediction

## VIII. Conclusion

With the help of machine learning model approaches including decision trees, random forests, and gradient boosting, we have created a user-friendly application for this project called prediction of crime hotspots. We have utilized the finest techniques we could find to display the type of crime.

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