International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 10 Issue: 01 | Jan - 2026 SJIF Rating: 8.586 ISSN: 2582-3930

AI Enabled Accident Detection and Alerting System Using IOT.

Manoj P M[1]

Department of electronics and Communication,

Jawaharlal Nehru New College of Engineering,

Karnataka, 577201

mpm78650@gmail.com

Gokul M D[2]

Department of electronics and Communication,

Jawaharlal Nehru New College of Engineering,

Karnataka, 577201

gokulmd584@gmail.com

Abhishek kolkar N[3]

Department of electronics and Communication,

Jawaharlal Nehru New College of Engineering,

Karnataka, 577201

abhishekkolkarn@gmail.com

Jayanth N U[4]

Department of electronics and Communication,

Jawaharlal Nehru New College of Engineering,

Karnataka, 577201

jayanthnu01@gmail.com

Ajay Betur P[5]

Department of electronics and Communication, Jawaharlal Nehru New College of Engineering,

Karnataka, 577201 ajaybetur@jnnce.ac.in

Abstract: This project focuses on the development of an intelligent IoT-based accident detection and alerting system enhanced with machine learning techniques. The proposed system is designed for vehicle safety by continuously monitoring the driver's physical condition, vehicle movement, and surrounding environment to reduce the risk of road accidents. A Raspberry Pi acts as the central processing unit and is interfaced with various sensors such as a USB camera, heart rate sensor, alcohol sensor, MEMS sensor, GPS module, ultrasonic sensor, and GSM module.

The system analyzes real-time data collected from these sensors to assess driver alertness, health status, and driving behavior. The camera tracks eye movements to identify signs of drowsiness or fatigue, while the heart rate sensor provides information about the driver's physiological condition. The alcohol sensor detects the presence of alcohol in the driver's breath and generates alerts if unsafe levels are detected. Accident detection is achieved using a MEMS sensor that identifies abrupt changes in acceleration or orientation, indicating a possible collision. Additionally, the ultrasonic sensor measures the distance to nearby vehicles to assist in collision avoidance.

I. INTRODUCTION

Embedded systems are purpose-built computing units developed to carry out specific functions as part of a larger system. These systems are commonly based on microcontrollers or microprocessors and are widely used across various fields such as consumer electronics, automotive technology, industrial automation, and medical equipment.

A key feature of embedded systems is their ability to operate in real time, ensuring timely responses to external inputs andevents. They are typically optimized for low power consumption, minimal cost, and high reliability, making them suitable for continuous operation in demanding environments. Embedded systems are present in everyday products like smartphones, digital cameras, washing machines, and household appliances, as well as in advanced applications such as automotive engine control units and aircraft avionics systems.

Developing embedded systems requires proficiency in low-level programming languages such as C or assembly language, along with a solid understanding of hardware architecture and peripheral devices. System design also involves careful planning of power usage, efficient memory utilization, and reliable communication with external components. These considerations ensure that embedded systems perform efficiently and reliably within their intended applications.

Embedded systems often operate with limited resources, which requires efficient use of processing power and memory.

II. LITERATURE REVIEW

Patil et al. proposed an accident detection system that identifies vehicle crashes and automatically notifies nearby police stations and emergency response teams. The system uses GSM technology to transmit alert messages to emergency services. It continuously monitors the vehicle's

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 10 Issue: 01 | Jan - 2026 SJIF Rating: 8.586 ISSN: 2582-3930

status and promptly sends notifications when an accident is detected. A Renesas microcontroller is employed along with a GSM modem and a GPS receiver to manage communication and location tracking. The alert message sent through GSM includes the exact location information obtained from the GPS module. The major components of the system include a piezoelectric sensor, GSM module, and GPS unit. Continuous tracking enables timely transmission of location details during an accident. However, a major limitation of this method is the absence of a manual option to cancel alert messages when the accident is minor. Additionally, constant location monitoring can result in increased power consumption, leading to faster battery drain.[1].

Alkandari et al. presented an accident detection approach for traffic signal zones using fuzzy logic techniques. The proposed framework is divided into two main components: a Detection System and an Action System. It is developed based on the Webster traffic control method with slight modifications. The system gathers real-time traffic data from multiple zones, including parameters such as vehicle count in each lane and the average speed of vehicles. Any abnormal disruption in regular traffic flow is treated as a key indicator of a possible accident.

The fuzzy logic system uses crisp inputs and outputs, membership functions, linguistic variables, and a set of fuzzy rules to analyze traffic conditions. Linguistic parameters such as cross ratio, zone condition, accident status, and sectional speed are used to evaluate whether an accident has occurred. Based on the fuzzy rule evaluation, appropriate actions are generated to regulate traffic and reduce congestion. Experimental results indicate that the system can detect various accident scenarios with high accuracy.

Additionally, an accident prediction model using fuzzy logic is discussed, highlighting its suitability for handling non-linear relationships between accidents and contributing factors. Inputs such as traffic density, vehicle speed, road width, and surface conditions are considered to effectively model accident likelihood.[2].

Eduku et al. presented a solution to prevent traffic hazards by proposing a system which uses eye blink sensor and automatic braking system to slow down the car and bring it in the state of halt, if drowsiness is detected in driver. A RF module routs the information to the nearby vehicles to alert them that alert car is there. IR sensors are used to monitor the eye blink and detect the state of drowsiness. Infra-red rays are transmitted to the eyes by means of a IR transmitter, the IR receiver on the other hand receives the reacted rays from the eye. If the output of IR receiver tend stop high ,it implies that the eyes are closed. Thus the drowsiness is detected by means of monitoring this high/low output. Its main modules consist of an alarm that warns the driver if drowsiness is detected, automatic breaking systems to slow down the car, and bring it to halt state and RF module to send alert messages to the nearby vehicles in range.[3].

Rao and Yellu presented a preventive safety system aimed at reducing road accidents caused by drunk driving. The system incorporates an alcohol sensor to continuously monitor the drier's breath for alcohol content. The sensor is mounted near the steering wheel so that it can accurately detect alcohol levels as the driver exhales. A predefined threshold value is set, and if the detected alcohol concentration exceeds this limit, the vehicle is automatically prevented from starting or moving.

In addition, a GPS module is used to determine the vehicle's location, while a GSM module sends alert messages to pre-stored contact numbers, informing them that the driver is intoxicated and unable to operate the vehicle. The primary objective of this system is accident prevention by stopping impaired drivers before a hazardous situation occurs. This approach benefits public safety by ensuring that intoxicated individuals are not allowed to drive.

Despite its advantages, the system has certain limitations. False detections may occur if a passenger near the driver has consumed alcohol while the driver has not. Furthermore, external air disturbances can influence the accuracy of the alcohol sensor, affecting overall system reliability.[4].

Kasera proposed a safety mechanism designed to reduce accidents in mountainous and hilly regions, where roads are typically narrow, steep, and sharply curved. The system employs ultrasonic sensors to detect vehicles approaching blind curves and to warn drivers traveling from the opposite direction.In this setup, ultrasonic sensors are installed on one side of the road before a curve, while LED indicators are positioned beyond the curve on the opposite side. When a vehicle approaches the curve, the sensor detects its presence and triggers a warning signal by illuminating an LED light for vehicles coming from the other direction. To ensure coverage from both sides, two ultrasonic sensors and two LED indicators are placed at each end of the curve.Once a vehicle is detected at one end, a red warning light on the opposite side is activated and remains on until the vehicle reaches the other end of the curve and is detected by the corresponding sensor. The system is energy efficient and economically viable, making it suitable for deployment in remote or hilly areas where cost and power consumption are critical factors.[5]

III. OBJECTIVES AND METHODOLOGY

1. Robot built using DC gear motor and Bluetooth HC-05 with sensor interfaced.

2. Automatic braking and accident detection will be carried out by IR, Ultrasonic, ADXL Sensors.

3. Camera is been interfaced with ESP32 via python coding to detect person normal status using media pipe deep learning and notification will be sent through GSM.

METHODOLOGIES:

1. Robot built using DC gear motor and Bluetooth HC-05 with sensor interfaced.

- The system detects accidents and location reliably in real time under different conditions.
- Sensors such as ultrasonic, IR, and ADXL345 are

used to detect motion, tilt, and impact.

- Arduino Nano or ESP32 processes and analyzes the sensor data.
- GPS, GSM/Wi-Fi, Bluetooth HC-05, buzzer, and LCD are used for alerts and communication

---

2. Automatic braking and accident detection will be carried out by IR Ultrasonic, ADXL Sensor

- The ADXL345 detects real-time acceleration and tilt on X, Y, and Z axes, while ultrasonic and IR sensors monitor nearby obstacles to help identify accidents.
- Sensor data is combined to confirm an accident and accurately determine its occurrence.
- The microcontroller obtains the latest latitude and longitude from the GPS module after accident detection.
- Location details are sent via HC-05 Bluetooth to a mobile phone, which uses GSM to automatically notify emergency contacts with the exact coordinates

---

3. Camera is been interfaced with ESP32 via python coding to detect person normal status using media pipe deep learning and notification will be sent through GSM.

- A camera module integrated with the ESP32 captures live video, which is processed using Python-based deep learning algorithms through MediaPipe.
- The ESP32 is configured with appropriate firmware to stream camera frames over Wi-Fi and validate the video feed using a Python script.
- Processed results from Python are sent back to the ESP32 to indicate the detected status.
- When an alert is received, the ESP32 triggers the GSM module to send SMS notifications to emergency contacts.

IV. BLOCK DIAGRAM

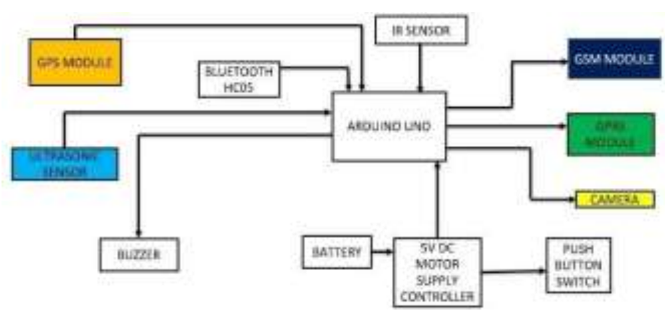

FIG-1: Block diagram

The proposed system is built around the Arduino Uno, which acts as the central controller. It receives input signals from various sensors and modules, processes the data, and controls the output devices accordingly.

The Ultrasonic Sensor is used to detect obstacles or objects by measuring distance. When an object is detected within a predefined range, the sensor sends a signal to the Arduino, which then activates the buzzer to alert the user.

The IR Sensor is used for object or motion detection. It provides digital input to the Arduino, enabling the system to identify nearby movement or presence.

The GPS Module is responsible for obtaining real-time location information such as latitude and longitude. This data is sent to the Arduino for tracking or monitoring purposes.

The GSM Module is used for communication. It allows the system to send alert messages or notifications to predefined mobile numbers. The GPRS Module supports data transmission over the mobile network for internet-based monitoring or data logging.

The Bluetooth HC-05 module enables short-range wireless communication between the system and a mobile device, allowing control or monitoring through a smartphone application.

A Camera module is interfaced with the Arduino to capture images or video when triggered by specific events such as obstacle detection or button press.

The system is powered by a battery, and a 5V DC motor supply controller regulates and provides the required voltage to the Arduino and other components. A push button switch is used for manual control or emergency activation.

Overall, the system integrates sensing, communication, and alert mechanisms to perform real-time monitoring and response efficiently.

IMPLEMENTATION

The AI-based accident detection and alert system using IoT combines sensors, a microcontroller, and communication modules to identify road accidents and send immediate alerts. Sensors such as accelerometers and gyroscopes are used to continuously monitor the vehicle's movement and sudden changes in speed or direction. The collected data is processed by the microcontroller and analyzed using trained AI algorithms to determine whether an accident has occurred.

When an accident is detected, the system automatically sends alert messages along with location details to emergency services or predefined contacts using cellular or Wi-Fi communication. GPS modules provide accurate location information, while a stable power supply ensures uninterrupted system operation.

The development of this system includes programming the microcontroller, training the AI model with accident and normal driving data, and testing the system for accuracy and reliability. By combining IoT connectivity with artificial intelligence, the system enables fast accident detection and timely alerts, helping to reduce injuries and improve emergency response and road safety.

The robot is designed using DC gear motors for controlled movement and an Arduino-based controller as the processing unit. Motor driver circuitry is used to interface the DC gear motors with the controller, enabling forward, reverse, and turning motions.A Bluetooth HC-05 module is integrated to provide wireless communication between the robot and a smartphone or control device. User commands are transmitted via Bluetooth and processed by the controller to control motor operations.Sensors are interfaced with the controller to detect obstacles or environmental conditions, and their outputs are used for decision-making and safety. A regulated power supply ensures stable operation of all components.

V. RESULTS

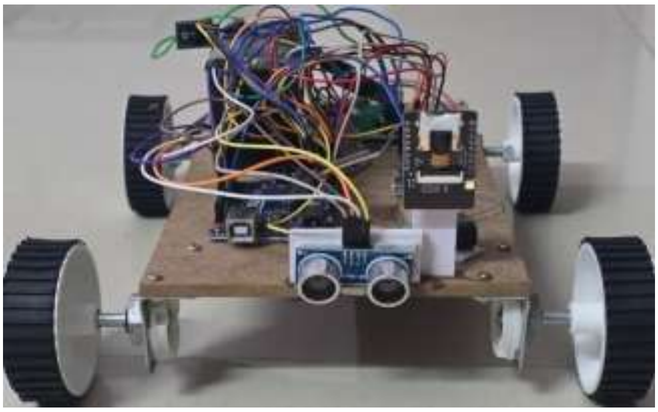

FIG-2: Accident detection model

FIG-3:Accident detected image

The proposed AI-based accident detection and alerting system integrated with IoT was developed and evaluated using both simulated environments and real-time testing. By analyzing sensor inputs such as vibration, acceleration, and angular orientation, the system was able to accurately recognize accident conditions. The inclusion of AI-driven logic significantly reduced the occurrence of false alerts. Once an accident was identified, the system immediately obtained the vehicle's geographical position through GPS and sent notification messages to registered emergency contacts and nearby healthcare facilities via IoT communication technologies.
The evaluation results confirmed that the system detected accident incidents with high dependability and very low latency. The time taken from accident recognition to alert dissemination was limited to only a few seconds, enabling rapid emergency response. Furthermore, the AI algorithm successfully distinguished genuine accident events from common road irregularities, resulting in improved accuracy when compared to conventional threshold- based detection methods.

VI. CONCLUSION

This project presents an embedded smart accident pre-alert and prevention system using machine learning to improve road safety. By combining sensors such as camera, heart rate, alcohol, MEMS, and ultrasonic sensors, the system continuously monitors the driver, vehicle movement, and surrounding conditions in real time. Machine learning helps in identifying unsafe situations early and triggering timely alerts to prevent accidents. In case of an accident, the system ensures quick detection and fast emergency notification, reducing response time. The solution is reliable, automated, cost- effective, and scalable for different environments. Future improvements may include integration with autonomous vehicles, advanced data fusion from multiple sources, IoT connectivity, and edge computing to enable faster local decision-making and more accurate accident prediction.

VI.REFERENCE

1. Sohel Rana, Md. Rabbi Hasan Faysal, Sajal Chandra Saha, Abdullah All Noman, Kawshik Shikder."Road Accident Prevention by Detecting Drowsiness & Ensure Safety Issues",2021 2nd International Conference on Robotics, Electrical and Signal Processing Techniques (ICREST), 2021.

2. Dr. C. K. Gomathy, K Rohan , Bandi Mani Kiran Reddy and Dr .V Geetha, " Accident Detection and Alert System," Journal of Engineering, Computing & Architecture, vol.12, Issue 3,March 2022.

3. S. Wang, J. Gwizdka, and W. A. Chaovalitwongse, "Using wireless EEG signals to assess memory workload in the $ n $- back task," IEEE Trans. Human- Machine Syst., vol. 46, no. 3, pp.

4. S. Kim, Y. Hwang, D. Yoon, W. Choi, and C. H. Park, “Driver workload characteristics analysis using EEG data from an urban road,” IEEE Trans. Intel. Transp. Syst., vol. 15, no. 4, pp.1844 – 1849, 2014.

5. Saranya s, Bhanupriya N, Nachimuthu J, Sakthivel K & balakrishanan N(2020)Automatic drowing rescue system.journal of advanced research in dynamical and controlsystems,12(3SpecialIssue),218225.doi:10.5373/JARDC S/V12SP3/202012.