# VEHICLE PARAMETER BASED ACCIDENT DETECTION USING INTERNET OF THINGS(IOT)

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**Abstract:** Vehicular Accidents are a major cause of concern in today's world. Safety of the driver and the co passengers can be threatened because of various reasons that lead up to an accident and moreover there is a huge lag between the time of accident and time when emergency services reach ground zero. Many lives can be saved if proper emergency services reach the accident location at the right time. With the help of the proposed system not only accidents are detected but also notifications are sent to the nearest hospital, police station and emergency contacts. Accidents are detected using two sensors i.e, vibration sensor, and IR sensor. These sensors form the part of the embedded system which has an arduino. The smartphone detects whether an accident has occurred or not using the Accident detection algorithm. On detection of an accident, a message along with the GPS coordinates (users current location),blood group and vehicle plate number(collected at the time of user registration) is sent to the nearest hospital, police station and emergency contacts. This process can significantly reduce the number of casualties because of delay in receiving proper medical care. Also in order to minimize false positives, an alarm system has been included which goes off as soon as accident has been detected. If the driver is safe, he/she can shut the alarm and cancel the sending of the message. The alarm rings for about 30 seconds after which it automatically forwards the message to emergency services and contacts. This application will help the service providers to reach on time and save valuable human life.

***Index terms*** *– vehicle detection, arduino, GPS, vibration sensor, IR sensor.*

## 1. INTRODUCTION

In the modern world, the proliferation of automobiles has brought about a corresponding increase in road accidents, resulting in significant loss of life and property. The lack of prompt emergency response exacerbates these tragedies. However, innovative solutions leveraging technology offer hope for mitigating these risks and saving lives. This paper proposes a comprehensive system designed to detect accidents swiftly, relay critical information to emergency services, and expedite medical assistance to accident victims.

The system's design focuses on rapid accident detection and transmission of vital data to first responders and family members. By leveraging GPS technology, the system can pinpoint the exact

location of the accident, along with the time and angle of impact, enabling swift response. The integration of GSM modules facilitates instant communication with emergency services and concerned parties, ensuring timely assistance. This real-time application has the potential to significantly reduce fatalities resulting from road accidents.

The importance of reducing response time in accident scenarios cannot be overstated. Studies indicate that every minute saved in emergency response correlates with a six percent increase in survival rates [2]. Therefore, the proposed system, by expediting the delivery of emergency medical services, can substantially enhance the chances of survival for accident victims.

While existing technologies such as Advance Traffic Management Systems (ATMS) and automatic car accident detection systems embedded in vehicles offer some solutions, they have limitations. ATMS relies on traffic sensors installed mainly on highways, making widespread implementation impractical due to high costs and environmental factors [3]. Similarly, vehicle-integrated accident detection systems require costly upgrades and are not standard features across all vehicle models [4].

To address these challenges, the proposed system leverages smartphones, which offer several advantages. Smartphones are regularly updated in terms of both software and hardware, ensuring the latest technology is available for accident detection. Additionally, smartphones are equipped with advanced sensors, processors, and communication interfaces, making them ideal for developing accident detection systems without the need for vehicle modifications. Moreover, smartphones are more cost-effective compared to traditional traffic technologies.

The integration of GSM technology into the proposed system represents a significant advancement in accident detection and tracking. By combining real-time detection, location tracking, and communication capabilities, this system enhances road safety and emergency response effectiveness.

In conclusion, the GSM-based Vehicle Accident Detection and Tracking System offers a promising solution to the pressing issue of road accidents. By leveraging smartphones and GSM technology, this innovative system can significantly reduce response times, thereby maximizing the chances of saving lives. With further research and development, widespread implementation of such systems could revolutionize road safety practices globally.

## 2. LITERATURE SURVEY

In recent years, there has been a surge in research and development aimed at leveraging technology to enhance road safety and mitigate the devastating impact of vehicular accidents. Numerous studies and projects have been undertaken worldwide, focusing on various aspects of accident prevention, detection, and emergency response systems. This section provides an overview of some of the key research efforts in this field, highlighting their methodologies, findings, and contributions to improving road safety.

Patole Gitanjali et al. [1] conducted a case study titled "IOT-Based Vehicle Tracking & Vehicular Emergency System," which delved into the architectural functioning of different units within the system. The study focused on units such as the Vehicle and Ambulance Unit, Traffic Unit, and

Server Unit, aiming to streamline communication and coordination between these entities to improve emergency response times.

Saed Tarapiah et al. [2] authored "Smart On-Board Transportation Management System Geocasting Featured," with the objective of notifying subsets about a vehicle's geographical location. This system aimed to enhance traffic management and emergency response by providing real-time updates on vehicle locations to relevant stakeholders.

Aishwarya et al. [5] implemented an IoT-Based Accident Prevention & Tracking System for Night Drivers. This system primarily focused on providing an Eye Blinking Monitoring System (EBMS) to alert night drivers of drowsiness, thereby preventing accidents caused by driver fatigue. Additionally, the system incorporated recording equipment connected to the cloud to provide real-time updates about crashes to the nearest hospital, facilitating prompt medical assistance.

In "IoT-Based Real-Time Autonomous Vehicle Tracking System" [8], M. Kavya and Shakeel Ahmed's work aimed to inform rescue teams and relatives about accidents using MEMS sensors to detect sudden vibrations during accidents. Ultrasonic sensors were also employed for distance calculations, enabling accurate determination of accident locations and facilitating swift emergency response.

Pooja Shindalkar et al. [12] developed an Arduino-Based Vehicle Accident Detection System, which utilized an accelerometer to detect vehicle vibrations during accidents. Upon detection of an accident, the system triggered a signal to the microcontroller, which then employed GSM and GPS modems for accident detection and notification. This system aimed to provide real-time alerts to emergency services and concerned parties, enabling timely intervention and assistance.

Priyanka et al. [16] proposed an Accident Alert and Vehicle Tracking System designed for early accident detection using vibration sensors. The system promptly notified a central emergency dispatch server and dispatched the nearest ambulance based on GPS coordinates. Components such as Raspberry Pi, Vibration Sensors, GPS, and GSM modules were utilized for accident detection, ensuring rapid response to accidents and minimizing potential fatalities.

Driver drowsiness detection has also been a focal point of research efforts aimed at preventing accidents caused by driver fatigue. Various methods and technologies have been explored to detect and mitigate drowsiness among drivers. One such approach is eye-tracking-based driver drowsiness monitoring and warning systems, as discussed by researchers [3]. These systems continuously monitor drivers' eyes and utilize image processing algorithms to detect signs of fatigue, such as microsleeps lasting 2 to 3 seconds. Additionally, ultrasonic sensors are employed to monitor distance and warn drivers of obstacles, further reducing the risk of accidents [4].

Another study examines the effectiveness of existing drowsiness detection methods and proposes a hybrid approach combining physiological and other measures to determine driver drowsiness accurately [5]. The study highlights the importance of timely warnings to prevent accidents caused by driver fatigue, emphasizing the need for consideration of individual differences in drowsiness detection methods. Camera-based detection methods are

identified as particularly useful for real-world driving scenarios, offering non-intrusive yet effective means of monitoring driver alertness [5].

In conclusion, the research and development efforts discussed above underscore the importance of leveraging technology to enhance road safety and mitigate the devastating impact of vehicular accidents. From IoT-based accident prevention and tracking systems to driver drowsiness detection technologies, these initiatives offer innovative solutions to address various challenges associated with road safety. By fostering collaboration between researchers, engineers, policymakers, and other stakeholders, these efforts have the potential to significantly reduce the incidence of accidents and save countless lives on the world's roads.

## 3. METHODOLOGY

### i) Proposed System:

In recent years, technological advancements have revolutionized transportation, making vehicles more efficient and sophisticated. However, despite these improvements, road accidents continue to pose a significant threat, often resulting in tragic consequences, especially in remote areas where rescue operations may be delayed. To address this issue and reduce the incidence of fatalities, a cost-effective automated accident detection system has been proposed.

This system is designed to promptly identify accidents and send notifications via SMS to concerned relatives, providing them with precise GPS coordinates of the accident location. It consists of both hardware and software components. The hardware module includes a controller board equipped with sensors and GPS, which is installed in the vehicle. Meanwhile, the software component comprises an Android application installed on the user's phone. Experimental results have demonstrated the effectiveness of this system in accurately detecting accidents and notifying relevant parties in a timely manner.

### ii) Circuit Diagram:

The controller used in this project is Arduino which is used for controlling all the modulesin the circuit. The two major parts other than controller is GPS module which is used as a receiver and other module is GSM. To receive the coordinates of the vehicleGPS moduleis used and GSM will send the received coordinates to the user through SMS. There is an additional LCD which is used for displaying status message or coordinates. When a person is driving the vehicle met with an accident then the vibrations of the vehicle is received by the vibration sensor and the sensor acts as a accident detection module which further send the information to the micro controller and the location of the vehicle is received through GPS module and the coordinates of the vehicle is send to the GSM module. The received information is send to arduino uno. The received coordinate’s information is collected andis send to the respected person through SMS.

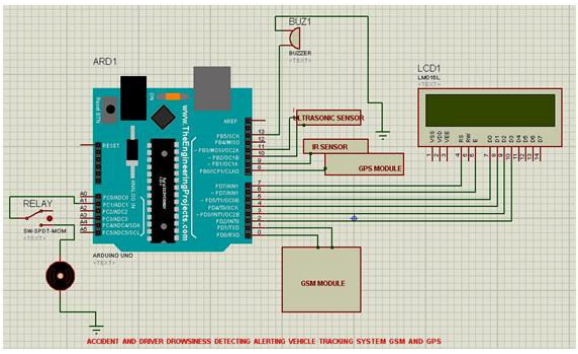

Fig 1 Circuit Diagram

Initially vehicle starts by ignition key. After ignition key activates Arduino checks alcohol sensor and accident sensor (limit sensor). If anyone sensor activates then motor (Engine) will be OFF. If alcohol sensor, accident sensor not activated and ignition key ON then motor (Engine) will be ON. Sensors data will be displayed on LCD. SMS will be sending when any sensor activated. While sending SMS Arduino sends GPS values to track vehicle position. Buzzer will be ON when any sensor gets activated. When Vehicle is in running mode we can get location by sending request SMS to modem.

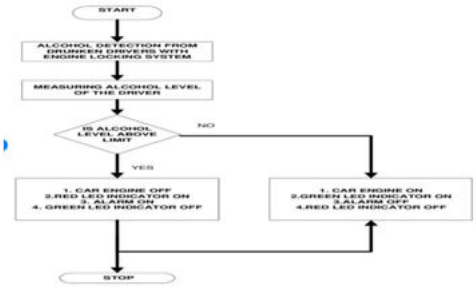


Fig 2 Flow Chart

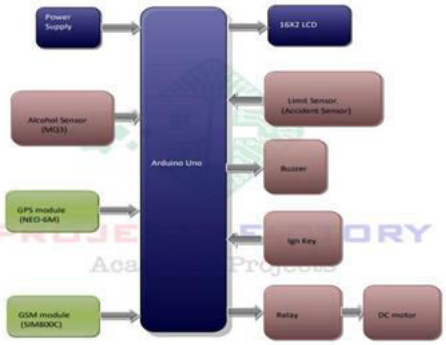


Fig 3 Proposed Architecture

The system architecture incorporates an Arduino Uno microcontroller as the central processing unit, interfaced with GSM and GPS modules for communication and location tracking, respectively. Additionally, an MQ3 alcohol sensor detects alcohol levels, while limit sensors provide input for monitoring vehicle parameters. A buzzer alerts users to critical events, while a relay controls external devices. Furthermore, a DC motor may be integrated for specific applications. This comprehensive setup enables real-time monitoring of vehicle conditions and facilitates timely responses to potential hazards or emergencies.

**iii) Component Used:**

**1. Arduino Uno:**

The Arduino Uno serves as the brain of the project, acting as a microcontroller unit (MCU) to control and coordinate various components. It interfaces with sensors, modules, and actuators, executing programmed instructions to manage the system's functionality. Its versatility and ease of programming make it an ideal choice for projects requiring real-time control and data processing. In this project, the Arduino Uno receives inputs from sensors such as the MQ3 alcohol sensor and limit sensors, processes the data, and triggers appropriate actions based on predefined logic. It also communicates with external devices like the GSM module to send alerts and the GPS module to track the vehicle's location. Overall, the Arduino Uno plays a crucial role in orchestrating the system's operations and ensuring efficient performance.

**2. GSM Module:**

The GSM (Global System for Mobile Communications) module enables the system to communicate with mobile networks, facilitating SMS alerts and data transmission. It provides a means of sending notifications to concerned parties, such as

emergency contacts or authorities, in the event of an accident or hazardous situation. Integrated with the Arduino Uno, the GSM module can send text messages containing critical information, such as the vehicle's GPS coordinates and status, ensuring prompt response and assistance. Additionally, it may support other communication functionalities, such as voice calls or data transmission, depending on the project's requirements. Overall, the GSM module enhances the system's capability to relay important data in real-time, contributing to improved safety and responsiveness.

**3. GPS Module:**

The GPS (Global Positioning System) module is essential for accurately determining the vehicle's location and tracking its movements in real-time. It receives signals from satellites to calculate precise geographic coordinates, including latitude and longitude. In this project, the GPS module interfaces with the Arduino Uno to provide location data, enabling the system to monitor the vehicle's position and trajectory. This information is crucial for various applications, such as accident detection, navigation, and fleet management. By integrating the GPS module, the system can relay accurate location information to users or authorities, facilitating timely responses to emergencies or incidents. Overall, the GPS module enhances the system's functionality by enabling reliable location tracking and enhancing situational awareness.

**4. MQ3 Alcohol Sensor:**

The MQ3 alcohol sensor detects the presence of alcohol vapors in the surrounding environment. It is commonly used in projects aimed at preventing drunk driving or monitoring alcohol consumption levels. In this project, the MQ3 sensor is integrated into the system to provide a safety feature that alerts users to potentially hazardous situations. By detecting alcohol levels, the sensor can trigger alarms or notifications to warn individuals about the risks of driving under the influence. This proactive approach helps promote responsible behavior and reduces the likelihood of accidents caused by impaired driving. The MQ3 alcohol sensor plays a crucial role in enhancing the safety and reliability of the system, contributing to its overall effectiveness in mitigating road accidents and ensuring user safety.

**5. DC Motor:**

The DC motor is an electromechanical device that converts electrical energy into mechanical motion. In this project, the DC motor may serve various purposes, depending on the specific application requirements. For example, it could be used to actuate physical mechanisms such as door locks or window controls in response to certain events detected by the system. Additionally, the motor might be employed to trigger emergency systems like airbag deployment or vehicle immobilization in critical situations. By integrating the DC motor into the system, it enhances the project's functionality by enabling physical actions or responses based on programmed logic. Overall, the DC motor adds versatility to the system, allowing it to interact with the vehicle or its surroundings in a dynamic manner, thereby enhancing safety and security measures.

**6. Buzzer:**

The buzzer is an acoustic signaling device that produces audible alerts or alarms when activated. It is commonly used in applications requiring immediate attention or notification of specific events. In this

project, the buzzer serves as an auditory indicator to alert users or nearby individuals to critical conditions or emergencies. For instance, it may emit warning tones in response to detected alcohol levels exceeding a predetermined threshold, indicating the risk of drunk driving. Similarly, the buzzer could sound alarms during accident detection to attract attention and prompt rapid response from bystanders or emergency services. By incorporating the buzzer into the system, it enhances situational awareness and responsiveness, ensuring that users are promptly notified of potential hazards or safety concerns. Overall, the buzzer plays a vital role in enhancing the effectiveness of the project by providing audible cues for immediate action or attention.

**iv) Implementation:**

The methodology for implementing the accident detection and notification system involves integrating the Arduino Uno microcontroller with various components, including the GSM module, GPS module, MQ3 alcohol sensor, buzzer, limit sensor, relay, and DC motor.

Firstly, the Arduino Uno serves as the central processing unit, receiving input from the sensors and controlling the output devices based on programmed logic. The GSM module enables communication with mobile networks, allowing the system to send SMS alerts. The GPS module provides accurate location tracking, essential for identifying the accident's location. The MQ3 alcohol sensor detects alcohol vapors, helping to prevent drunk driving incidents.

Additionally, the buzzer provides audible alerts, the limit sensor monitors vehicle parameters, the relay controls external devices, and the DC motor may be used for specific applications like door locks or emergency systems.

The methodology involves connecting these components to the Arduino Uno, programming the microcontroller to read sensor data, process information, and trigger appropriate actions. Testing and validation are crucial steps to ensure the system functions as intended and effectively detects accidents, notifies concerned parties, and enhances road safety.

## 4. EXPERIMENTAL RESULTS

The proposed system deals with the accident alerting and detection. Arduino is the heart of the system which helps in transferring the message to different devices in the sys- tem. Vibration sensor will be activated when the accident occurs and the information is transferred to the registered number through GSM module. Using GPS the location can be sent through tracking system to cover the geographical coordinates over the area. The accident can be detected by a vibration sensor which is used as major module in the system.

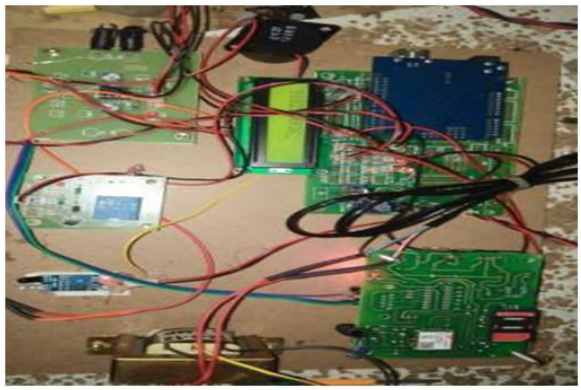

Fig 4 Hardware Kit Image

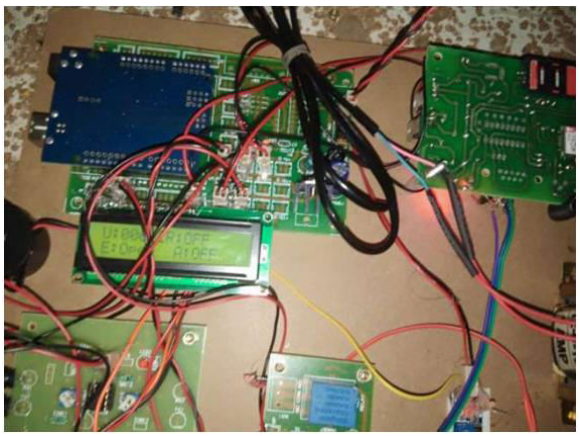

Fig 5 Accident Detected time indicated in LCD

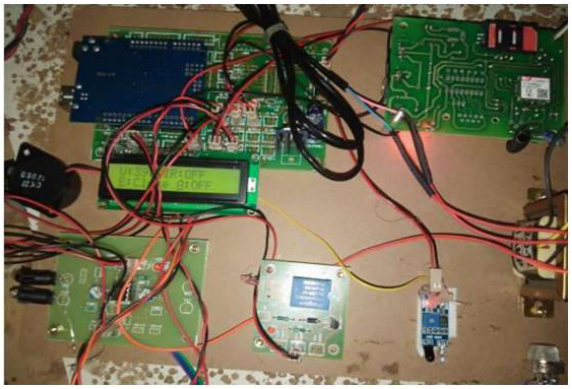

Fig 6 Eyes closed indication

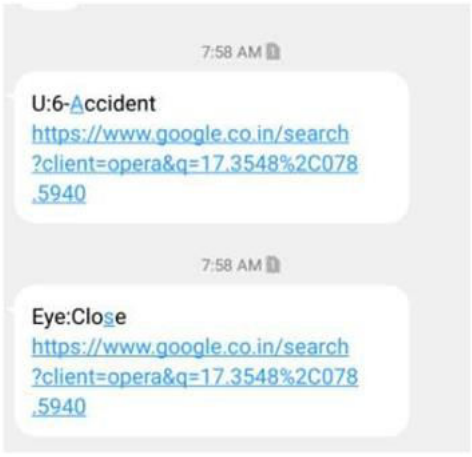


Fig 7 Ultrasonic sensor accident detection in mobile

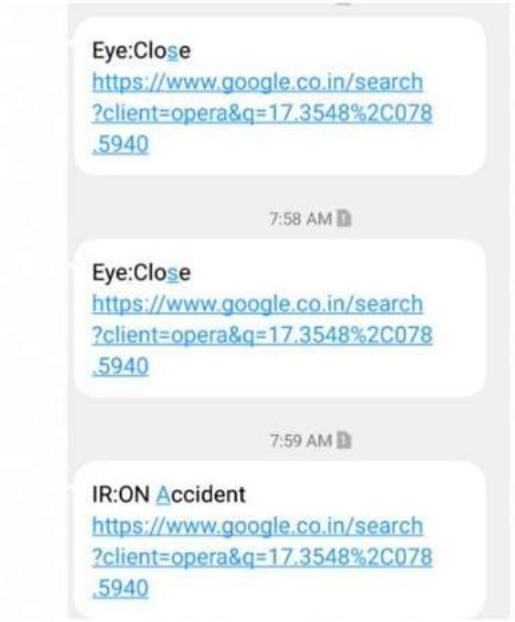


Fig 8 Eyes closed indication and IR sensor accident indication

## 5. CONCLUSION

The proposed programmed accident identification system represents a potential life-saving solution for individuals involved in road accidents. It plays a crucial role in reducing the mortality rate associated with such incidents. Notably, the system is designed to be user-friendly, ensuring that even non-technical individuals can utilize it without difficulty. Comprising both hardware and software components, the system features accident identification sensors controlled by a PICO board, which is installed within the vehicle. On the other hand, the software component consists of an Android mobile application installed on the driver's smartphone, providing detailed mapping functionality. The key advantages of this system include its low cost, user-friendly interface, and enhanced security. By promptly detecting accidents and providing accurate location information, it facilitates swift emergency responses,

thereby minimizing the severity of injuries and reducing fatalities resulting from road accidents. Overall, the implementation of this system holds the potential to significantly mitigate the adverse impacts of road accidents on individuals and communities.

## 6. FUTURE SCOPE

In future work, enhancing the accuracy of accident detection and reducing false positives can be achieved by exploring activity recognition using smartphone sensors to distinguish between driving, walking, and running. Additionally, integrating a voice recognition module can differentiate between airbag deployment and ambient noise, further improving system reliability and reducing false alarms. These advancements would enhance the effectiveness of the proposed system in accurately identifying accidents and ensuring timely responses.

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