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Accident Detection, Alert and Tracking System

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ABSTRACT

Traffic accidents are among the leading causes of death and injury globally, with road accidents being a major public safety issue, especially in countries like India. In India, over 1.5 lakh people lose their lives every year due to accidents, making it a critical concern for public health and safety. The high number of fatalities highlights the urgent need for measures to reduce road accidents and their impact on people's lives. The causes of these accidents are varied but often alcohol consumption. This paper represents a unique Internet of Things (IoT)- based system designed to detect accidents, detect alcohol, and give alerts to a person who cannot drive and emergency responders in real-time. The proposed system utilizes multiple sensors, including motion, ADXL, and alcohol sensors, PIR sensors to identify dangerous situations and provide immediate alerts. When an accident happens, the system utilizes GPS (Global Positioning System) and GSM (Global System for Mobile Communications) modules to pinpoint the vehicle's precise location and send out emergency alerts to pre-registered numbers, such as family members, friends, or emergency services. Additionally, the system proactively alerts if the driver's alcohol consumption is detected. This proactive mechanism aims to reduce accidents by offering early warnings and ensuring timely assistance during accidents. The design and operation of the system are discussed in detail. This paper also inspects the future capacity of integrating these technologies with autonomous vehicles for greater road safety.

KEYWORDS: GPS, GSM, Traffic Accidents, Vehicle Location, Alert System, Alcohol Sensor, PIC Microcontroller, IOT

1. INTRODUCTION

In India, road accidents claim a life every four minutes, with around 1.5 lakh deaths annually.[1] This alarming rate continues to rise due to the increasing number of vehicles on the road. One major cause of accidents is drunk driving, which contributes to 78.4% of incidents, with alcohol consumption being a key factor in many accidents.[2] The problem is worsened by the fact that the current traffic system relies mostly on manual methods for detecting drunk drivers and accident reporting.[3] To address this, a new system has been proposed that alerts drivers if their blood alcohol level exceeds 80mg per 100ml. The system uses various sensors such as motion, alcohol, and axis sensors to monitor the driver's condition. In case of an accident, the system uses GPS and GSM technology to send the location of the accident to emergency services through [4] a text message. The goal of this system is to quickly locate the accident site and provide immediate assistance. The microcontroller at the heart of the system plays a crucial role, coordinating the sensors and communication modules. When an accident is detected, such as through a sudden change in acceleration, the system sends an alert to register [5] mobile numbers. This helps ensure that emergency teams can respond quickly.[6] The system also relies on internet connectivity to function properly. As accident rates continue to rise, this method provides a promising solution to reduce the number of lives lost due to alcohol-related accidents. The system is designed to be easy to implement in vehicles, using a combination of sensors, a microcontroller, GPS, GSM, and other components to improve road safety.

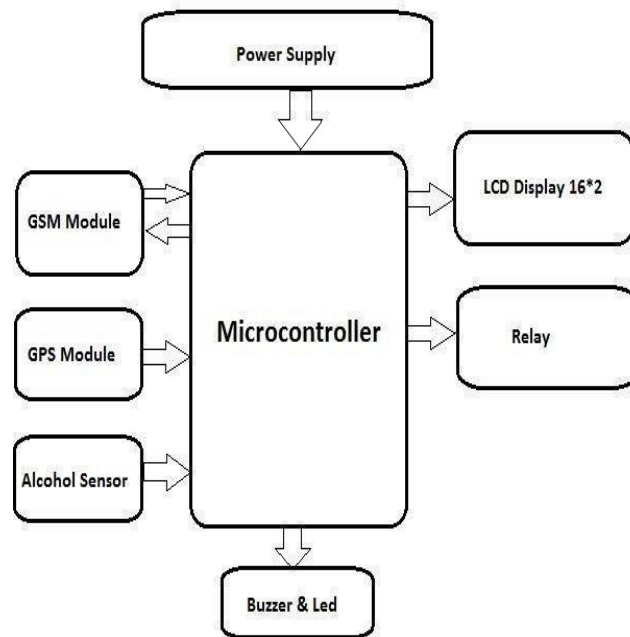


Figure 1: Block diagram of the Accident Detection, Alert and Tracking System

2. HARDWARE COMPONENTS

Alcohol Sensor: Monitors the breath of the driver for alcohol content.

ADXL Sensor (Accelerometer): Detects sudden changes in vehicle acceleration, indicating a possible accident.

PIC Microcontroller: Central unit for processing sensor data and managing communication with other components.

GPS Module: Tracks the exact geographical location of the vehicle.

GSM Module: Sends out emergency alerts and location information to pre-registered contacts.

Buzzer: Provides auditory alerts to the driver. **PIR Sensor:** Detects abnormal vehicle movement and impacts.

Relay and Motor: Used to control vehicle operation and safety measures like engine shutdown if alcohol is detected. Below is a figure of components fig (2).

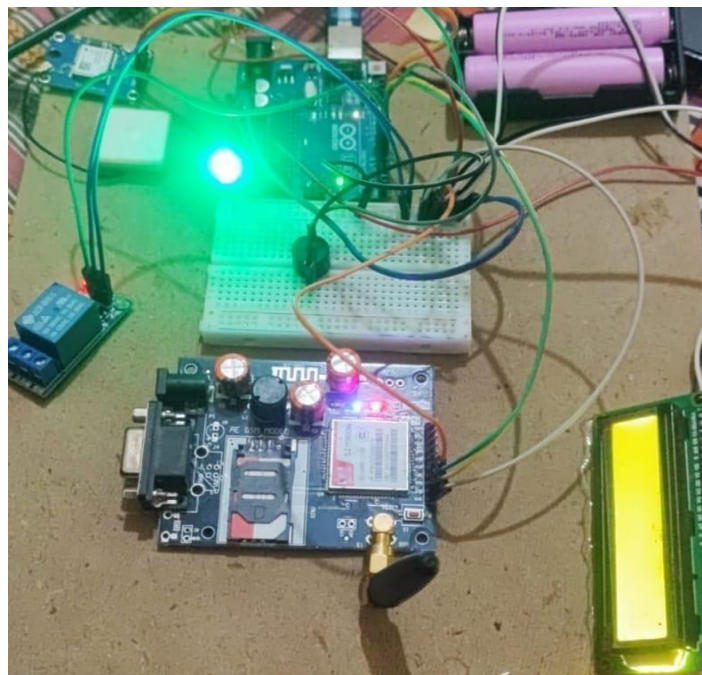


Fig 2: Components of Accident Detection, Alert and Tracking System

3. PROPOSED METHODOLOGY

3.1 Motion and Accident Detection

The motion sensor module is a crucial component in an accident detection, alert, and tracking system-based project. To detect accidents based on the vehicle's movement and sudden impact and send location-based alerts to emergency services. And the components are used like PIR sensor (Accelerometer) and Buzzer. And PIR sensor is use for Measures acceleration changes and helps detect abnormal vehicle movement or sudden deceleration, indicating an accident. or Buzzer is use for Alerts the driver immediately if an accident is detected.

The motion sensor module is designed to detect a wide range of motion, from slight vibrations to sudden impacts. In addition to detecting accidents, the motion sensor module can also provide valuable data for tracking the location and movement of vehicles or assets. This information can be used to track the location and movement of vehicles or assets in real-time, providing valuable insights for logistics, transportation, and asset management. The benefits of using a motion sensor module in an accident detection, alert, and tracking system are numerous.[7] For example, the system can provide improved road safety by detecting accidents and sending alerts to emergency services. The system can also provide enhanced emergency response times by providing real-time location and movement data. Additionally, the system can provide increased asset security and tracking efficiency by providing real-time location and movement data. Furthermore, the motion sensor module can also provide valuable insights for vehicle maintenance and diagnostics. In terms of implementation, the motion sensor module can be integrated with other components, such as GPS modules and microcontrollers.

The data from the motion sensor module can be processed and analyzed using algorithms and machine learning techniques Its applications are numerous, and it has the potential to revolutionize the way we approach road safety, emergency response, and asset tracking.

The motion sensor module can also be used in various other applications, such as industrial automation, aerospace, medical devices, and consumer electronics. In industrial automation, the motion sensor module can be used to monitor the movement and orientation of industrial equipment, such as robots and conveyor belts. In aerospace, the motion sensor module can be used to monitor the movement and orientation of aircraft and spacecraft. In medical devices, the motion sensor module can be used to monitor the movement and orientation of medical devices, such as prosthetic limbs and wheelchairs. In consumer electronics, the motion sensor module can be used to monitor the movement and orientation of consumer electronics, such as smartphones and gaming controllers. In conclusion, the motion sensor module is a versatile and powerful tool that can be used in a wide range of applications, from accident detection and tracking to industrial automation and medical devices. Its ability to detect changes in acceleration, orientation, rotation, and magnetic field makes it an ideal solution for many applications.

3.2 Alcohol Detection

The alcohol sensor module is a crucial component in an accident detection, alert, and tracking system-based project. This module utilizes sensors to detect the presence of alcohol in a driver's breath or blood and measures the Blood Alcohol Concentration (BAC) levels. And the main purpose of Alcohol detection that detect alcohol consumption by the driver and prevent the vehicle from starting if the alcohol level is above a predefined threshold. And the components are Alcohol Sensor that detects the concentration of alcohol in the driver's breath. It works by measuring the chemical reaction between alcohol molecules and the sensor's material. And LCD Display and Buzzer that Alerts the driver visually and audibly if alcohol consumption is detected. The main operation of this module When the alcohol sensor detects a high concentration of alcohol, it sends a signal to the microcontroller. The microcontroller activates the relay to prevent the vehicle from starting, and the buzzer sounds an alarm [8].

The LCDs a message about alcohol detection data provided by the alcohol sensor module is essential in determining if a driver is intoxicated, and provides valuable insights for accident prevention, alert systems, and tracking systems. The alcohol sensor module is designed to detect more than 90 PH amounts of alcohol in a driver's system. In terms of implementation, the alcohol sensor module can be integrated with other components, such as GPS modules, and microcontrollers. The data from the module can be processed and analysed using advanced algorithms and machine learning techniques for more accurate results.

The system can also be designed to provide real-time alerts and notifications to emergency services and stakeholders. while alcohol wafers smelled by the sensor. Sensor sends the input voltage to microcontroller. If alcohol levels exceed the set limit, the system will immediately lock the engine and activate a buzzer. This system helps reduce accidents by monitoring drivers' behaviour on the road. So that we can avoid accidents.

Overall, the alcohol sensor module is a powerful tool for detecting intoxicated drivers, preventing accidents, and providing valuable insights for fleet management and vehicle maintenance. Its applications are numerous, and it has the potential to revolutionize the way we approach road safety and emergency response. The alcohol sensor module can also be used in various other applications, such as industrial automation, aerospace, medical devices, and consumer electronics. In conclusion, the alcohol sensor module is a versatile and powerful tool that can be used in a wide range of applications, from accident detection and prevention to industrial automation and medical devices. Its ability to detect the presence of alcohol in a driver's system makes it an ideal solution for many applications.

3.3 Axis Based Accident Detection

The axis sensor module is a crucial component in an accident, alert, and tracking system-based project. This module utilizes accelerometer and PIR sensors to detect changes in acceleration, orientation, and movement.[9] The data provided by these sensors is essential in determining the occurrence of an accident, sending alerts to emergency services, and tracking the location and movement of vehicles. The axis sensor module typically consists of a combination of sensors, including accelerometers. Accelerometers measure the acceleration of an object in three dimensions, providing data on the x, y, and z axes.

The benefits of using an axis sensor module in an accident, alert, and tracking system are numerous. For example, the system can provide improved road safety by detecting accidents and sending alerts to emergency services. The system can also provide enhanced emergency response times by providing real-time location and movement data. By analysing the data from the accelerometers, the system can detect changes in vehicle performance, such as changes in acceleration or orientation. In terms of implementation, the axis sensor module can be integrated with other components, such as GPS modules and microcontrollers.

The data from the axis sensor module can be processed and analysed using algorithms and machine learning techniques. The system can also be designed to provide real-time alerts and notifications to emergency services and stakeholders [10]. The axis sensor module can also be used in various other applications, such as:

Industrial automation: The axis sensor module can be used to monitor the movement and orientation of industrial equipment, such as robots and conveyor belts.

Aerospace: The axis sensor module can be used to monitor the movement and orientation of aircraft and spacecraft [11].

Medical devices: The axis sensor module can be used to monitor the movement and orientation of medical devices, such as prosthetic limbs and wheelchairs.

Consumer electronics: The axis sensor module can be used to monitor the movement and orientation of consumer electronics, such as smartphones and gaming controllers.

3.4 GSM/GPS

The GSM/GPS sensor module is a crucial component in an accident detection, alert, and tracking system-based project. This module uses GSM (Global System for Mobile Communications) and GPS (Global Positioning System) technologies to offer location details and send alerts through SMS. The module enables real-time tracking and monitoring of vehicles or assets, making it an ideal solution for a wide range of applications, including accident detection and alert systems. The GSM/GPS sensor is designed to provide accurate and reliable location information, even in areas with limited or no GPS coverage.

The module uses a combination of GPS and GSM technologies to determine the location of a vehicle or asset and can provide location information in real-time. The module can also send alerts via SMS, allowing users to receive notifications in the event of an accident or other emergency. And the main purpose of this module is providing real-time location information and SMS of the vehicle in case of an accident. And we use components are GPS Module that Provides precise location data (latitude and longitude) of the vehicle. And second component is GSM Module (SIM900) that Sends SMS messages with location data (latitude and longitude) to the pre-registered phone numbers and third one is SIM Card that required for the GSM module to connect to mobile networks and send text messages.

One of the primary applications of the GSM/GPS sensor module is in accident detection and alert systems. In the event of an accident, the module can detect the impact and send an alert to emergency services.

The alert can include information such as the location of the accident. This information can be used by emergency responders to quickly respond to the accident and provide assistance to those in need. In terms of implementation, the GSM/GPS sensor module can be integrated with other components, such as accelerometers and microcontrollers. [12] The data from the module can be processed and analysed through algorithms and machine learning methods.

The system can also be designed to provide real-time alerts and notifications to emergency services and stakeholders. [13] The GSM/GPS sensor module is a powerful tool for providing location information and alerts in a wide range of applications, from accident detection and vehicle tracking to asset monitoring and emergency response. Its ability to provide accurate and reliable location information, even in areas with limited or no GPS coverage, makes it an ideal solution for many applications.

Here's a table outlining the modules used in the IoT-based Accident Detection, Tracking, and Alert System. This table breaks down the various components and functions of each module in the system Table (1). Each module serves a specific purpose within the overall IoT-based accident detection, alert, and tracking framework.

Table (1): Table of Modules, Features and Function

Modules Name	Components/ Features	Function
Accident Detection Module	ADXL Sensor, PIR Sensor, Buzzer, LCD Display	Detects the sudden changes or impact, identifies accidents, and alerts to the driver.
Alcohol Detection Module	Alcohol Sensor, LCD Display and Buzzer	Detects alcohol concentration in the driver's breath and trigger alerts.
GPSTracking Module	GPS Module	Track the vehicle exact location in real time.
GSM Module	GSM Module (SIM900), SIM Card	Send emergency alerts with vehicle location data to pre-registered number.
Display and Alert Module	LCD Display, Buzzer	Display system status, warning and the vehicle's location and also provide alerts.
Motion Detection Module	PIR sensor, Buzzer	Detects abnormal vehicle movement and sudden Impact, alert.

4. RESULTS AND DISCUSSION

The proposed system was tested under various conditions, including simulated accidents and alcohol detection scenarios. The results confirmed that:

1. The ADXL sensor successfully [14] detected sudden accelerations and impacts, triggering alerts to emergency contacts.
2. The alcohol sensor detected alcohol concentrations and alerted the driver before they could start the vehicle or if they were impaired while driving.
3. The GPS module accurately determines the location of the vehicle, providing precise coordinates even in urban environments with obstacles.
4. The GSM module successfully transmitted alerts to the registered numbers, ensuring that emergency services were notified without delay.

In each test case, the system demonstrated real-time accident detection, alcohol consumption reduces the time it takes for emergency services to respond to an accident, improving survival chances and minimizing injuries.

5. CONCLUSION

In conclusion, this research paper presented an IoT-based Accident Detection, Alcohol Alert, and Tracking [15] System that combines real-time accident detection with alcohol consumption monitoring and location tracking. The use of ADXL accelerometers, alcohol sensors, GPS, and GSM modules provides a comprehensive, automated solution for enhancing road safety. The system is fully automated, requires minimal human intervention, and operates efficiently under various conditions. Future work will focus on expanding the system's capabilities to integrate with autonomous vehicles and enhancing the network connectivity to work in remote locations.

6. FUTURE

In the future, several enhancements can be made to improve the project and extend its functionality. One area to focus on is integration with advanced AI and machine learning to predict accidents based on historical and real-time data. And will focus on expanding the system's capabilities to integrate with autonomous vehicles and enhancing the network connectivity to work in remote locations.

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