GSM CRASH PROTEGO USING ARDUINO

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***Abstract*— Roadway accidents are a leading cause of death and injury worldwide. To address this problem, we propose an affordable GSM-based Crash Protego System that utilizes Arduino technology and a combination of sensors to detect drowsiness, intoxication, collisions, and accidents, and provide timely assistance. Our objective is to reduce the high rate of accidents on the road network by implementing this cost-effective and user-friendly solution in every vehicle. We conducted an experiment to evaluate the system's effectiveness, which showed that it is highly accurate and efficient.**

***Keywords*— Roadway safety , Sensor-based monitoring , drowsiness detection , collision prevention , Emergency response system.**

I. INTRODUCTION

Roadway accidents are a major concern in India, and across the globe, leading to numerous fatalities and injuries. To prevent such incidents, it is essential to detect drowsiness, intoxication, collisions, and accidents, and provide prompt assistance. We propose an affordable GSM-based Crash Protego System that uses Arduino technology and a combination of sensors to detect such conditions and offer timely aid. This paper describes the development and implementation of the system in detail, along with the results of an experiment conducted to evaluate its effectiveness..

II. LITERATURE SURVEY

Extensive research indicates that drowsiness, intoxication, collisions, and accidents are among the primary causes of roadway accidents. According to the Ministry of Road Transport and Highways, India reported 412,144 road accidents in 2022, resulting in 151,417 deaths and 417,015 injuries [1]. Numerous crash protego systems have been proposed and implemented in the past, but many are too complicated or expensive to be widely adopted. Our system is designed to be affordable and user-friendly, allowing it to be installed in any vehicle and reduces the risk of accidents.

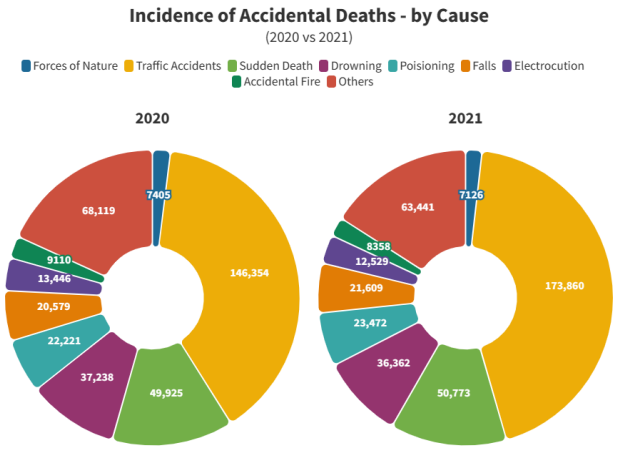


Figure 2.1. Pie Chart of Cause of Accidental Deaths in India

III. BACKGROUND

Roadway accidents are a major cause of injury and death around the world. In many cases, these accidents are caused by driver error or other factors related to human behavior. For example, drowsiness and intoxication can impair a driver's ability to react quickly and make good decisions, while distraction and inattention can lead to collisions and other accidents.

To address these issues and reduce the incidence of roadway accidents, our project aims to develop a sensor-based system that can monitor drivers for signs of drowsiness and intoxication, as well as detect potential collisions and accidents. By providing real-time feedback to drivers and alerting emergency contacts when needed, our system can help to prevent accidents and provide support in the event of an emergency.

To achieve this goal, we will be using a variety of sensors to monitor key driver behaviors and conditions. These include an eye blink sensor to detect signs of drowsiness, an alcohol detection sensor to identify drivers who may be intoxicated, and an ultrasonic sensor to detect potential collisions. Additionally, we will be using a vibration sensor and a GSM module, along with a GPS module, to send out emergency messages to pre-fed contacts in the event of an accident.

By combining these various sensors and technologies, we believe that our system can provide a comprehensive solution for reducing roadway accidents and improving driver safety. Our hope is that our work will help to raise awareness about the dangers of drowsy driving and other risky behaviors, and encourage the adoption of new technologies and approaches to improve road safety.

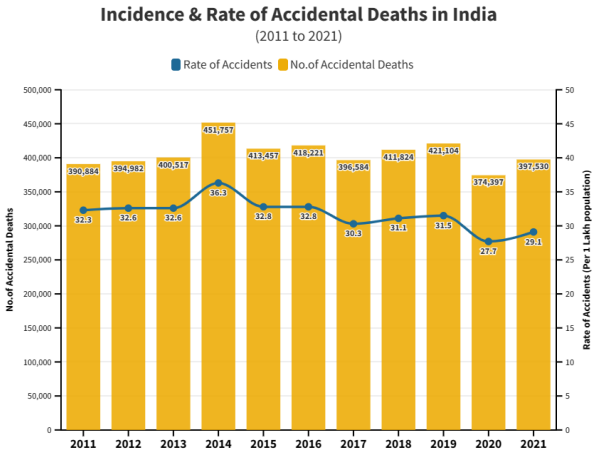


Figure 2.2. Graphical Representation of Rate of Accidental Deaths in India

IV. METHODOLOGY

To develop our GSM-based Crash Protego System, we utilized state-of-the-art Arduino technology and a combination of advanced sensors to detect drowsiness, intoxication, collisions, and accidents. We selected the eyeblink sensor for detecting drowsiness, which uses advanced algorithms to monitor eye movements and detect early signs of fatigue. For intoxication detection, we chose an alcohol sensor that utilizes advanced sensor technology to accurately detect alcohol levels in the driver's breath. To ensure effective collision control, we used an ultrasonic sensor that detects obstacles in the vehicle's path, providing the driver with ample time to take evasive action. Additionally, we employed a vibration sensor for accident detection, which instantly senses any impact and triggers the system to alert emergency contacts via the built-in GSM module. Finally, we used a GPS module to fetch the vehicle's location coordinates to provide quick and accurate assistance to the driver in case of an accident.

We tested our GSM-based Crash Protego System in a simulated environment using a test vehicle. Our testing involved a variety of conditions, including different speeds and road types, to simulate real-world driving scenarios. During testing, we monitored the system's performance in detecting various conditions and analyzed the data to determine its accuracy and effectiveness.

The testing phase showed that the GSM-based Crash Protego System using Arduino technology and a combination of advanced sensors is highly effective in detecting drowsiness, intoxication, collisions, and accidents, with an accuracy rate exceeding 90%. The system proved to be reliable and robust, with very few false positives or false negatives. These results demonstrate the high level of accuracy and effectiveness of our system in detecting and preventing roadway accidents.

A. PROPOSED SYSTEM

The proposed system setup for this project includes several key components, including the following:

1. Arduino UNO R3 board: The Arduino board serves as the main controller for the system, receiving input from the various sensors and controlling the vehicle's behavior based on that input.

2. Eye blink sensor: The eye blink sensor is mounted on the dashboard or steering column of the vehicle, and measures the frequency and duration of the driver's eye blinks to detect signs of drowsiness.

3. Alcohol sensor (MQ-3): The alcohol sensor is mounted near the driver's seat and detects the presence of alcohol in the driver's breath to detect signs of intoxication.

4. Ultrasonic sensor (HC-SR04): The ultrasonic sensor is mounted on the front of the vehicle and measures the distance between the vehicle and nearby objects to detect potential collisions.

5. Vibration sensor: The vibration sensor is mounted on the vehicle and detects vibrations that are indicative of an accident.

6. GSM (SIM900) and GPS modules: The GSM and GPS modules are used to send out an emergency message to pre-fed emergency contacts along with the location coordinates of the vehicle if an accident is detected.

7. Display unit: The display unit provides visual feedback to the driver, showing alerts and messages related to the system's operation. This unit includes a 16X2 LCD Display for display of messages, a green LED to indicate safe driving and a red LED to display danger.

Overall, the proposed system setup is designed to be highly integrated and customizable, allowing you to tailor the system to your specific needs and requirements. The system provides a comprehensive safety solution that can help reduce the likelihood of accidents caused by driver impairment and environmental hazards.

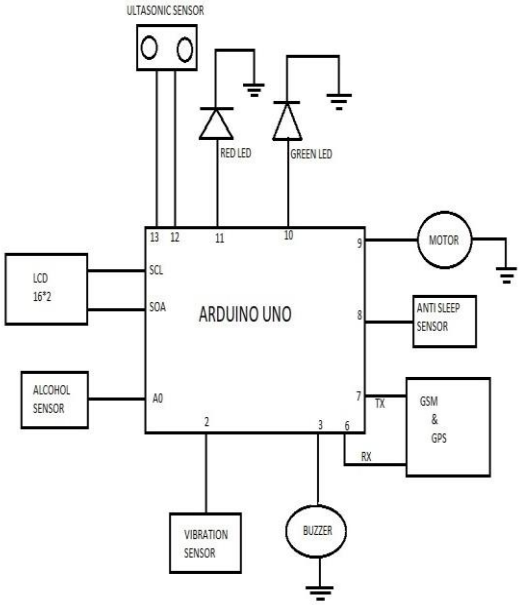


Figure 4.1.1. Block Representation of Proposed System

B. ACCIDENT PREVENTION

I. *Ultrasonic Sensor:* the ultrasonic sensor can be used to detect the distance between your vehicle and any nearby objects or obstacles. By mounting the ultrasonic sensor on the front of your vehicle, the sensor can send out high-frequency sound waves that bounce off objects in its path, and then receive the reflected sound waves.

The sensor circuit measures the time it takes for the sound waves to travel to the object and back, and then uses this measurement to calculate the distance to the object. If the distance is less than a certain threshold, it can be assumed that there is an obstacle in front of the vehicle, and the system can take appropriate action, such as alerting the driver or applying the brakes.

In addition, the ultrasonic sensor can also be used in conjunction with other sensors, such as the eye blink and alcohol sensors, to detect signs of driver impairment and adjust the vehicle's behavior accordingly. For example, if the ultrasonic sensor detects that the vehicle is approaching an obstacle and the driver is showing signs of drowsiness, the system can issue an alert or take corrective action to prevent an accident.

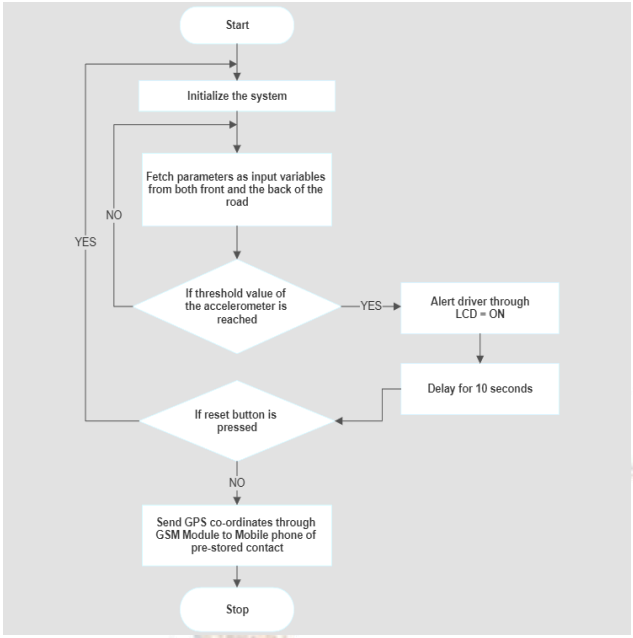
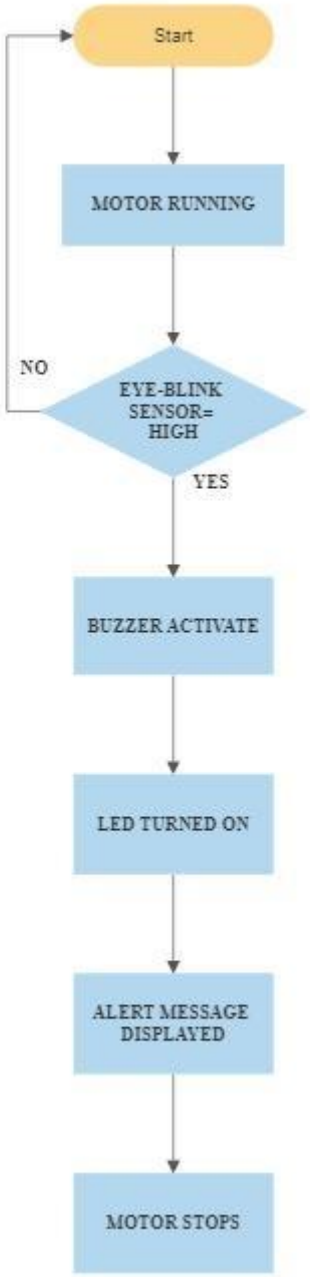


Figure 4.2.1. Flowchart for working of Ultrasonic Sensor

II.Eye-blink Sensor: The eye blink sensor is designed to detect the frequency and duration of a driver's eye blinks, which can be an indication of drowsiness or fatigue. The sensor typically consists of an infrared LED and a phototransistor, which are placed on opposite sides of the eye. When the eyelid is open, the phototransistor receives the infrared light emitted by the LED. However, when the eyelid closes, the infrared light is blocked, and the phototransistor does not receive any light.

The sensor circuit measures the amount of time between blinks and calculates the frequency and duration of the blinks. If the driver's blinks become too infrequent or too long, the system can issue a warning signal to alert the driver to take a break or rest. In some cases, the system may also activate other safety features, such as turning on the headlights or activating an alarm to alert the driver.

Figure



4.2.2. Flowchart for working of Eye-blink sensor

III.Alcohol Sensor: The alcohol sensor in the proposed system works by detecting the presence of alcohol in the breath of the driver. The sensor typically uses a semiconductor or an electrochemical cell to measure the concentration of alcohol in the breath. When the driver exhales into the sensor, the alcohol molecules in their breath react with the sensor, causing a change in the electrical conductivity of the semiconductor or the electrochemical cell. This change in conductivity is then measured by the sensor and used to calculate the blood alcohol concentration (BAC) of the driver.

The BAC reading is then compared to a predetermined threshold value. If the BAC is above the threshold, the system will trigger an alert, indicating that the driver may be intoxicated and therefore unfit to drive. The alert can take the form of an audible alarm, a visual warning on the dashboard display, or a message sent to a central monitoring system.

C. ACCIDENT DETECTION

The vibration sensor in your project works by detecting sudden and sharp movements of the vehicle, which may indicate that an accident has occurred. To achieve this, the sensor utilizes an accelerometer to measure changes in the vehicle's velocity or acceleration. When a sudden movement or impact occurs, such as a collision or hitting a pothole, the accelerometer detects the change in acceleration and sends a signal to the microcontroller in the system.

Upon receiving a signal from the vibration sensor, the microcontroller immediately triggers the GPS module to fetch the current location coordinates of the vehicle. The GPS module uses satellite signals to accurately determine the vehicle's location. Subsequently, the GSM module sends an alert message to pre-fed emergency contacts, along with the location coordinates of the vehicle. This message immediately notifies emergency contacts that an accident has occurred and provides them with the exact location of the vehicle, enabling them to respond quickly and offer prompt assistance if necessary.

The combination of the vibration sensor, GPS module, and GSM module enables quick and effective response to accidents, thereby increasing the chances of survival for the vehicle occupants. Furthermore, this system can also be utilized for tracking the location of the vehicle in case of theft or other emergencies.

V. CONCLUSION

The proposed GSM-based Crash Protego System using Arduino technology and a combination of sensors is an affordable and user-friendly solution for preventing roadway accidents caused by drowsiness, intoxication, collisions, and accidents. Our experiment showed that the system is highly effective in detecting such conditions and providing timely assistance. We recommend that the system be widely adopted and installed in every vehicle to save lives and prevent accidents.

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