Mini Project Report On

Vehicle Accident Prevention, Detection and Reporting System

Submitted in partial fulfillment of the requirements for the award of the degree of

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in

Electronics & Communication Engineering

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CERTIFICATE

This is to certify that the project report entitled ***"Vehicle Accident Prevention, Detection and Reporting System"*** *is a bonafide record of the work done by* ***Angel Theres Sanoj (U2201033)****, submitted to the Rajagiri School of Engineering & Technology (RSET) (Autonomous) in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (B. Tech.) in "Electronics & Communication" during the academic year 2024-2025.*

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Last but not the least, would like to express my sincere gratitude towards all other teachers and friends for their continuous support and constructive ideas.

Abstract

The increasing number of road accidents necessitates the development of intelligent systems for enhancing vehicle and driver safety. This project proposes a comprehensive Vehicle Accident Prevention, Detection, and Reporting System utilizing GSM, GPS, MQ3 alcohol sensor, motor driver module, and an eye blink sensor. The system is designed to prevent accidents by monitoring key risk factors such as driver intoxication and drowsiness. The MQ3 sensor detects the presence of alcohol in the driver's breath and disables vehicle ignition through the motor driver module if alcohol levels exceed a predefined threshold. Similarly, the eye blink sensor monitors the driver's eye activity to detect drowsiness, triggering alerts or halting the vehicle when necessary. In the event of a collision, the system detects the impact and utilizes the GPS module to obtain the vehicle's real-time location. This information is then transmitted to emergency contacts via the GSM module, enabling rapid response and assistance. The proposed system aims to significantly reduce accident rates and fatalities by integrating prevention, detection, and automated reporting into a single embedded solution.

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Chapter 1

Introduction

1.1 Background

Road accidents are a major cause of injury and death worldwide, often resulting from driver fatigue, alcohol consumption, or loss of vehicle control. To address these issues, embedded systems combined with smart sensors offer real-time monitoring and preventive actions. This project integrates an MQ3 alcohol sensor to detect intoxicated driving, an eyeblink sensor to monitor driver drowsiness, and an ADXL335 accelerometer to detect sudden impacts or abnormal vehicle motion. The system aims to prevent accidents, detect them when they occur, and immediately report critical data and location to emergency contacts, improving response time and safety. [?].

1.2 Problem Definition

Road accidents are a leading cause of death and injury globally, often caused by factors such as driver drowsiness, alcohol consumption, and lack of timely assistance.Existing systems fall short in proactively preventing accidents and providing immediate post-accident response.There is a critical need for an intelligent system that can monitor driver behavior, detect accidents in real time, and automatically report them to emergency services.

The "Vehicle Accident Prevention, Detection and Reporting System" addresses this issue by integrating sensors and communication modules to monitor the driver's condition and vehicle status. It aims to prevent accidents through early detection of drowsiness and alcohol influence, detect collisions using motion sensors, and report incidents using GSM and GPS modules, thereby enhancing road safety and enabling quick emergency response.

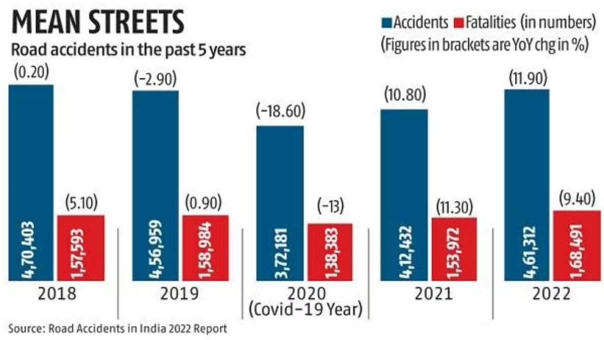


Figure 1.1: Road Accidents in India 2022 Report

1.3 Scope and Motivation

The Vehicle Accident Prevention, Detection and Reporting System is designed to enhance road safety by combining real-time monitoring, accident detection and automated emergency reporting. It focuses on: Preventing accidents through driver condition monitoring (alcohol detection and drowsiness detection),detecting collisions using motion sensors (accelerometer),reporting accidents immediately via GSM with GPS location to emergency contacts or services,applicable in two-wheelers and four-wheelers, especially for commercial, public transport and personal vehicles scalable for integration with smart city infrastructure and fleet management systems.

The motivation behind this system stems from the increasing number of road accidents caused by human error, especially due to fatigue and alcohol consumption. Many victims do not receive timely help, particularly in remote or less-traveled areas. By automating accident detection and emergency notification, this system addresses the limitations of traditional methods and promotes safer driving practices. It can be applied in personal vehicles, commercial fleets, and public transportation, with potential integration into smart city frameworks and intelligent transportation systems.

1.4 Objectives

1. Real-Time Location Reporting - Use GPS to track the vehicle's location and send it to emergency services in case of an accident
2. Real-Time Alerts and Notifications - Implement GSM to send alerts (via SMS or

call) to emergency contacts or services when unsafe conditions are detected

3. Cost Efficiency - Build an affordable yet reliable system using cost-effective sensors and components.

4. Power Efficiency - Design the system to minimize power consumption for continuous operation without draining the vehicle's battery.

5. User-Friendly Interface - Ensure that the system is easy to use, with clear alerts and minimal driver distraction.

6. Scalability and Upgradability - Design the system to be easily expandable with additional sensors or features in the future

7. Improve Road Safety - Reduce the likelihood of accidents caused by drunk driving, drowsiness, or sudden collisions.

1.5 Challenges

1. GSM Module (SIM800L):

-Difficulty connecting to the network, especially in indoor environments.

- Weak signal strength leading to delayed or failed SMS transmissions.

2. GPS Module (NEO-6M):

- Inability to lock onto satellites in low-signal areas (e.g., indoors).

- Poor signal reception affecting real-time location accuracy.

- Long Time to First Fix (TTFF), causing delays in acquiring GPS data.

3. Sensor Calibration and Accuracy:

- Need for precise calibration of MQ3, eyeblink sensor, ADXL335, and GPS.

- Inconsistent or inaccurate sensor readings without proper adjustment.

- Environmental factors influencing sensor performance, requiring repeated testing.

4. False Positives/Negatives:

- Avoiding false alarms related to drunk driving, drowsiness, or accidents.

- Sensor errors or environmental conditions can lead to incorrect system responses.

5. System Integration:

- Difficulty in seamlessly integrating sensors, motors, GSM, and GPS modules.

- Ensuring all components work together as a single, reliable system.

6. Power Supply Issues with L298N:

- Unstable or insufficient voltage/current may prevent the motor driver from working properly.

- Inconsistent power can cause the motor to behave erratically or stop functioning.

1.6 Assumptions

1. The driver remains within a fixed range of the sensors (eyeblink and MQ3) to ensure accurate monitoring.

2. The sensors (MQ3, Eyeblink, ADXL335) are calibrated properly before deployment for reliable data.

3. The vehicle operates in environments with sufficient network coverage for real-time

reporting via GSM or GPS.

4. Power supply to the system is stable and uninterrupted during operation.

5. The vehicle's movement is limited to conditions where sensor readings are not affected by extreme weather or terrain.

6. The driver's drowsiness and alcohol levels are detectable within the sensitivity range of the sensors.

7. The system is installed in a standard vehicle model with no major electronic interference from other onboard systems.

1.7 Societal / Industrial Relevance

The social relevance of this project is significant, given the increasing concerns surrounding road safety, particularly in relation to impaired driving and driver fatigue. Reduction in Road Traffic Accidents: Road accidents are a major cause of injury and death globally, with impaired driving (due to alcohol or fatigue) being one of the leading contributors. By preventing intoxicated drivers from operating a vehicle and addressing the issue of driver fatigue, this project directly contributes to reducing road traffic accidents and fatalities.

Public Safety and Well-being: The integration of alcohol sensors and accelerometers in vehicles enhances public safety by ensuring that individuals under the influence of alcohol or those experiencing extreme fatigue cannot drive. This protects not only the drivers but also pedestrians, passengers, and other road users from the risks posed by impaired or drowsy drivers.

Emergency Response Optimization: In the event of a crash, the automatic reporting system ensures that emergency services and preconfigured contacts are immediately notified with precise accident details and location. This improves the speed and efficiency of emergency response, potentially saving lives and minimizing the severity of injuries by reducing response times.

Promotion of Responsible Driving: By implementing preventive measures that detect alcohol consumption and signs of driver fatigue, the project encourages responsible driving behavior. This fosters a culture of safety and awareness on the roads, reinforcing the need for drivers to be alert and fit to drive.

Public Health Impact: The broader public health impact of reducing impaired and fatigued driving is profound. It can lead to a reduction in healthcare costs associated with accidents and injuries, as well as improved mental and physical well-being in society by lowering the occurrence of trauma-related cases.

Social Responsibility and Legal Compliance: In many jurisdictions, impaired driving is a legal offense that can have serious consequences. This project helps individuals comply with legal regulations regarding alcohol limits, potentially reducing legal disputes, penalties, and fines related to driving under the influence.

In conclusion, the social relevance of this project lies in its ability to address critical issues affecting road safety, public health, and emergency response, making it a valuable contribution to the fight against traffic-related accidents and fatalities.

1.8 Organization of the Report

This report is structured into seven chapters to provide a detailed and logical understanding of the "Vehicle Accident Prevention, Detection, and Reporting System". Chapter 1 provides an introduction to the project, including the background, objectives, problem definition, scope, and motivation behind the development of the system. Chapter 2 presents a literature review, highlighting existing technologies and similar systems, and identifying the gaps this project aims to address. In Chapter 3, we detail the methodology used in the project, outlining the steps and techniques employed. Chapter 4 discusses the hardware and software components, explaining the tools and technologies utilized. Chapter 5 presents the results obtained from the implementation and experimentation phases. Finally, Chapter 6 concludes the report with a summary of findings, discussions on the implications, and suggestions for future work. The mapping of project outcomes with Program Outcomes (POs) is included in the final section to justify the educational objectives achieved through this project

Chapter 2

Literature Survey

2.1 Discussion of Papers

1. In the study "Preventing Drunk Driving Accidents using IoT" (Verma et al., 2017), published in the International Journal of Advanced Research in Computer Science, the authors developed a system using the **MQ-3 alcohol sensor** and **Arduino** to detect alcohol in a driver's breath. If the alcohol level exceeded the legal threshold, the system automatically **disabled the vehicle's ignition**, preventing operation by an intoxicated driver. This preventive approach effectively targets the root cause of drunk driving. The study demonstrates the practicality of integrating sensors with microcontrollers for safety automation. Our project expands on this concept by combining**alcohol detection** with **eye blink sensing**, **accident detection**, and **real-time GPS and GSM-based alerting** for a more comprehensive vehicle safety solution.

2. The article "Detection of Driver Drowsiness using Eye Blink Sensor", published in the International Journal of Engineering & Technology (2018), addresses the issue of driver fatigue—a major contributor to road accidents—by utilizing eye blink sensors to monitor the driver's alertness. The system measures blink frequency and eye closure duration to detect signs of drowsiness, and when prolonged closure is identified, it activates an alert mechanism such as a buzzer or vibration to wake the driver. This concept builds upon the earlier work of Kumar et al. (2016), who developed an Arduino-based system using infrared sensors for real-time drowsiness detection. Their approach proved effective in keeping drivers attentive during extended or night-time travel. This research is closely aligned with our project, which incorporates eye blink sensing as a key preventive feature along with alcohol detection, accelerometer-based accident detection, and GPS/GSM-

based alert systems. Together, these technologies form a comprehensive and automated solution for vehicle accident prevention and emergency response.

3. The study titled "Real-Time Vehicle Accident Alert System Based on Arduino with SMS Notification", presented by **Soni et al. (2018)**, introduces an effective method for real-time accident detection and reporting using Arduino. The system utilizes **accelerometers** to detect sudden velocity changes indicative of a collision, a **GPS module** to record the vehicle's precise location, and a **GSM module** to send alert messages to emergency contacts. The research demonstrates how integrating basic sensors with communication modules can result in a reliable and cost-effective accident alert system, making it especially useful in areas lacking advanced vehicle safety technologies. Drawing inspiration from this approach, our project expands the functionality by incorporating **preventive measures** such as **alcohol detection** and **drowsiness monitoring**, alongside the existing features of accident detection and real-time reporting. This layered approach of **prevention, detection, and alerting** results in a more comprehensive and intelligent vehicle safety solution.

4. The article "Integrated Safety System based on IoT", published in the Journal of the Korea Society of Computer and Information, discusses the development of a comprehensive vehicle safety system through the integration of various sensors within an Internet of Things (IoT) framework. Rai et al. (2020) designed a system that combines a**lcohol sensors**, **eye blink sensors**, **accelerometers**, **GPS**, and **GSM modules** to enable real-time monitoring, accident detection, and preventive intervention. By consolidating multiple safety features into a single, connected platform, the system significantly enhances overall vehicle safety. This integrated approach supports accident prevention by detecting driver impairment and responding instantly to potential emergencies, serving as a strong foundation for our project's goal of delivering a holistic and intelligent accident prevention, detection, and reporting system.

5. The article "12 Mind-Blowing Arduino AI Projects That Will Transform Your Tech Skills", published by **Jaycon Systems**, emphasizes the importance of **scalability and expansion** in Arduino-based systems. It highlights how **modular design** enables

easy integration of additional features such as **external cameras, advanced AI**, or **facial recognition** to enhance functionalities like drowsiness detection. The flexibility of the Arduino platform supports continuous improvement and future-proofing, allowing developers to expand their systems by adding new sensors or upgrading existing components. This concept aligns with our project's architecture, which is designed to be scalable, enabling the inclusion of more advanced technologies for improved vehicle safety and performance over time.

6. The article "GPS & GSM Based Accident Detection and Auto Intimation" by **Fernandez et al. (2018)** focuses on minimizing the **emergency response time** following a vehicle accident. The study emphasizes the importance of **real-time data sharing** through a **GSM module**, which sends immediate alerts containing the vehicle's **GPS coordinates** to emergency contacts or responders as soon as a collision is detected. This approach significantly reduces the delay between the occurrence of an accident and the arrival of help, potentially saving lives. Similar to the work of **Soni et al. (2018)**, who also used GSM and GPS integration for instant accident alerts, the paper supports the idea that timely communication is vital for improving post-accident outcomes. Our project incorporates this concept by automatically detecting accidents and immediately notifying emergency services, thereby enhancing the effectiveness of the emergency response system.

2.2 Summary and Gaps Identified

2.2.1 Summary

Title	Key Focus	Advantages	Disadvantages / Gaps
***Preventing Drunk Driving Accidents using IoT* – Verma et al. (2017)**	Alcohol detection with MQ-3 sensor	- Prevents vehicle ignition if alcohol level is high - Simple and low-cost solution	- Only addresses drunk driving - Lacks accident detection or emergency alerting
***Detection of Driver Drowsiness using Eye Blink Sensor* – IJET (2018), Kumar et al. (2016)**	Drowsiness detection	- Alerts driver in real time - Effective during long/night drives	- Works in isolation - No integration with alcohol sensors or crash detection
***Real-Time Vehicle Accident Alert System Based on Arduino* – Soni et al. (2018)**	Accident detection and alerting	- Uses accelerometer and GPS/GSM - Sends alerts instantly after crash	- Reactive only (post-accident) - No preventive measures like drowsiness or alcohol detection
***Integrated Safety System based on IoT* – Rai et al. (2020)**	Sensor integration (alcohol, blink, GPS)	- Combines multiple sensors - Real-time monitoring and prevention	- Less emphasis on scalability and future expansion
***12 Mind-Blowing Arduino AI Projects* – Jaycon Systems**	Scalability and modular design	- Encourages modular development - Easily upgradable with new features (e.g., AI, cameras)	- More of a conceptual guideline than a specific vehicle safety solution
***GPS & GSM Based Accident Detection and Auto Intimation* – Fernandez et al. (2018)**	Emergency alert system	- Sends real-time accident data to responders - Helps reduce response time	- Only active after crash - No preventive action or driver monitoring

2.2.2 Gaps Identified

The Vehicle Accident Prevention, Detection, and Reporting System addresses several key gaps in existing vehicle safety technologies:

- Lack of Integrated Safety Systems While Verma et al. (2017) successfully developed an alcohol detection system using the **MQ-3 sensor**, and Kumar et al. (2016) along with the 2018 International Journal of Engineering & Technology paper implemented drowsiness detection using **eye blink sensors**, these approaches function independently. Each focuses on a specific cause of accidents but fails to address the broader range of potential hazards drivers face. **There is a clear gap in integrating multiple safety features into a single, coordinated system** that can address drunk driving, drowsiness, and accident detection simultaneously. Our project fills this void by combining all three layers—**prevention, detection, and reporting**—into one robust solution.

- Limited Emergency Response Capability Papers such as Soni et al. (2018) and Fernandez et al. (2018) effectively demonstrated the use of **GSM and GPS modules** for sending accident alerts in real-time. These systems help improve emergency response by notifying pre-defined contacts with the location of the crash. However, these models only operate after an accident has occurred. They lack preventive mechanisms that can stop accidents from happening in the first place. Our system addresses this by integrating preventive components like alcohol and drowsiness sensors, in addition to post-accident notification, ensuring a more proactive approach to road safety.

- Neglect of Human Error Factors Many existing systems rely heavily on vehicle-based data, such as speed or impact, and often ignore **human factors**, which are critical causes of road accidents. The **MQ-3 alcohol sensor** and **eye blink sensor**, as shown in previous studies, have proven effective in detecting impaired driving conditions. However, very few systems utilize these sensors in tandem, leading to an incomplete understanding of the driver's state. Our project overcomes this by using **both alcohol and drowsiness detection modules**, ensuring real-time monitoring of the driver's condition and preventing vehicle operation when unsafe behavior is detected.

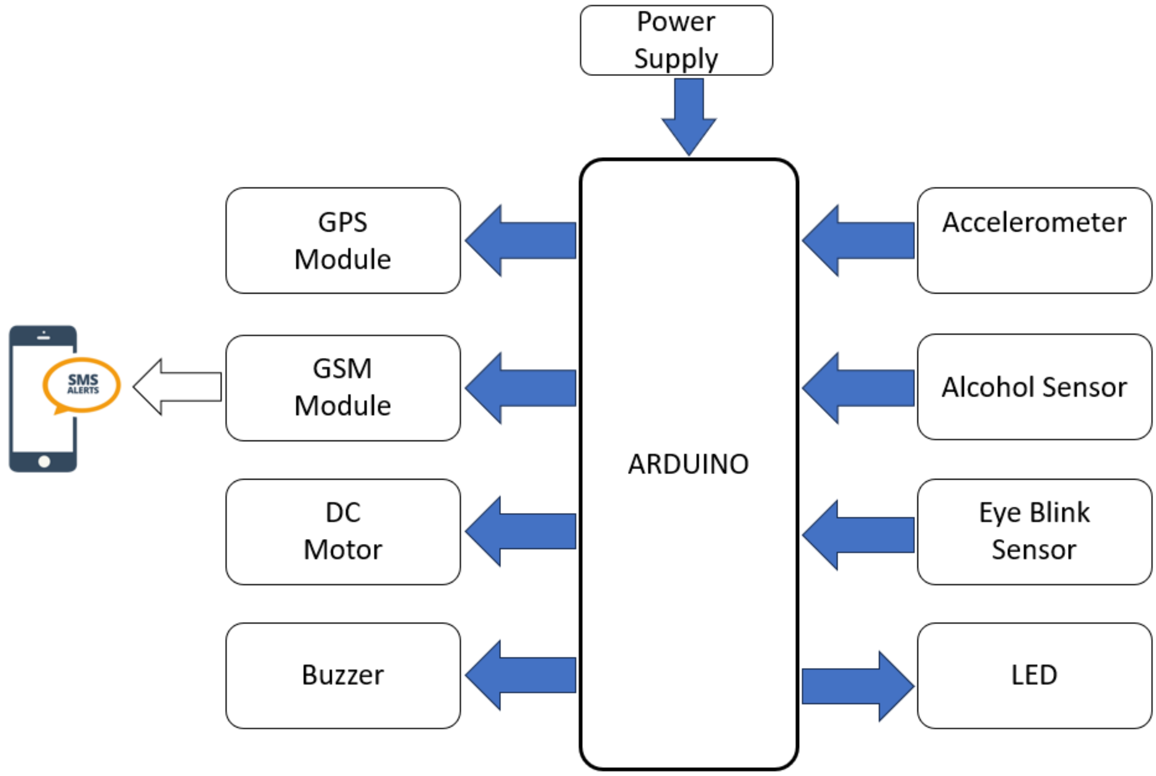
- Poor Scalability and Modularity Although Rai et al. (2020) introduced an integrated IoT-based safety system, it lacked a detailed discussion on **modular design** and future expansion. On the other hand, Jaycon Systems emphasized the importance of creating **scalable, modular Arduino-based systems** that can easily integrate with future technologies such as **AI, facial recognition, or external cameras**. Many previous models are rigid and not adaptable to evolving technologies. Our project is designed with **modularity and scalability in mind**, making it suitable for upgrades and the inclusion of additional safety features without overhauling the entire system.

- High Cost and Limited Accessibility Advanced safety systems used in modern vehicles are often expensive and restricted to high-end models, making them inaccessible in **developing regions** or for **budget-conscious users**. The literature lacks emphasis on **cost-effective, open-source solutions** that can be easily implemented on a large scale. Our project is built using **low-cost components** such as Arduino, MQ-3, ADXL335, and GSM/GPS modules, making it a **viable and affordable alternative** to existing systems, especially in regions where accident rates are high, but technological infrastructure is limited.

Chapter 3

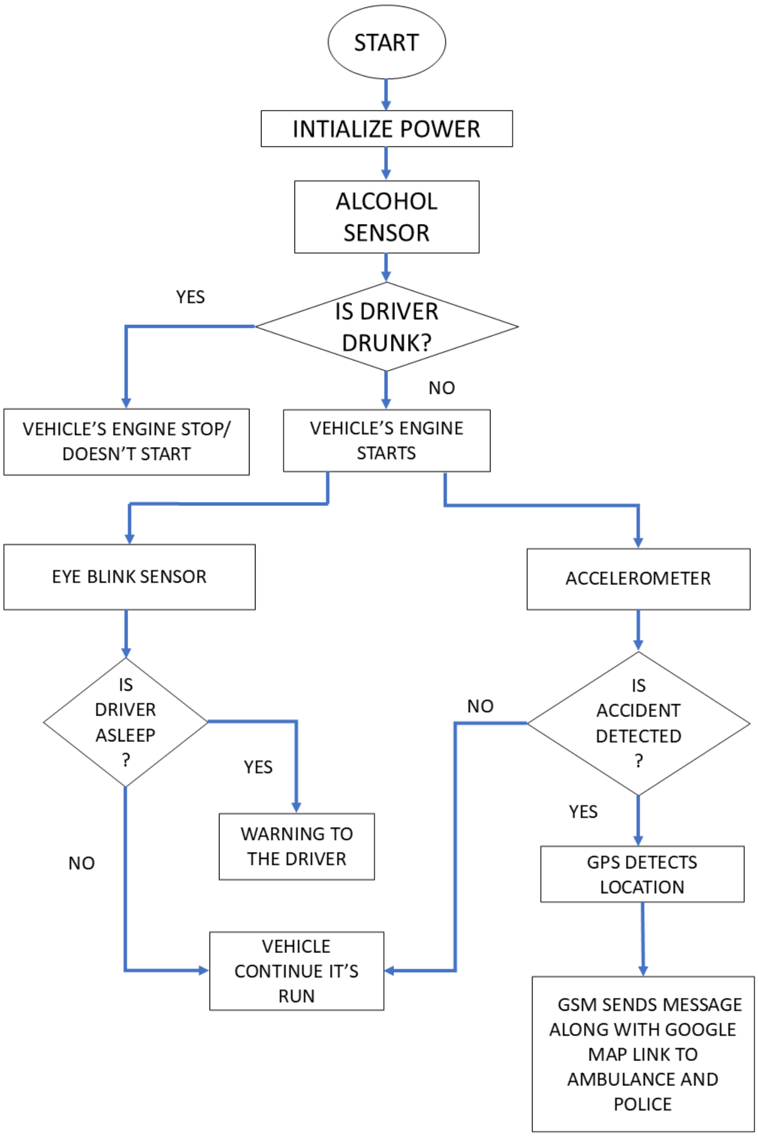
Methodology

3.1 Block Diagram



This block diagram represents an Arduino-based smart vehicle monitoring and alert system designed to enhance driver and passenger safety. The system integrates various sensors and modules to detect critical driving conditions, such as alcohol consumption, drowsiness, and sudden movements due to accidents. It also includes location tracking and real-time communication features using GPS and GSM technology. The Arduino microcontroller acts as the central unit, processing inputs from multiple sensors and triggering appropriate outputs like buzzers, LEDs, DC motors, and SMS alerts. This system aims to provide a proactive safety mechanism by monitoring driver behavior and sending emergency alerts to designated contacts, potentially reducing road accidents and enabling quicker response in critical situations.

3.2 Flow Chart



This flowchart outlines the operation of a vehicle safety system using various sensors to monitor the driver's condition and detect accidents. Here's a step-by-step explanation of the flow:

Flowchart Explanation:

1. Start ans Power Initialization:

The system begins when power is initialized.

2. Alcohol Sensor Check: The alcohol sensor checks whether the driver is drunk.

If the driver is drunk:

The vehicle's engine is disabled or doesn't start.

The system then uses the eye blink sensor to check if the driver is asleep.

If asleep: A warning is issued to the driver (likely via buzzer or LED).

If not asleep: The vehicle continues to run.

If the driver is not drunk:

The vehicle's engine starts and the system proceeds to monitor for accidents.

3. Accelerometer Check:

The accelerometer continuously monitors for abnormal motion or impact.

If no accident is detected: The vehicle keeps running normally.

If an accident is detected:

The GPS module detects the location.

The GSM module sends an SMS alert (including a Google Maps link) to emergency services like ambulance and police.

This system aims to ensure driver safety, prevent drunk driving, and provide real-time accident alerts for faster emergency response. It integrates decision-making with sensors and communication modules, automating critical responses during unsafe driving conditions.

3.3 Impementation

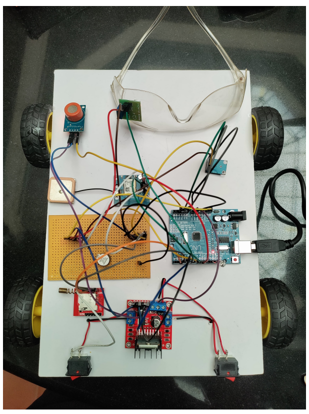


Figure 3.1: Implementation of all elements

Chapter 4

Hardware and Software Implementation

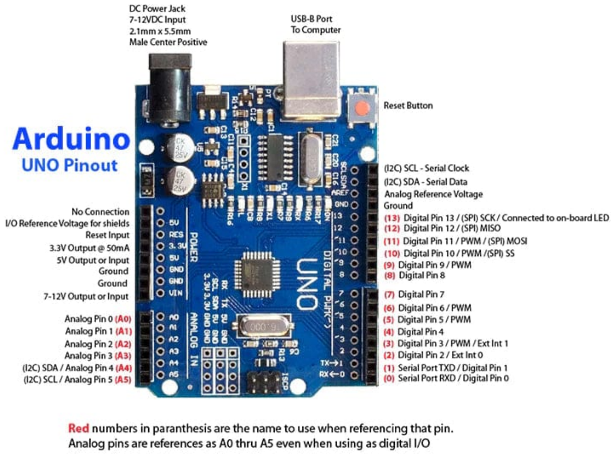
4.1 Hardware Details

4.1.1 Components

Board: Arduino Uno R3

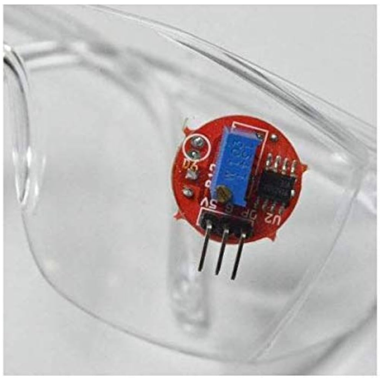
It is a micro-controller board based on the ATMega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs),6 analog inputs,a 16MHz resonator,USB connection,power jack,reset button.t contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.The Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328P provides UART TTL (5V) serial communica tion, which is available on digital pins 0 (RX) and 1 (TX). The ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed.The Arduino Uno R3 is suitable for various applications ranging from simple LED blinking to complex IoT systems.

One of the standout features of the Arduino ecosystem is its open-source nature, allowing users to customize, modify, and share their designs. The Arduino IDE is free to use and compatible with various operating systems (Windows, macOS, and Linux). The Arduino community provides a wealth of resources, tutorials, and forums to support users at all levels. With the Uno R3, you can create projects ranging from simple applications, like controlling an LED or reading a temperature sensor, to more advanced systems, including robotics, home automation, and Internet of Things (IoT) devices.



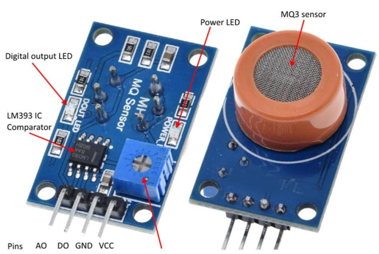
Eye Blink Sensor

An eye blink sensor is a non-intrusive device used in vehicle safety systems to monitor the driver's eye movement and detect signs of drowsiness or fatigue. It typically uses infrared (IR) technology to measure the frequency and duration of eye blinks by detecting whether the eyes are open or closed. In a normal alert state, a driver blinks regularly and briefly, but when drowsiness sets in, blinking slows down and eye closure lasts longer, indicating reduced alertness. The sensor captures this data in real time and sends it to a microcontroller (like Arduino), which processes the information to determine if the driver is becoming drowsy. If prolonged eye closure or abnormal blink patterns are detected, the system activates an alert—such as a buzzer, vibration, or message—to immediately warn the driver and help avoid potential accidents. By providing continuous, real-time monitoring without physical contact, the eye blink sensor plays a crucial role in accident prevention by ensuring that the driver remains alert, especially during long or late-night drives.



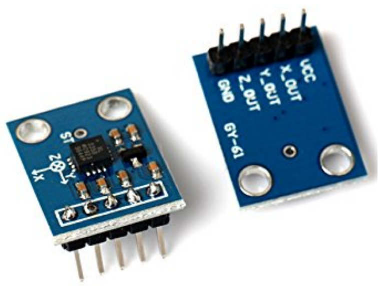
Alcohol sensor(MQ-3)

The MQ-3 alcohol sensor is a widely used gas sensor specifically designed to detect the presence of alcohol vapors in the air, making it an essential component in vehicle safety systems aimed at preventing drunk driving. It operates based on a chemical sensing layer made of tin dioxide (SnO), whose conductivity changes in the presence of alcohol. When alcohol vapors are detected in a driver's breath, the sensor produces an analog output signal that varies according to the alcohol concentration. This output can be read and processed by a microcontroller like Arduino to assess whether the alcohol level exceeds a predefined safety threshold. If the threshold is surpassed, the system can trigger preventive measures such as disabling the vehicle's ignition, sounding an alert, or notifying emergency contacts. The MQ-3 is known for its high sensitivity to ethanol and quick response time, and it is capable of detecting a wide range of alcohol concentrations, making it suitable for real-time breath analysis. Its compact size, low cost, and ease of integration into embedded systems make it ideal for use in smart vehicle applications focused on enhancing road safety by ensuring that only sober individuals are allowed to operate the vehicle.



Accelerometer(ADXL335)

The ADXL335 is a compact, low-power, 3-axis analog accelerometer widely used in motion sensing applications, including vehicle safety and accident detection systems. It can measure acceleration in three dimensions—X, Y, and Z—allowing it to detect motion, orientation, and the impact forces experienced by a vehicle during movement or a collision. The sensor operates on a voltage range of 1.8V to 3.6V and outputs analog voltage signals proportional to the acceleration experienced along each axis. In vehicle accident detection, the ADXL335 plays a critical role by identifying sudden changes in acceleration, which are strong indicators of a crash or collision. When integrated with a microcontroller like Arduino, the system continuously reads acceleration values and compares them to a predefined threshold. If a sharp or abnormal change is detected—such as rapid deceleration or an impact—the system interprets it as an accident and triggers further actions, such as activating a buzzer, logging GPS coordinates, or sending an emergency SMS via a GSM module. Due to its sensitivity, reliability, and real-time response capabilities, the ADXL335 is a valuable component in intelligent vehicle safety systems aimed at enhancing driver protection and emergency response efficiency.



GSM module(SIM800L)

The GSM module SIM800L is a compact and efficient communication device used in embedded systems to enable wireless data transmission over mobile networks. It supports GSM (Global System for Mobile Communications) quad-band frequencies, allowing it to send and receive SMS messages, make or receive calls, and access basic GPRS (General Packet Radio Service) for data connectivity. In vehicle safety and accident detection systems, the SIM800L plays a crucial role in real-time communication by sending automated

SMS alerts to emergency contacts or authorities when an accident is detected. For example, when combined with sensors like the ADXL335 (for collision detection) and GPS modules (for location tracking), the SIM800L can instantly transmit the vehicle's location and incident status via SMS. This rapid communication helps reduce emergency response time and potentially saves lives. The module is controlled through AT commands sent via serial communication from a microcontroller such as Arduino. Its small size, low power consumption, and reliable network connectivity make the SIM800L an ideal component in IoT-based safety systems, ensuring seamless and timely information sharing in critical situations.

GPS module NEO-6M

The GPS module NEO-6M is a high-performance positioning device widely used in navigation and tracking applications, including vehicle safety and accident reporting systems. This module receives signals from multiple satellites to calculate precise geographical coordinates—such as latitude, longitude, and laltitude—which are essential for real-time location tracking. In the context of accident detection systems, the NEO-6M module plays a vital role by providing the exact location of the vehicle at the moment an incident occurs. When integrated with a microcontroller (e.g., Arduino) and paired with a GSM module like SIM800L, the GPS module enables the system to automatically send the accident location via SMS to predefined emergency contacts or authorities. The NEO-6M features a built-in EEPROM for configuration storage, a high-gain antenna for improved signal reception, and compatibility with standard serial communication protocols, making it easy to integrate into embedded systems. Its ability to deliver accurate and continuous location data even in remote or mobile environments ensures that help can be dispatched quickly and efficiently. As a result, the GPS module NEO-6M is a key component in enhancing the responsiveness and reliability of modern vehicle safety solutions.

Motor driver module(L298)

L298N is a high voltage,high current dual full bridge motor driver module that controls both DC and stepper motors.This module uses 2 techniques that's PWM– for controlling speed and H-Bridge– for controlling rotation direction.It has an operating voltage of 5V-35V.It's current rating is 2A per channel.It has a power dissipation of 25W and the control logic voltage is 5V.L298N motor driver module uses the H-Bridge technique to control the direction of rotation of a DC motor. In this technique, H-Bridge controlled DC motor rotating direction by changing the polarity of its input voltage.An H-Bridge circuit contains four switching elements, like transistors (BJT or MOSFET), with the motor at the center forming an H-like configuration. Input IN1, IN2, IN3, and IN4 pins actually control the switches of the H-Bridge circuit inside L298N IC.We can change the direction of the current flow by activating two particular switches at the same time, this way we can change the rotation direction of the motor.A black color heat sink is attached to the L298 IC of the module.L298N motor driver module uses the PWM technique to control the speed of rotation of a DC motor. In this technique, the speed of a DC motor can be controlled by changing its input voltage.Pulse Width Modulation is a technique where the average value of the input voltage is adjusted by sending a series of ON OFF pulses. The average voltage is proportional to the width of the pulses, these pulses known as Duty Cycle.If the duty cycle higher, then the average voltage is applied to the DC motor (High Speed), and the lower the duty cycle, the less the average voltage being applied to the dc motor(Low Speed). A heat sink is a passive heat exchanger that transfers the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant.

DC Motor and Wheels

A DC motor and wheel assembly is a fundamental component in many mobile robotic and vehicle-based systems, enabling physical movement and navigation. The DC (Direct Current) motor converts electrical energy into mechanical rotation, allowing the attached wheels to turn and propel the vehicle or model forward or backward. In vehicle safety systems or prototype models, DC motors are typically controlled through a motor driver module (such as the L298), which allows for precise regulation of speed and direction using signals from a microcontroller like Arduino. This control is achieved via techniques like Pulse Width Modulation (PWM), enabling the vehicle to perform smooth starts, stops, and turns. The wheels, usually made of rubber or plastic, are selected based on the required traction, load capacity, and surface compatibility. In the context of accident prevention projects, a DC motor and wheel setup may be used in a scaled-down model vehicle to simulate real-world actions such as stopping when alcohol is detected or demonstrating an automatic response when drowsiness is sensed. The simplicity, reliability, and ease of control make DC motors and wheels essential for both demonstration purposes and automation in safety-focused embedded systems.

4.1.2 Design and specification

Board: Arduino Uno R3:

- It consumes low power, making it ideal for real-time accident detection applications.
- The Arduino Uno has an easy-to-use development environment (Arduino IDE) with a wide community of support.
- Since accident prevention and detection systems require a real-time response, the Uno's simple architecture and lack of OS overhead make it more reliable than complex systems like Raspberry Pi.

Eye Blink Sensor:

- The sensor detects eye closure in milliseconds, allowing immediate corrective action.
- Does not interfere with normal driving but ensures safety monitoring.
- Compatible with Arduino
- Fast detection of drowsiness for immediate accident prevention
- Low cost and power consumption

Alcohol sensor(MQ-3):

- Provides analog output, making it easy to read alcohol concentration.
- High sensitivity to alcohol vapors
- Simple integration with Arduino microcontrollers

Accelerometer(ADXL335):

- It operates at 3.3V – 5V with very low power consumption (350 µA), making it suitable for battery-operated systems.
- When an accident occurs, ADXL335 detects the sudden change in acceleration.

GSM module(SIM800L):

- It operates at 3.4V–4.4V, consuming less power compared to alternatives like SIM900, which requires higher voltage and power.
- This ensures real-time accident reporting, even in areas with poor network coverage.
- Works seamlessly with Arduino Uno

GPS module NEO-6M:

- NEO-6M provides accurate position tracking with an accuracy of 2.5 meters.
- The NEO-6M has a fast TTFF (Time to First Fix)
- The NEO-6M can store previous GPS data

Motor driver module(LM298):

- The L298 motor driver is used to control the DC motors or relay systems in accident prevention applications.
- Allows simultaneous control of two DC motors, making it ideal for automated braking systems or electric vehicle control.
- Automatic braking and engine cut-off in emergencies

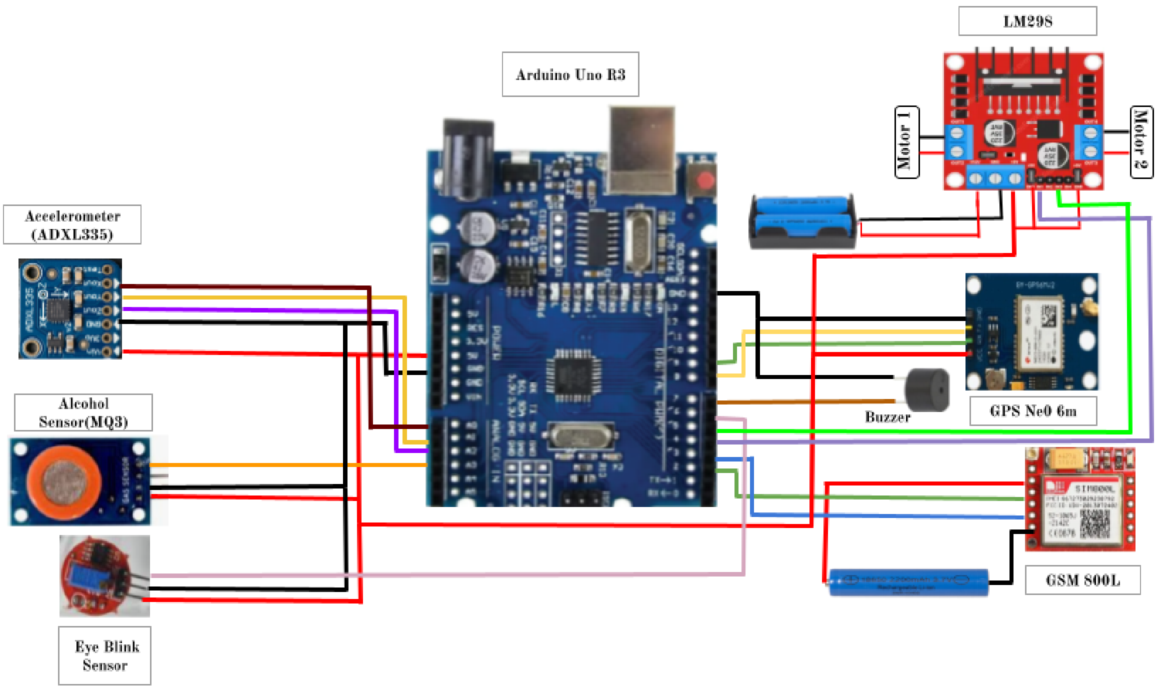
DC Motor and Wheels:

DC motors with wheels are preferred because they:

- Simulate vehicle motion
- React to accident-related inputs (like alcohol, drowsiness, or crash detection)

- Are easy to control and integrate with microcontrollers
- Help visualize and test accident prevention systems effectively

4.1.3 Circuit Diagram Layout



The system is built around an Arduino Uno R3, interfacing with multiple sensors and modules for accident detection, prevention, and alert reporting. The ADXL335 accelerometer is connected to analog pins A0, A1, and A2 for its X, Y, and Z outputs, and powered through the 5V pin. The alcohol sensor (MQ3) is connected to analog pin A3 and powered via 5V and GND.

The eye blink sensor is connected to digital pin D6 and monitors driver drowsiness. A buzzer is connected to digital pin D7 and serves as an alert mechanism during abnormal conditions. The GPS module (Neo 6M) is connected with TX to D8 and RX to D9, powered via 5V, and provides real-time location data.

The GSM module (SIM800L) uses TX connected to D3 and RX to D2, and is powered by an external 3.7V battery with a shared ground. A motor driver (L298N) receives control signals from digital pins (e.g., D10–D13) and powers two DC motors using an external 7.4V battery.

4.2 Software Details

4.2.1 Arduino IDE 2.3.4

Arduino IDE 2.3.4 is the latest stable release of Arduino's official integrated development environment, offering a modern and powerful platform for programming Arduino boards. Released in December 2024, this version brought several performance improvements, bug fixes, and enhanced user experience features. Notably, it resolved issues related to the Serial Monitor and Serial Plotter, which previously caused the IDE to freeze during certain operations. The update also addressed a bug where failed uploads were mistakenly shown as successful, ensuring more reliable project development and debugging. With enhanced compilation caching and support for sketch files up to 16 MB, the IDE is now better suited for large and complex Arduino projects. Additionally, version 2.3.4 introduced improved support for non-English users through expanded language translations and marked the final version compatible with Linux systems using glibc 2.28. Overall, Arduino IDE 2.3.4 provides a stable, efficient, and user-friendly environment for developers and hobbyists working on embedded systems and IoT applications.

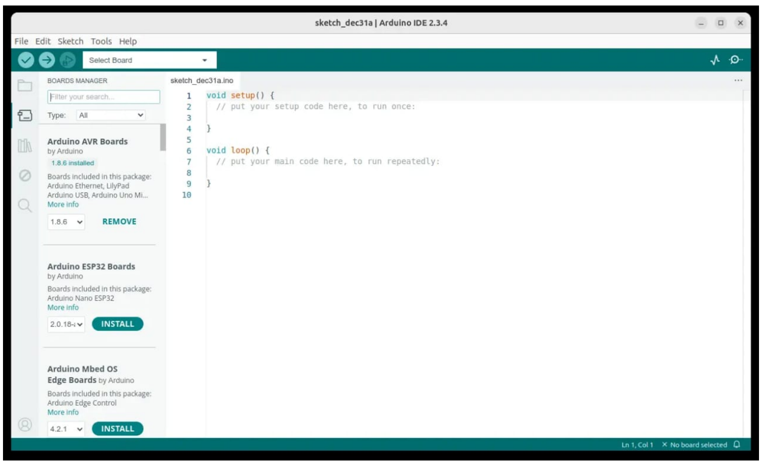


Figure 4.1: Window of Arduino IDE 2.3.4

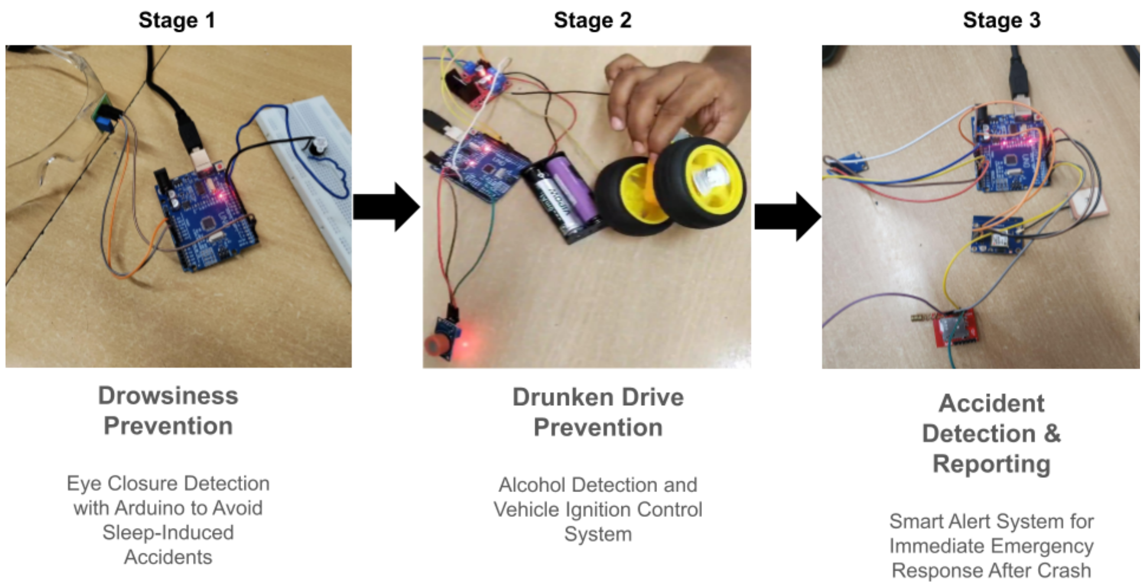
4.2.2 C++

C++ is a cross-platform language that can be used to create high-performance applications.C++ was developed by Bjarne Stroustrup, as an extension to the C language.C++ gives programmers a high level of control over system resources and memory.One of the key features of C++ is its ability to support low-level, system-level programming, making it suitable for developing operating systems, de vice drivers, and other system software. At the same time, C++ also provides a rich set of libraries and features for high-level application programming, making it a popular choice for developing desktop applications, video games, and other complex applications.C++ is an object-oriented, multi-paradigm language that supports pro cedural, functional, and generic programming styles.C++ provides robust exception handling capabilities, making it easier to write code that can handle errors and un expected situations.Overall, C++ is a powerful and versatile programming language that is widely used for a range of applications and is well-suited for both low-level system programming and high-level application development.

Chapter 5

Results and Discussions

5.1 Experimental Phases



5.1.1 Stage 1: Drowsiness Prevention

An IR eye blink sensor monitors the driver's eye movements. If prolonged eye closure is detected, the system triggers an alert to prevent accidents caused by drowsiness.

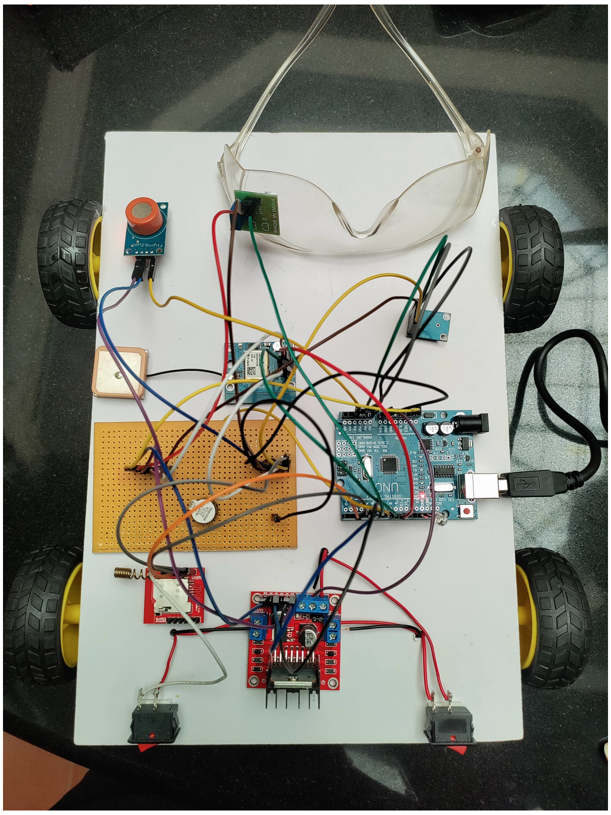
5.1.2 Stage 2: Drunken Drive Prevention

An alcohol sensor checks the driver's breath before starting the vehicle. If alcohol is detected above a set limit, the system prevents the vehicle from starting.

5.1.3 Stage 3: Accident Detection Reporting

An accelerometer detects accidents based on sudden motion. Upon detection, the GPS fetches the location and the GSM module sends an alert message to emergency contacts.

5.2 Final Working Model Status



1.Accident Detection:

Accident detection using the **ADXL335 accelerometer** centers around its ability to accurately sense sudden and intense changes in motion, which are characteristic of vehicle collisions. The ADXL335 is a compact, low-power, 3-axis analog accelerometer that measures acceleration along the X, Y, and Z axes. During normal driving, the acceleration values from the sensor remain within predictable ranges, reflecting typical movements like turning, braking, or accelerating. However, during a collision, the vehicle experiences a rapid and forceful change in velocity, resulting in a sharp spike in acceleration—often referred to as a **high-g** event. These abrupt changes are picked up by the ADXL335, which converts them into analog voltage signals. These signals are continuously monitored by a microcontroller, such as an Arduino, which is programmed to detect values that exceed a certain **threshold**. This threshold is carefully calibrated to distinguish between regular driving motions and actual impact forces that occur during accidents. When the sensed acceleration surpasses this threshold on any axis, the system flags it as a potential accident. The simplicity and responsiveness of the ADXL335 make it ideal for real-time accident detection, allowing it to act almost instantaneously. This forms the core of an automated alert system, where the detection of abnormal acceleration patterns directly triggers subsequent actions, such as location tracking and alert messaging. The key to its effectiveness lies in its sensitivity, fast response time, and its ability to accurately interpret motion dynamics, making it a critical component in developing life-saving vehicle safety solutions.

2.Accident Reporting:

Once an accident is detected using the ADXL335 accelerometer, the system immediately transitions to the **accident reporting phase**, which plays a crucial role in ensuring timely assistance and improving emergency response times. After the microcontroller, such as an Arduino, identifies a sudden spike in acceleration—interpreted as a collision—it triggers a series of automated actions designed to notify emergency contacts. The first step involves gathering the vehicle's **precise location** using a **GPS module**, which communicates with satellites to determine the exact latitude and longitude coordinates at the time of the crash. This location data is critical, especially if the accident occurs in a remote or unfamiliar area where the driver might not be able to communicate their position. Following this, the system composes a detailed **SMS alert** containing a warning message along with the captured GPS coordinates, often formatted into a clickable **Google Maps link** for easy navigation. This message is sent using a **GSM module** (such as the SIM800L), which allows the microcontroller to transmit text messages over the mobile network. The alert can be sent to multiple predefined contacts, including family members, emergency services, or roadside assistance providers. This automatic reporting process ensures that help can be dispatched as quickly as possible, even if the occupants of the vehicle are unconscious or unable to use a phone. In some advanced implementations, the system may also initiate a voice call or log the accident data for insurance and investigation purposes. Overall, this seamless and immediate accident reporting mechanism significantly enhances road safety by minimizing the delay between the occurrence of an accident and the arrival of aid.

3.Accident Prevention:

Accident prevention systems in modern vehicles are increasingly incorporating **eye blink sensors** to detect and address driver drowsiness before it leads to dangerous situations. These sensors use i**nfrared (IR) technology** to monitor the driver's eyelid movement in real time, observing how frequently and how long the eyes remain closed. Under normal circumstances, a driver blinks at a regular and healthy rate, but as fatigue sets in, this pattern changes—blinks become slower, longer, or more infrequent, and the driver may begin experiencing micro-sleeps. The eye blink sensor captures these irregularities and sends the data to a microcontroller (such as Arduino), which is programmed to identify signs of drowsiness. Once detected, the system immediately activates **preventive measures** like buzzing alarms, flashing dashboard lights, vibrating seats, or even gentle voice prompts to alert the driver and suggest taking a break. This proactive approach helps prevent accidents caused by a loss of attention or falling asleep at the wheel, which are common in long-distance travel or late-night driving.

Similarly, an **alcohol sensor** plays a crucial role in preventing accidents caused by impaired driving. These sensors, commonly based on the **MQ-3 gas sensor**, are designed to detect alcohol vapors in the driver's breath. When the driver exhales near the sensor—either through a dedicated breathalyzer module or an embedded system near the steering wheel—the sensor measures the alcohol concentration and sends the data to the microcontroller. If the alcohol level exceeds a set threshold, the system can trigger a range of safety responses, such as **disabling the vehicle's ignition system** to prevent the engine from starting. In more advanced setups, it may also send an SMS alert to family members or authorities, notifying them of a potential DUI attempt. This ensures that individuals under the influence of alcohol are unable to operate the vehicle, thereby greatly reducing the risk of alcohol-related accidents. Together, the eye blink and alcohol sensors form a robust **driver monitoring system** that proactively addresses two of the most significant human-related risk factors on the road, enhancing overall traffic safety and saving lives.

5.3 Video Output

Link:

`https://drive.google.com/file/d/1uhTlI9ZkK2eT7mGENugCGMl-QnHJWQnW/view?usp=drivesdk`

5.4 Outputs

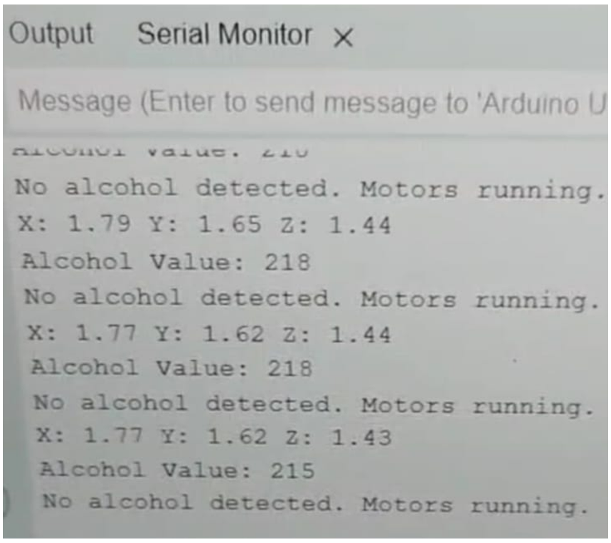


Figure 5.1: Shows X,Y,Z coordinates and alcohol value

5.4.1 Prevention Part

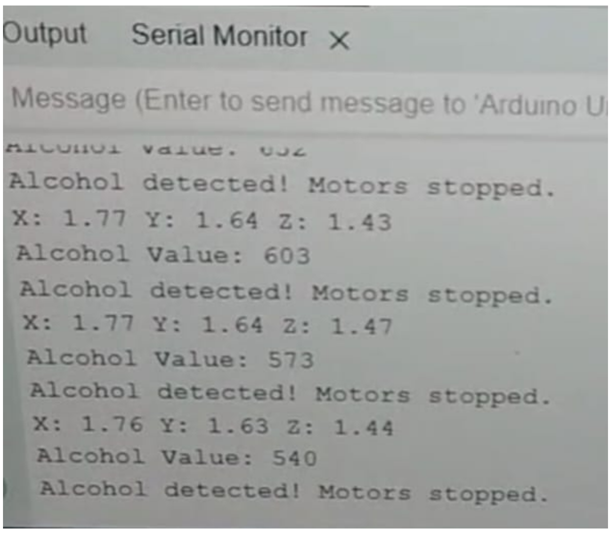


Figure 5.2: Alcohol is detected and motor stops

5.4.2 Detection Part

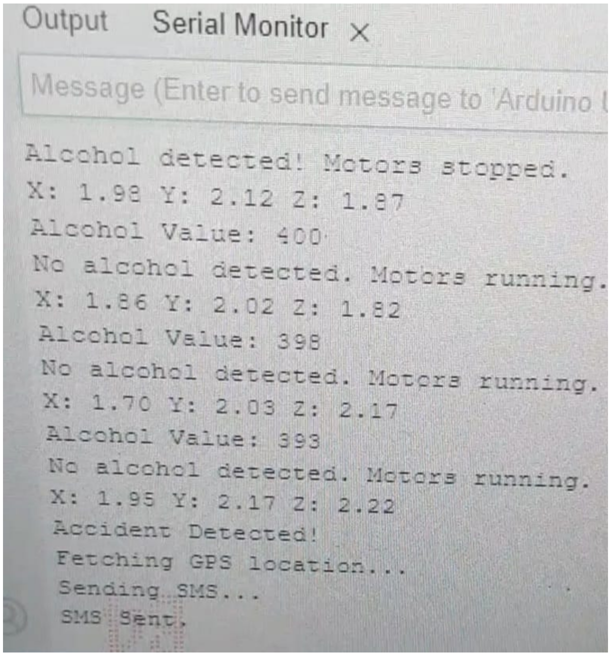
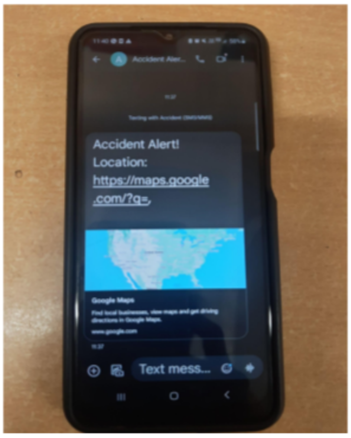
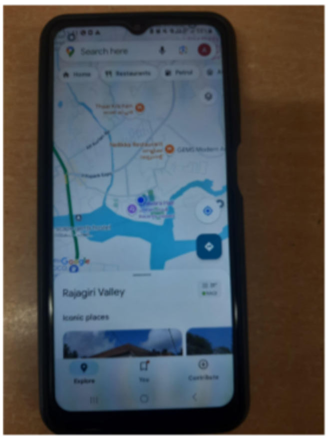


Figure 5.3: Accident is detected and sms alert is sent with location

5.4.3 Reporting Part





Chapter 6

Conclusions & Future Scope

The Vehicle Accident Prevention, Detection, and Reporting System developed in this project offers a practical and intelligent solution to enhance road safety through real-time monitoring and automated response mechanisms. By integrating alcohol detection, eye blink sensing for drowsiness, accident detection via accelerometer, and location-based alerting using GPS and GSM modules, the system addresses multiple critical aspects of vehicular safety. It not only helps in preventing accidents caused by driver impairment but also ensures immediate communication with emergency contacts when an accident occurs, thereby reducing the time taken for medical or rescue response.

This multi-functional system demonstrates the potential of combining low-cost hardware components with efficient programming to build a scalable and effective safety solution. It contributes meaningfully to the field of intelligent transportation systems by offering a proactive approach to accident prevention and post-accident management. The system is especially valuable in regions where advanced vehicular safety technologies are not yet widespread, making it a significant step toward smarter, safer, and more responsive driving environments.

This project can be further enhanced by integrating advanced technologies such as facial recognition and AI-based driver behavior analysis for more accurate detection of fatigue or distraction. Cloud connectivity could be implemented to store real-time data for future analysis and tracking. Integration with mobile applications would allow users and emergency services to monitor and manage alerts more efficiently. Additionally, camera-based obstacle detection and automatic braking systems can be incorporated to further improve vehicle safety. The modular design of the system also allows easy upgrades and scalability for future developments.

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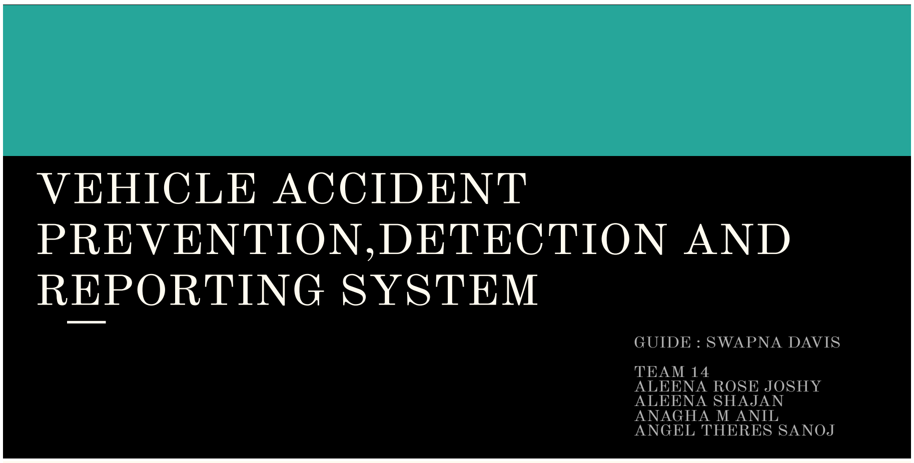
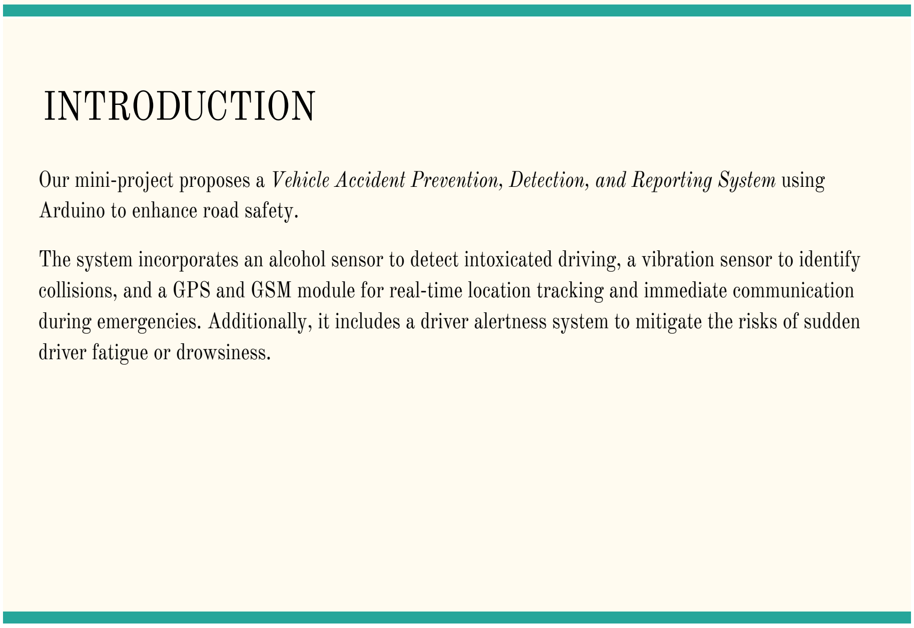
[10] V. T. Student, T. R. Student, and P. J. Student, “Car safety system with airbag notification,” Nov. 2024, doi: 10.21203/rs.3.rs-5391967/v1.

Appendix A: Presentation, Programs, and Posters

6.1 Presentation





AIM

- Detect alcohol consumption in drivers using an alcohol sensor and alert them to prevent vehicle operation while intoxicated.
- Prevent accident which happens due to sudden asleep of driver.
- Use a accelerometer to detect sudden impacts or collisions and trigger necessary actions.
- Automatically report accident details, including location, to emergency services and preconfigured contacts for prompt assistance.
- Minimize accidents by addressing key factors like impaired driving and delayed response times.

OBJECTIVE

❏ Real-Time Location Reporting
❏ Real-Time Alerts and Notifications
❏ Cost Efficiency
❏ Power Efficiency
❏ User-Friendly Interface
❏ Scalability and Upgradability
❏ Improve Road Safety

SOCIAL RELEVANCE

The **social relevance** of your **accident prevention system** is significant as it directly contributes to improving road safety, reducing fatalities, and minimizing injuries caused by accidents.

This project can:

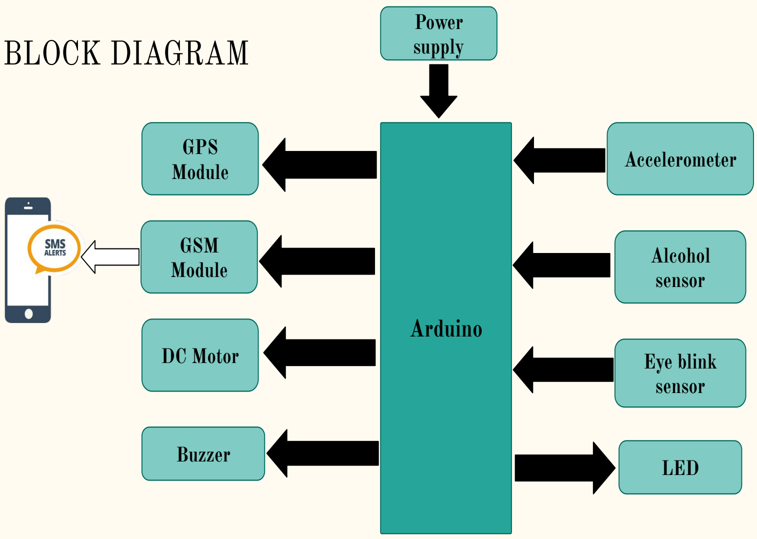
- **Save lives** by preventing drunk driving and alerting drivers when drowsy, promoting safer driving practices.
- **Improve emergency response times** by providing real-time location data in case of an accident, ensuring timely assistance.
- **Raise awareness** about road safety and the potential for technology to mitigate preventable accidents

LITERATURE SURVEY

ARTICLE	CATEGORY & DETAILS	REFERENCE
International Journal of Advanced Research in Computer Science published an article titled "Preventing Drunk Driving Accidents using IoT" in March-April 2017	**Drunk Driving Detection** - Alcohol sensors (e.g., MQ-3) detect alcohol content in breath.- Prevents vehicle operation if alcohol level exceeds legal threshold.	- **Verma et al. (2017):** Used alcohol sensors with Arduino to disable vehicle ignition if alcohol level exceeds 0.08%.
International Journal of Engineering & Technology published an article titled "Detection of Driver Drowsiness using Eye Blink Sensor" in 2018, detailing a system that alerts drivers when prolonged eye closure is detected.	**Drowsiness Detection** - Eye blink sensors detect eye closure and blink rate to monitor drowsiness.- Alerts the driver when drowsiness is detected.	- **Kumar et al. (2016):** Developed an eye blink sensor-based drowsiness detection system integrated with Arduino to alert the driver when eye closure is prolonged.
Study titled "Real-Time Vehicle Accident Alert System Based on Arduino with SMS Notification" discusses a system with accelerometers to detect accidents, GPS to determine the vehicle's location, and GSM to send alerts	**Accident Detection & Reporting** - Accelerometers detect sudden changes in speed, indicating a collision.- GPS records vehicle location during an accident.- GSM sends real-time alerts.	- **Soni et al. (2018):** Integrated accelerometer and GPS with Arduino to detect crashes and send vehicle location via GSM to emergency contacts.

ARTICLE	CATEGORY AND DETAILS	REFERENCE
"Integrated Safety System based on IoT": This article, published in the Journal of the Korea Society of Computer and Information, explores the integration of sensors within the Internet of Things (IoT) framework to enhance safety systems.	**Integrated Safety Systems** - Integration of multiple sensors (alcohol, eye blink, accelerometer, GPS, GSM) into a single system for comprehensive monitoring.- Improves overall vehicle safety.	- **Rai et al. (2020):** Created an integrated system combining alcohol sensors, eye blink sensors, accelerometers, and GPS for real-time monitoring and accident prevention.
The article "12 Mind-Blowing Arduino AI Projects That Will Transform Your Tech Skills," published by Jaycon Systems,	**Scalability and Expansion** - Systems need to be scalable for future improvements.- Easy integration of additional features like external cameras or advanced AI.	- Modular designs with Arduino allow for future upgrades such as adding more sensors (e.g., facial recognition for drowsiness) or AI-based predictive accident models.
"GPS & GSM Based Accident Detection and Auto Intimation" by Fernandez et al. (2018)	**Emergency Response Time** - Reducing the time between accident detection and emergency response is critical.- Real-time data sharing with emergency contacts or services via GSM.	- **Soni et al. (2018):** Used GSM module to send immediate accident alerts with GPS coordinates to emergency responders, reducing response time and potentially saving lives.

BLOCK DIAGRAM



METHODOLOGY

1. Data Collection: Sensors detect the presence of alcohol , drowsiness of driver ,impact, or sudden changes.

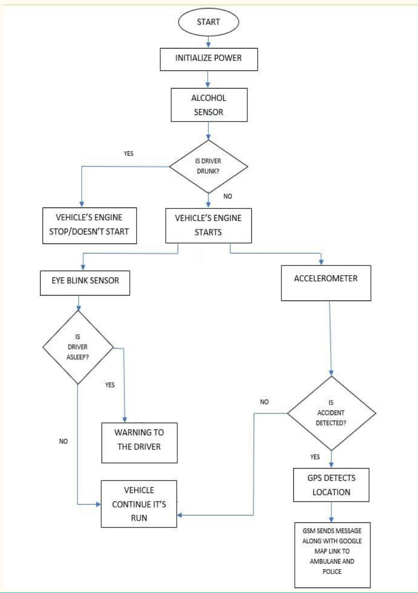
2. Processing: The Arduino processes the data

3. Action:

- If the driver is drunk system provides warning and engine stops ,if not vehicle starts properly.
- If the driver is drowsy system warns him with alarm and red light alert
- If a crash is detected, the system triggers safety responses

4. Communication: The system uses the vehicle's battery and can communicate through GPS or GSM modules.

FLOW CHART



COMPONENTS

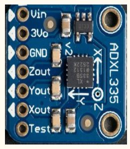
- Arduino Uno
- Accelerometer
- Alcohol sensor
- Eye blink sensor
- LED
- Buzzer
- GPS module
- GSM module
- DC motor
- Motor driver

DESIGN AND SPECIFICATION

1.Arduino Uno

- It consumes **low power**, making it ideal for real-time accident detection applications.
- The Arduino Uno has an **easy-to-use** development environment (Arduino IDE) with a vast community of support.
- Since accident prevention and detection systems require a **real-time response**, the **Uno's simple architecture and lack of OS overhead** make it **more reliable** than complex systems like Raspberry Pi.

2.Accelerometer(ADXL335)



- It operates at **3.3V – 5V** with very low power consumption (~350 μA), making it **suitable for battery-operated systems**.
- When an accident occurs, ADXL335 detects the sudden change in acceleration.

3.GSM module(SIM800L)

- It operates at **3.4V–4.4V**, consuming **less power** compared to alternatives like **SIM900**, which requires higher voltage and power.
- This ensures **real-time accident reporting**, even in areas with poor network coverage.
- Works seamlessly with Arduino Uno

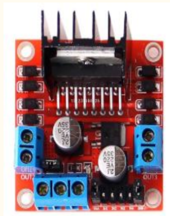
4.GPS module(NEO-6M)

- **NEO-6M provides accurate position tracking** with an accuracy of **2.5 meters**.
- The NEO-6M has a fast **TTFF (Time to First Fix)**
- The NEO-6M can **store previous GPS data**

5.Alcohol sensor(MQ-3)

- Provides **analog output**, making it **easy to read alcohol concentration**.
- High sensitivity to alcohol vapors
- Simple integration with Arduino & microcontrollers

6.Motor driver module(L298)



- The **L298 motor driver** is used to **control the DC motors or relay systems** in accident prevention applications.
- Allows **simultaneous control of two DC motors**, making it ideal for **automated braking systems or electric vehicle control**.
- Automatic braking and engine cut-off in emergencies

7.Eye blink sensor

- The sensor detects **eye closure in milliseconds**, allowing **immediate corrective action**.
- **Does not interfere with normal driving** but ensures safety monitoring.
- Compatible with Arduino
- **Fast detection of drowsiness** for immediate accident prevention
- **Low cost and power consumption**

PREVENTION

- Alcohol Sensor : detects alcohol concentration in the air.
- DC motor : Performs an action based on the detection, such as locking a door.
- Motor Driver Module : Enables the Arduino to drive the DC motor.
- Eye blink sensor:senses eye blink using infrared rays.

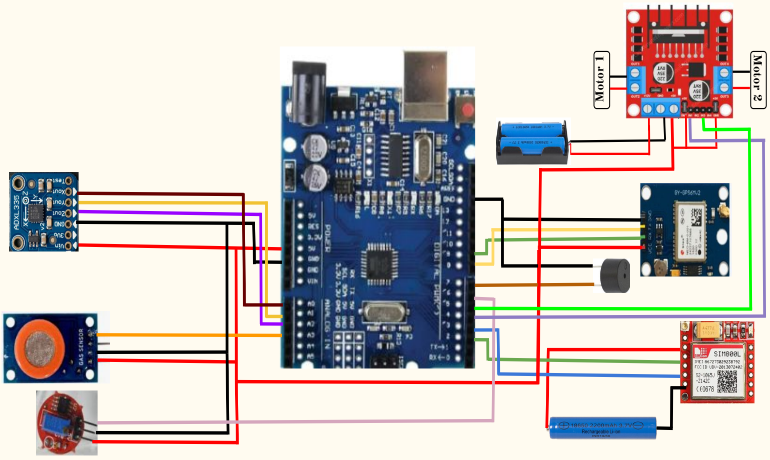
DETECTION

- ADXL335 accelerometer : Detects sudden changes in acceleration or orientation during a crash,Can measure vibrations, tilts, and shocks.

REPORTING

- GPS Module : To determine the exact location of the vehicle during a crash.
- GSM Module : To send crash alerts to emergency contacts or services.
- In a crash scenario, timely information sharing can be life-saving. The GSM module ensures immediate communication.

CIRCUIT DIAGRAM



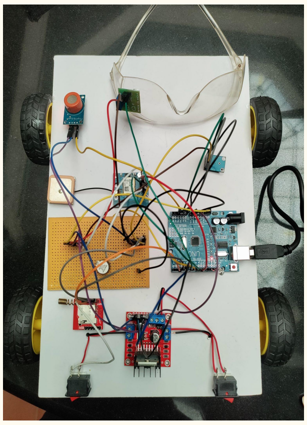
Estimate of product cost

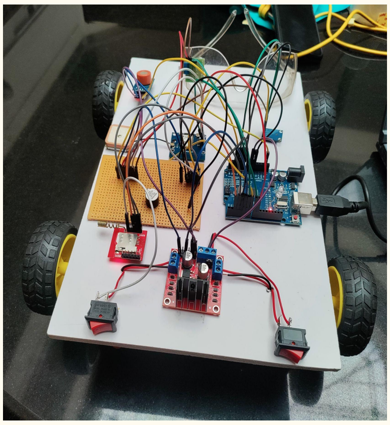
S.no	Component	Quantity	Price(Rs)
1	Accelerometer(335)	1	750
2	GSM800l	1	450
3	GPS neo6m	1	500
4	Alcohol sensor(mq3)	1	195
5	LM298 Motor driver	1	225
6	Eye Blink sensor	1	330
7	Buzzer	1	15
8	LED	1	1
9	DC Motor	2	90*(2)=180

10	Arduino UNO R3	1	400
11	Jumper wires	30	2.5*(30)=75
12	Wheels	4	50*(4)=200
13	Switch	2	5*(2)=10
14	3.7V Battery	3	130*(3)=390
15	PCB	1	20

Total	3,561

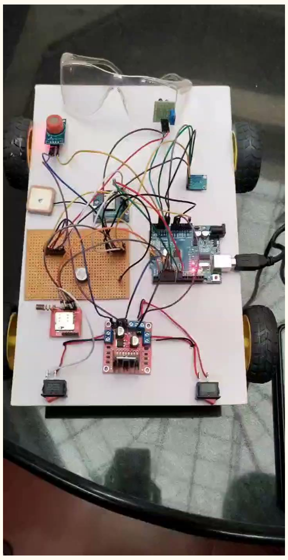
FINAL PROTOTYPE



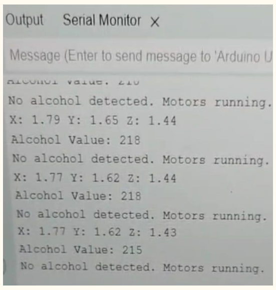


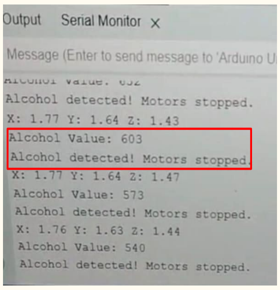
VIDEO

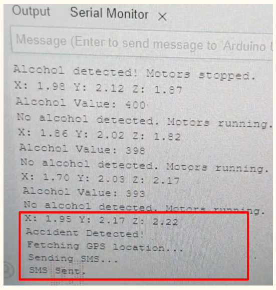
https://drive.google.com/file/d/1uhTlI9ZkK2eT7mGENugCGMl-QnHJWQnW/view?usp=drivesdk

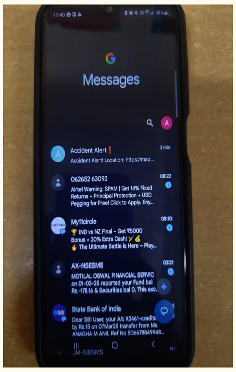


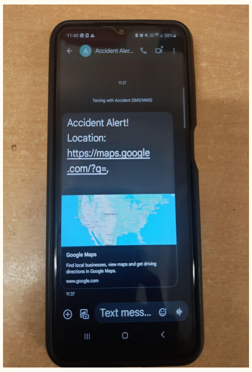
OUTPUT

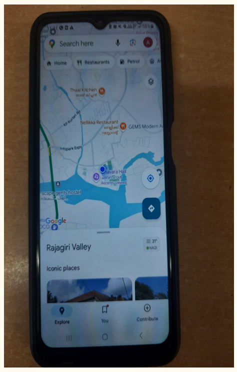












CHALLENGES

- **GSM Module (SIM800L) Issues:**
  - Unable to connect to the network, especially indoors.Weak signal strength affecting SMS transmission.

- **GPS Module (NEO-6M) Issues:**
  - Unable to lock onto satellites.Poor signal reception, especially in indoor environments.
  - Longer time to get a GPS fix (TTFF – Time to First Fix).

- **Sensor Calibration and Accuracy:**
  - Ensuring that sensors like the alcohol sensor, eye-blink sensor, accelerometer, and GPS provide accurate and consistent data.

- **False Positives/Negatives**:
    - Avoiding false alarms for drunk driving, drowsiness, or accidents due to sensor errors or environmental factors

- **System Integration**:
    - Seamlessly integrating all components (sensors, motor, GSM, GPS) into a single, functional system.

- **Power Supply Issues with lm298**:
    - If the voltage or current provided to the motor is not stable or within the required range, the LM298 may fail to drive the motor correctly, or cause erratic behavior.

STATUS OF PROJECT

1. Accident Detection:

- **Implemented using an accelerometer to detect sudden impacts.**
- **Successfully triggers the accident alert mechanism.**

2. Accident Reporting:

- **SMS notification successfully sent to an emergency contact.**
- **Accident location included in the SMS for precise emergency response.**

3. Accident Prevention:

- **Eye-blink sensor implemented to monitor driver drowsiness.**
- **Alcohol detection sensor integrated to monitor driver sobriety.**
- **Both sensors work together to help prevent accidents caused by fatigue and impaired driving.**

ADVANTAGES

1. **Real-Time Alerts**: These systems can provide real-time alerts to drivers, reminding them to take breaks, stay alert, or avoid driving altogether if they are impaired.
2. **Enhanced Safety**: By addressing various driving risks, these systems significantly enhance road safety for all drivers
3. **Emergency Response**: Automatically notifies 911 with location and crash details.
4. **Roadside Assistance**: Alerts tow services or repair providers.
5. **Family Notifications**: Informs emergency contacts of an accident.
6. **Insurance Claims**: Provides crash data for faster and accurate claims processing.
7. **Medical Pre-Triage**: Sends passenger and injury details to hospitals pre-arrival.
8. **Traffic Law Enforcement**: Supplies crash evidence for investigations.

FUTURE SCOPE

- **AI Integration**: Implementing **machine learning** or **AI algorithms** to enhance drowsiness detection or accident prediction based on sensor data.

- **Smart Vehicle Connectivity**: Future systems may integrate with **smart vehicle networks**, allowing for more accurate accident detection and quicker emergency responses.

- **Vehicle-to-Vehicle Communication**: With the advent of **V2V (Vehicle-to-Vehicle)** communication, systems may one day allow vehicles to communicate with each other to prevent accidents in real-time.

CONCLUSION

This project improves vehicle safety by detecting accidents caused by drunk driving and drowsiness. It uses a low-cost, automatic system with GPS and GSM to alert emergency services, ensuring quick response and saving lives. The system is affordable and easy to install in all vehicles.

REFERENCES

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[2] A. Alert, "Vehicle Accident Alert System Using Accelerometer GPS And GSM | ADXL 335," *YouTube*, Sep. 18, 2022. https://youtu.be/WNezQ0maD9I?si=5Nwk1_dxwMlmdXOj (accessed Jan. 14, 2025).

[3] L. Ramalingam, Umamagewaran Jambulingam, S. Muthumarilakshmi, N. Malathi, and M. Venkatesh, "IoT-Based Car Safety System With Airbag Notification for Emergency Assistance," vol. 9, pp. 484–489, Aug. 2023, doi: https://doi.org/10.1109/smarttechcon57526.2023.10391442

[4] VENUSREE. T. Student, T. R. Student, and P. j Student, "Car Safety System With Airbag Notification," Nov. 2024, doi: https://doi.org/10.21203/rs.3.rs-5391967/v1.

[5] D. says, "ACCIDENT PREVENTION, DETECTION AND REPORTING SYSTEM USING ARDUINO." https://electronicsworkshops.com/2021/07/05/accident-prevention-detection-and-reporting-system-using-arduino/

6.2 Program

```
#include <SoftwareSerial.h>

// Pin definitions for SIM, GPS, and LED
#define SIM_TX 3
#define SIM_RX 2
#define GPS_TX 8
#define GPS_RX 9
#define X_PIN A0
#define Y_PIN A1
#define Z_PIN A2
#define LED_PIN 13  // Pin for LED (built-in LED on most boards)

// Pin definitions for motor control, alcohol sensor, IR sensor, and buzzer
const int motor1Pin1 = 4;  // IN1 of L298 (Motor 1)
const int motor2Pin1 = 5;  // IN3 of L298 (Motor 2)
const int alcoholPin = A3; // Analog input from MQ3 sensor
const int IRSensor = 6;    // Digital input from IR Eye Blink sensor
const int BUZZER = 7;      // Pin connected to the buzzer

// Threshold values
float threshold = 2.2;  // Accident detection threshold (adjustable)
const int alcoholThreshold = 400; // Alcohol detection threshold

// Create SoftwareSerial objects for SIM and GPS
SoftwareSerial sim800l(SIM_TX, SIM_RX);
SoftwareSerial gpsSerial(GPS_TX, GPS_RX);

float x, y, z;
String latitude = "", longitude = "";

void setup() {
  Serial.begin(9600);
  sim800l.begin(9600);
  gpsSerial.begin(9600);

```

```
  // Set motor pins as outputs
  pinMode(motor1Pin1, OUTPUT);
  pinMode(motor2Pin1, OUTPUT);

  // Set IR sensor pin as input
  pinMode(IRSensor, INPUT);

  // Set buzzer pin as output
  pinMode(BUZZER, OUTPUT);

  // Set LED pin as output
  pinMode(LED_PIN, OUTPUT);

  delay(3000);
  Serial.println("System Ready...");
}

void loop() {
  // Read ADXL335 sensor
  x = analogRead(X_PIN) * (5.0 / 1023.0);
  y = analogRead(Y_PIN) * (5.0 / 1023.0);
  z = analogRead(Z_PIN) * (5.0 / 1023.0);

  Serial.print("X: "); Serial.print(x);
  Serial.print(" Y: "); Serial.print(y);
  Serial.print(" Z: "); Serial.println(z);

  // Detect accident based on threshold
  if (x > threshold || y > threshold || z > threshold) {
    Serial.println("Accident Detected!");

    // Turn on LED
    digitalWrite(LED_PIN, HIGH);

    // Get GPS location
```

```
    getGPSLocation();

    // Send alert
    sendSMS();

    delay(10000); // Avoid multiple triggers in a short time

    // Turn off LED after delay
    digitalWrite(LED_PIN, LOW);
  }

  // Alcohol detection logic
  int alcoholValue = analogRead(alcoholPin);
  Serial.print("Alcohol Value: ");
  Serial.println(alcoholValue);

  if (alcoholValue > alcoholThreshold) {
    // Stop the motors if alcohol is detected
    stopMotors();
    Serial.println("Alcohol detected! Motors stopped.");
  } else {
    // Start the motors if no alcohol is detected
    startMotors();
    Serial.println("No alcohol detected. Motors running.");
  }

  // Read IR eye blink sensor
  int statusSensor = digitalRead(IRSensor);

  if (statusSensor == HIGH) {
    // If no blink detected, turn off the buzzer
    digitalWrite(BUZZER, HIGH);
  } else {
    // If blink detected, turn on the buzzer
    digitalWrite(BUZZER, LOW);
```

```
  }

  delay(500); // Small delay to avoid rapid switching
}

// Function to get GPS location
void getGPSLocation() {
  Serial.println("Fetching GPS location...");
  while (gpsSerial.available()) {
    char c = gpsSerial.read();
    if (c == '$') {
      String nmeaData = gpsSerial.readStringUntil('\n');
      if (nmeaData.startsWith("GPGGA")) { // Standard GPS format
        parseGPS(nmeaData);
        break;
      }
    }
  }
}

// Function to parse GPS data
void parseGPS(String nmeaData) {
  char *ptr = strtok((char *)nmeaData.c_str(), ",");
  int field = 0;
  while (ptr) {
    field++;
    if (field == 3) latitude = String(ptr);
    if (field == 5) longitude = String(ptr);
    ptr = strtok(NULL, ",");
  }
  Serial.print("Latitude: "); Serial.println(latitude);
  Serial.print("Longitude: "); Serial.println(longitude);
}

// Function to send SMS alert
```

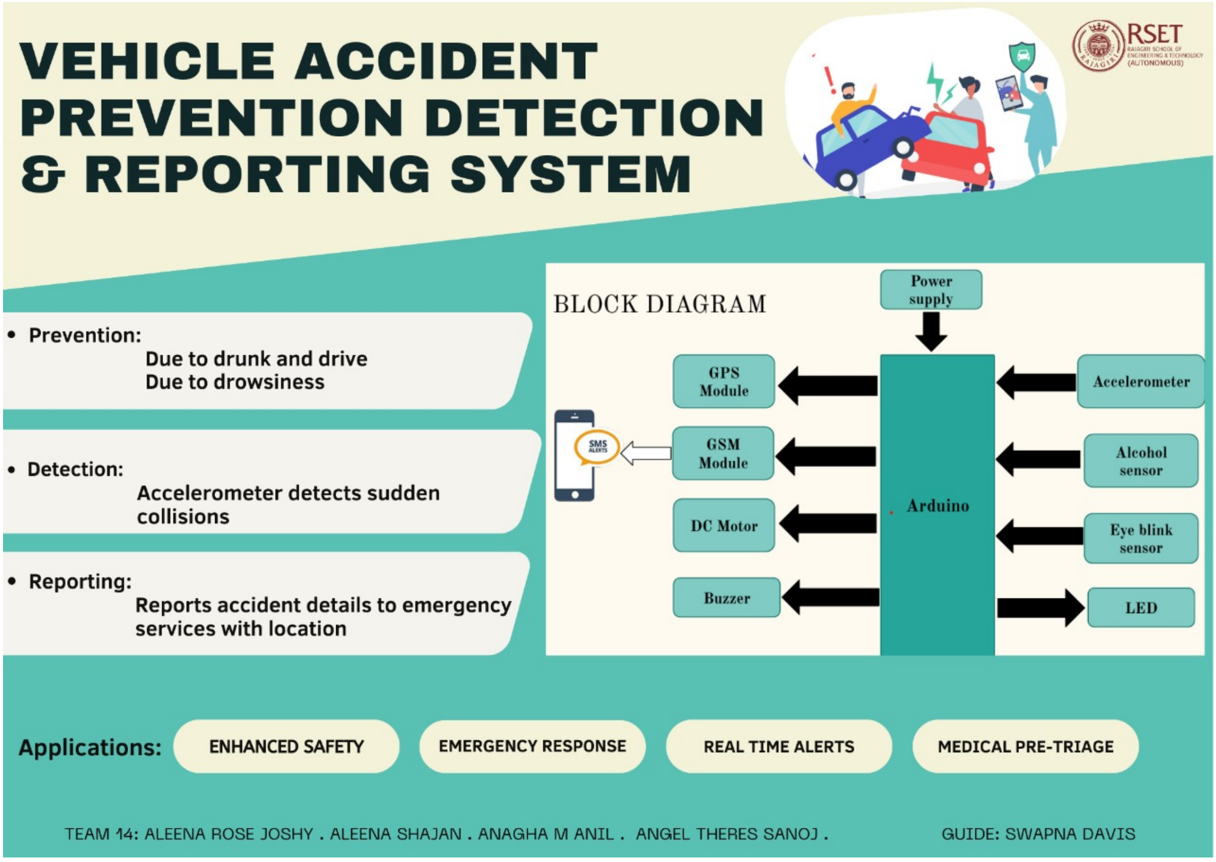
```
void sendSMS() {
  String smsMessage = "Accident Alert! Location: https://maps.google.com/?q=" + latitude + "," + longitude;

  Serial.println("Sending SMS...");
  sim800l.println("AT+CMGF=1");
  delay(1000);
  sim800l.println("AT+CMGS=\"+919961760844\"");  // Replace with recipient number
  delay(1000);
  sim800l.println(smsMessage);
  delay(1000);
  sim800l.write(26); // End SMS
  Serial.println("SMS Sent.");
}

// Function to start both motors
void startMotors() {
  digitalWrite(motor1Pin1, HIGH);
  digitalWrite(motor2Pin1, HIGH);
}

// Function to stop both motors
void stopMotors() {
  digitalWrite(motor1Pin1, LOW);
  digitalWrite(motor2Pin1, LOW);
}
```

6.3 Poster


VEHICLE ACCIDENT PREVENTION DETECTION & REPORTING SYSTEM
RSET
• Prevention:
Due to drunk and drive
Due to drowsiness
• Detection:
Accelerometer detects sudden collisions
• Reporting:
Reports accident details to emergency services with location
BLOCK DIAGRAM
Power supply
GPS Module
GSM Module
DC Motor
Buzzer
Arduino
Accelerometer
Alcohol sensor
Eye blink sensor
LED
SMS
Applications:
ENHANCED SAFETY
EMERGENCY RESPONSE
REAL TIME ALERTS
MEDICAL PRE-TRIAGE
TEAM 14: ALEENA ROSE JOSHY . ALEENA SHAJAN . ANAGHA M ANIL . ANGEL THERES SANOJ .
GUIDE: SWAPNA DAVIS

Appendix B: Vision, Mission, Programme Outcomes and Course Outcomes

RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Vision and Mission

Institute Vision

To evolve into a premier technological institution, moulding eminent professionals with creative minds, innovative ideas and sound practical skill, and to shape a future where technology works for the enrichment of mankind.

Institute Mission

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

Department Vision

To evolve into a centre of excellence in electronics and communication engineering, moulding professionals having inquisitive,innovative and creative minds with sound practical skills who can strive for the betterment of mankind

Department Mission

To impart state-of-the-art knowledge to students in electronics and communication and to inculcate in them a high degree of social consciousness and a sense of human values, thereby enabling them to face challenges with courage and conviction.

PO, PSO and CO

Programme Outcomes (PO)

Engineering Graduates will be able to:

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and Team work: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

10. Communication: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

Engineering students will be able to:

PSO1: Demonstrate their skills in designing, implementing and testing analogue and digital electronic circuits, including microprocessor systems, for signal processing, communication, networking, VLSI and embedded systems applications;

PSO2: Apply their knowledge and skills to conduct experiments and develop applications using electronic design automation (EDA) tools;

PSO3: Demonstrate a sense of professional ethics, recognize the importance of continued learning, and be able to carry out their professional and entrepreneurial responsibilities in electronics engineering field giving due consideration to environment protection and sustainability.

Course Outcomes (CO)

Course Outcome 1: Students will be able to practice acquired knowledge within the selected area of technology for project development.

Course Outcome 2: Students will be able to Identify, discuss and justify the technical aspects and design aspects of the project with a systematic approach.

Course Outcome 3: Students will be able to Reproduce, improve and refine technical aspects for engineering projects.

Course Outcome 4: Work as a team in development of technical projects.

Course Outcome 5: Communicate and report effectively project related activities and findings

Appendix C: CO-PO-PSO Mapping

CO - PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	3	3	2	3	3	2					2
2	3	3	3	2	3	3	2			3	2	2
3	3	3	3	2	3	3	2			3	2	2
4					2			3	3	3	2	2
5					2			3	3	3	2	2

CO - PSO Mapping

CO	PSO 1	PSO 2	PSO 3
1	3	3	2
2	3	3	2
3	3	3	2
4	2	2	3
5	2	2	3

Mini Project Outcomes

P1	Practiced acquired knowledge within the selected area of technology (such as embedded systems, sensors, GSM/GPS modules) for the development of a vehicle accident prevention and reporting system.
P2	Identified, discussed, and justified the technical and design aspects of the project such as alcohol detection, drowsiness detection, accident detection, and real-time reporting using a systematic engineering approach.
P3	Reproduced, improved, and refined the integration of sensors and communication modules to enhance the functionality and accuracy of the accident prevention and detection system.
P4	Worked effectively as a team in the planning, design, and implementation of the vehicle safety system.
P5	Communicated and documented project activities, design decisions, and results effectively through presentations and technical reports.

P - PO Mapping

P	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	3	3	2	3	1	2					2
2	2	2	1	2	2	3	2			3	2	2
3	2	3	3	2	3	3	1			3	1	2
4					2			3	3	3	2	2
5					2			3	3	1	2	2

Justification for P - PO Mapping

Mapping	**Level**	**Justification**
P1-PO1	3	Applied core engineering knowledge in embedded systems and accident prevention technologies.
P1-PO2	3	Analyzed real-world issues like drunk driving and accident scenarios.
P1-PO3	3	Designed multi-sensor systems (e.g., GSM, accelerometer) for accident reporting.
P1-PO4	2	Conducted systematic investigations and testing of system performance.
P1-PO5	3	Used modern embedded tools for system development and testing.
P1-PO6	1	Focused on societal safety by integrating communication and sensing technologies.
P1-PO7	2	Considered safety regulations and societal impact in project design.
P1-PO12	2	Improved technical learning through continuous feedback and exploration.
P2-PO1	2	Applied theoretical knowledge for system aspects like alcohol/drowsiness detection.
P2-PO2	2	Identified technical challenges and proposed systematic design solutions.
P2-PO3	1	Developed safety-related systems with societal relevance.
P2-PO4	2	Conducted testing and validation for functionality and reliability.
P2-PO5	2	Used modern engineering tools for detection and communication modules.
P2-PO6	3	Considered public safety and systematic design principles.
P2-PO7	2	Incorporated ethical and societal aspects during project planning.
P2-PO10	3	Planned and managed project components effectively.
P2-PO11	2	Participated actively in project planning and communication.
P2-PO12	2	Gained knowledge through experience and feedback application.

Mapping	Level	Justification
P3-PO1	2	Reproduced previous systems and improved with technical modifications.
P3-PO2	3	Improved system knowledge by refining sensor integration.
P3-PO3	3	Enhanced hardware/software interactions to improve system efficiency.
P3-PO4	2	Validated system improvements with structured testing.
P3-PO5	3	Applied modern tools and techniques for better system accuracy.
P3-PO6	3	Ensured reliability and upgraded safety mechanisms.
P3-PO7	1	Designed modules considering safety and ethical aspects.
P3-PO10	3	Efficiently managed time and tasks during project execution.
P3-PO11	1	Organized and participated in project documentation and reporting.
P3-PO12	2	Refined designs based on feedback and continuous learning.
P4-PO5	2	Worked collaboratively to use appropriate tools for system testing.
P4-PO8	3	Maintained teamwork ethics during project execution.
P4-PO9	3	Communicated and coordinated well within the team.
P4-PO10	3	Effectively planned, organized, and executed team-based tasks.
P4-PO11	2	Participated actively in documentation and communication activities.
P4-PO12	2	Continuously improved teamwork strategies based on reflections.
P5-PO5	2	Followed professional and ethical practices during project reporting.
P5-PO8	3	Communicated project activities clearly and effectively.
P5-PO9	3	Produced organized reports, presentations, and technical documentation.
P5-PO10	1	Communicated technical concepts concisely in documentation.
P5-PO11	2	Contributed actively to preparation of project reports.
P5-PO12	2	Improved documentation and presentation skills based on feedback.

P - PSO Mapping

P	**PSO 1**	**PSO 2**	**PSO 3**
1	2	2	2
2	3	3	2
3	3	3	1
4	2	1	3
5	1	2	3

Justification for P - PSO Mapping

Mapping	Level	Justification
P1-PSO1	2	Applied foundational knowledge of embedded systems and sensors to develop a prototype for accident detection and prevention.
P1-PSO2	2	Demonstrated problem-solving skills and applied design thinking for real-time alert systems using GSM and accelerometer modules.
P1-PSO3	2	Integrated multidisciplinary knowledge to deliver a functional and innovative mini-project solution.
P2-PSO1	3	Conducted in-depth technical analysis and design of system architecture for detecting drowsiness and alcohol.
P2-PSO2	3	Identified and addressed practical challenges using domain-specific technical skills.
P2-PSO3	2	Collaborated and contributed to design improvements in safety-critical applications.
P3-PSO1	3	Enhanced and refined system functionality by iterating through sensor calibrations and performance testing.
P3-PSO2	3	Improved the quality and performance of technical modules through systematic development.
P3-PSO3	1	Showed emerging awareness of broader engineering practices through refinement.
P4-PSO1	2	Contributed technically while working in teams, especially during the hardware assembly and coding phase.
P4-PSO2	1	Participated in system integration tasks using basic technical knowledge.
P4-PSO3	3	Demonstrated effective team communication, project division, and cooperative project execution.
P5-PSO1	1	Involved in interpreting and explaining technical outcomes during documentation.
P5-PSO2	2	Reported technical project activities effectively through structured formats.
P5-PSO3	3	Delivered project presentations and reports using well-developed communication skills.