ALCOHOL DETECTION AND MOTOR LOCKING SYSTEM

Project Report

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

Master Of Science

in

Automotive Embedded System

by

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DECLARATION

We solemnly declare that this submission is a product of our diligent efforts and that, to the best of our knowledge and conviction, it does not contain any material previously authored by another person, nor has it been submitted for the fulfilment of any other academic degree or diploma from this or any other institution of higher learning. In cases where external content is utilized, due acknowledgment has been duly made within the text.

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Place: Varikoli
Date: December 2023

Muthoot
Institute of Technology & Science

CERTIFICATE

This is to certify that the report entitled **"Alcohol Detection and Motor Locking System"** is a bonafide record of the **Project** presented by **Rosmia Jose**(Reg. No.: **MGCER202316**) and **Sanisha P S**(Reg. No.: **MGCER202318**) in partial fulfilment of the requirements for awarding the degree of **Master Of Science** in **Automotive Embedded System**.

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Place : Varikoli
Date: December 2023

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Rosmia Jose
Sanisha P S

ABSTRACT

A cutting-edge method of improving road safety by fusing a motor locking mechanism in cars with a sophisticated alcohol-detecting system. A major contributor to traffic accidents globally, driving under the influence of alcohol is something that the proposed method seeks to reduce. A complete solution to stop drunk drivers from operating automobiles is created by combining state-of-the-art alcohol-detecting technology with an intelligent motor locking mechanism.

The component for alcohol detection makes use of cutting-edge sensors that can precisely measure blood alcohol concentration (BAC). The placement of these sensors inside the car is intended to provide accurate and quick detection. When the system detects a BAC level that is higher than what is allowed, it initiates an instant reaction. A message is sent to the guardians via the GSM (Global System for Mobile Communication) module. The vehicle's speed is managed by the sensor value, and messages are sent to the guardians via the GSM module. The purpose of the motor locking device is to prevent anyone with a detected alcohol impairment from operating the car by disabling the ignition or transmission system. User safety is maintained while system effectiveness is ensured through the deployment of tamper-proof and secure locking methods.

The technological viability, dependability, and legal ramifications of incorporating such a system into contemporary cars are examined in this study. User acceptance, privacy issues, and adaptation to different vehicle types are all taken into account. The suggested approach is in line with international initiatives to lower alcohol-related collision rates and improve general road safety.

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CHAPTER 1

INTRODUCTION

A complete strategy to improve road safety by avoiding drunk driving is the integration of alcohol detection systems, motor locking mechanisms, GPS (Global Positioning System) modules, GSM (Global System for Mobile Communications) modules, and speed control technology. This cutting-edge method attempts to address the grave repercussions of driving under the influence of alcohol, which is a major global source of accidents and fatalities.

1.1 Alcohol Detection System

The purpose of the alcohol detection system is to measure the amount of alcohol in a driver's blood or breath. By using sophisticated sensors and technology, including alcohol-specific sensors or breathalyzers, the system determines the driver's degree of intoxication with accuracy.One popular gas sensor for determining the concentration of alcohol vapor is the MQ-3 sensor. It belongs to the MQ series of sensors, which are widely used for gas detection in a variety of applications.In addition to methane and propane, the MQ-3 sensor is also sensitive to a few other gases.It operates on the same principle as a variable resistor, in which the presence of target gases causes the resistance to change.After that, an analog voltage signal that can be measured and examined is created from the change in resistance.

1.2 Motor Locking Mechanism

The motor locking mechanism activates when it senses that the driver's system contains an increased amount of alcohol. This part keeps the car from starting and, if it is already moving, helps to bring it to a controlled stop gradually. To safeguard other drivers on the road as well as the intoxicated driver, this intervention is an essential safety precaution.When a driver is detected to be under the influence of alcohol, technology can be used to either prevent the vehicle from starting or to bring it to a controlled stop gradually. This is known as the motor locking mechanism.The MQ-3 sensor-based system for alcohol detection, as described, is integrated with the motor locking mechanism.The motor locking mechanism is triggered by the detection system when the concentration of alcohol surpasses a predetermined threshold.

1.3 GSM Technology

The GSM module allows the car and a central monitoring system to communicate in real time. When the motor locking mechanism is activated by alcohol detection, the GSM module instantly notifies predefined contacts, like emergency services or law enforcement. This quick communication guarantees prompt action and response.The motor locking mechanism and the MQ-3 sensor are two parts of the alcohol detection system that are integrated with the GSM module.The GSM module is simultaneously activated and the motor locking mechanism is triggered when the alcohol detection system detects an elevated alcohol concentration.These contacts might be emergency services, law enforcement, or any other pertinent authorities in charge of handling such cases.

1.4 GPS Module

The ability to track and monitor location is made possible by integrating GPS technology. This feature makes it possible for authorities to locate the vehicle precisely, enabling prompt assistance and response. It can also be applied to legal proceedings and post-incident analysis.An alcohol detection system's overall functionality is improved by the incorporation of GPS (Global Positioning System) technology, which offers precise location tracking capabilities. This feature is crucial for a number of reasons, from post-event analysis and legal proceedings to the quick reaction to incidents. The GPS unit constantly provides real-time location updates for the car.Relevant authorities can access the central monitoring system to which this information is transmitted.When the motor locking mechanism is triggered by alcohol detection, it activates simultaneously with the GSM module.When authorities receive the alerts, they can use the vehicle's real-time location to respond and assist promptly.It is possible to promptly dispatch emergency services to the scene when the precise location of the impaired vehicle is known.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Drunk and Drive Controller for Vehicles [1]

Authors: P. Manikandan; V. Muneeswaran; G. Ramesh; Ravuru Siva Rakesh; Peddysetty Chakraesh; Nagireddy Sumanth Reddy; Noorbonala Sahul
Year: 2021

2.1.1 Summary

The paper introduces a project to reduce drunk driving accidents. It makes use of an MQ-3 alcohol sensor that is installed on the steering wheel of the car and an Arduino ATMEGA328 microprocessor. The driver uses an Arduino to regulate the motor after a sensor measures the amount of alcohol in his breath. The device reduces the chance of an accident by sending an order to turn off the engine if the alcohol content goes above a predetermined limit.

The four primary stages of the conceptual design are motor locking, Arduino control, pulse production, and sensor data. To find the alcohol level, the microcontroller reads the analog voltage value from the alcohol sensor and converts it to a digital value. There are three levels to this system, representing varying degrees of alcohol intake, and each level sets off distinct functions including his LED indication, buzzer, and engine control. The findings demonstrate that the system was successful in determining the alcohol content, setting off the alert, and stopping the engine. The suggested system is efficient, dependable, and small. The study makes suggestions for potential follow-up uses, such as incorporating the system into car production to enhance safety features. The overall goal of this project is to increase road safety by preventing drunk driving-related incidents.

2.2 Vehicle Tracking with Alcohol Detection and Seat Belt Control System [2]

Authors: Nitesh Mandal; Abhishek Sainkar; Omkar Rane; Mahesh Vibhute
Year: 2020

2.2.1 Summary

The paper suggests a thorough approach to reduce the risk of drunk driving accidents and to increase traffic safety. Real-time GPS tracking, seat belt status monitoring, and alcohol detection are all features of the system. The intention is to keep the car's ignition off until after the driver has buckled up and completed a breathalyzer test. Furthermore, this system uses the Internet of Things (IoT) cloud platform to notify end users in case of an emergency. A switch-based circuit is used to assess the seat belt status, and an alcohol sensor is used for alcohol detection. A Global Positioning System (GPS) for tracking location in real-time and an Android application serving as a dashboard is included in the suggested model. The device keeps an eye on variables including temperature, acceleration, and speed continuously. The outcomes show how well the features that check for alcohol use, indicate whether a seat belt is on, and display real-time data on the dashboard worked. The system communicates and reports using a cloud platform. This study looks into potential future applications, like applying advanced machine learning to assess driving abilities, adding cameras for event capture, integrating GSM for emergency notifications, and integrating heart rate sensors for accident prediction. It is proposed to make improvements. The suggested system offers a flexible approach to road safety by combining real-time tracking, seat belt monitoring, and alcohol detection with upgrades to further increase safety features and accident avoidance.

2.3 Alcohol Detection For Car Locking System [3]

Authors: Shahad Al-Youif; Musab A. M. Ali; M. N. Mohammed

Year: 2018

2.3.1 Summary

The authors of the paper implement a project aimed at alcohol detection using pre-existing alcohol sensing modules in the project. The main goal of this project is the creation of a car lock system that forbids the vehicle from starting without alcohol control. This system interprets data about butane (a substitute for alcohol) using gas sensors and an Arduino UNO. The goal is to increase road safety and end drunk driving-related accidents. We gather data and display behaviour in descending order of measured voltage over time using an Arduino UNO and a gas sensor. The system showed that it could regulate two-wheeler ignition based on preset gas thresholds and that it could detect butane gas concentration with success. Despite being a prototype, this provides a foundation for enhancements and modifications. The incorporation of logical elements like relays for integration into actual automobiles is one of the proposals. Systems for testing for alcohol can connect the car's ignition control to the detecting process and automate it. Future upgrades to the system's functionality and efficacy could include more displays, wireless alarms, or audible alarms.

2.4 A GPS-GSM predicated vehicle tracking system, monitored in a mobile app based on Google Maps [4]

Authors: Neha Mangla; G Sivananda; Aishwarya Kashyap; Vinutha

Year: 2017

2.4.1 Summary

The paper implements a system for vehicle tracking using features that check for alcohol use, indicate whether a seat belt is on, and display real-time data on the dashboard worked. The system communicates and reports using a cloud platform. The study looks into potential future applications, like applying advanced machine learning to assess driving abilities, adding cameras for event capture, integrating GSM for emergency notifications, and integrating heart rate sensors for accident prediction. It is proposed to make improvements. The suggested system offers a flexible approach to road safety by combining real-time tracking, seat belt monitoring, and alcohol detection with upgrades to further increase safety features and accident avoidance.

The Atmega microcontroller serves as an interface, the GSM modem facilitates communication, the GPS antenna generates coordinates, and the mobile application utilizes Google Maps. All of these components are thoroughly discussed in the procedural section of the system. Through the mobile application, users may find the location of their vehicle and start the process of creating coordinates that can be texted to others. The results section displays the user interface and procedure for entering the received latitude and longitude into the car tracking software.

The UI of the mobile app, the GPS coordinates that were obtained through SMS, and the procedure for entering latitude and longitude to find the vehicle on a map are all displayed in the results. Users may easily launch and navigate the vehicle monitoring process with the help of the mobile app, which enhances the system's accessibility and user-friendliness.

Lastly, by integrating IoT into car tracking systems as an example, this research illustrates the development of IoT and its influence on conventional systems. This system exemplifies networked data collection and communication, highlighting the Internet of Things' transformational potential across multiple industries.

2.5 A GPS-GSM predicated vehicle tracking system, monitored in a mobile app based on Google Maps [5]

Authors: SeokJu Lee; Girma Tewolde; Jaerock Kwon
Year: 2014

2.5.1 Summary

This article outlines a practical and affordable vehicle monitoring system that tracks cars in real time by fusing a microcontroller with a smartphone application. Global System for Mobile Communications/General Packet Radio Service (GSM/GPRS) and GPS are the two location systems used by in-car gadgets. The GPS and GSM/GPRS modules are managed by the microcontroller, which also periodically calculates the geographic coordinates and uses GSM/GPRS to transmit the position of the vehicle to the database. Users of smartphone applications created with Google Maps APIs can track the movements of vehicles, calculate travel durations, and anticipate when they will arrive at particular locations. When a car gadget is being tested, satellite coordinates are received by the GPS module and communicated via the GSM/GPRS network to a web server. The car's location is updated in real-time on Google Maps using the smartphone app. The system's ability to track vehicle positions and provide information on the duration and distance between places along a certain route has been demonstrated. Real-time vehicle tracking is successfully made possible by the created vehicle tracking system. Microcontrollers and GPS/GSM/GPRS modules collaborate with in-car gadgets, servers, and smartphone apps to guarantee precise position data. The vehicle's unique ID and geographic coordinates are recorded by the online interface, which establishes a direct connection with the database. An inexpensive prototype built upon readily obtainable commercial electronic modules shows how the suggested car tracking system is both affordable and useful.

CHAPTER 3

METHODOLOGY

Various technologies, including alcohol detection sensors, GSM modules, GPS modules, and a control system, must be integrated when designing a system for motor locking, speed control, and alcohol detection in a car.

3.1 Alcohol Detection System

To determine the driver's blood alcohol content, use breathalyzers or alcohol detection sensors. Select sensors that are appropriate for use in cars, like alcohol sensors based on semiconductors. To process data, connect the alcohol detection system to a microcontroller or processing unit. An important advancement in road safety is the Alcohol Detection System with the MQ-3 Sensor, which forbids drivers who are intoxicated from operating a vehicle. This system uses cutting-edge sensor technology to identify alcohol vapours in the surrounding air, especially in a vehicle's small space. Because of its sensitivity and specificity to ethanol vapours, the MQ-3 alcohol sensor—the main component—provides accurate readings even at low concentrations. Key Components

3.1.1 MQ-3 Sensor (Micro Quality Sensor)

The MQ-3 sensor, which is well-known for its dependability, is used to identify alcohol vapours by observing variations in electrical conductivity. This sensor is perfect for applications involving alcohol detection because it is made expressly to react to ethanol.

A well-liked gas sensor module for detecting different gases, including alcohol vapour, is the MQ-3 sensor. It works based on the chemiresistor principle, which states that when a sensing material comes into contact with the target gas, it changes electrical conductivity. The following are some important characteristics and things to think about with the MQ-3 alcohol detection sensor:

Principal attributes

- **Reactivity to Ethanol:** The main ingredient in alcoholic beverages, ethanol (C2H5OH), is particularly sensitive to the MQ-3 sensor.
- **Analog Output:**Depending on how much of the detected gas is present, the sensor outputs an analog voltage. Higher voltage outputs are produced by higher gas concentrations.
- **Quick Reaction:** Changes in alcohol concentration can be quickly detected thanks to the MQ-3 sensor's reputation for having a relatively quick response time.
- **Broad Detection Spectrum:** Because of its wide detection range, the sensor can identify alcohol vapours at different concentrations.
- **Minimal Power Usage**: Because of its low power consumption, it can be integrated into systems that run on batteries or into portable electronics.

Chemiresistor Theory

MQ-3 sensor heats a sensing element, usually made of a thin film of tin dioxide (SnO2), using a tiny heater. The material's electrical conductivity changes when alcohol vapour comes into contact with the heated sensing element. The voltage across the sensor changes as a result of the sensing element's altered electrical resistance. The voltage across the sensor changes as a result of the sensing element's altered electrical resistance. A microcontroller or other processing units can then measure this change after it has been converted into an analog signal.

3.1.2 Microcontroller

The system processes data from the MQ-3 sensor, applies control algorithms, and carries out preventive actions using a microcontroller ESP32. The way the Alcohol Detection System works is that it keeps an eye out for alcohol vapours in the air inside the car. Real-time data on alcohol concentration is provided by the microcontroller in conjunction with the MQ-3 sensor. To guarantee safe driving, the system starts preventive actions when the detected alcohol level surpasses a predetermined threshold.

Integration with Microcontrollers

- **Conversion of Analog to Digital**

  A microcontroller's analog pin is frequently linked to the analog signal originating from the MQ-3 sensor. Sensor data can be read and processed by microcontrollers that can be programmed, like the Raspberry Pi or Arduino.

- **Setting the Threshold**

  It is possible to program the microcontroller to set an alcohol concentration threshold that, when exceeded, will cause particular actions to occur.The MQ-3 sensor is a useful tool for detecting alcohol vapors when used appropriately and integrated into a well-designed system. This helps to improve safety in a variety of applications, particularly when it comes to preventing driving while intoxicated.

3.2 Motor Locking Mechanism

Install a motor locking mechanism to stop the car from starting if the alcohol content goes above a set limit.To operate the motor locking mechanism, connect the microcontroller to the car's ignition system.One essential part of an alcohol detection system intended to stop drunk drivers is the motor locking mechanism in a car. The motor locking mechanism is triggered by the system when it detects an alcohol level above a predefined threshold. This disables the ignition of the vehicle and stops the engine from starting.

This is a thorough breakdown of the motor locking mechanism.

- **Electronic Switch or Relay**

  Relays or electronic switches that cut off the vehicle's ignition system's power supply are used in the motor locking mechanism. An electronic signal can be used to control a relay, an electromechanical device that opens or closes electrical contacts.

- **Using the Ignition System Interface**

  The ignition system of the car incorporates the relay or electronic switch. It usually has a connection to the circuit that powers the starter motor or ignition coil.

- **Control of Microcontrollers**

  Relay or electronic switch control is programmed into the microcontroller of the alcohol detection system, which receives data from the alcohol sensor.The microcontroller alerts the relay when the alcohol concentration rises above the set threshold.

- **Safety Consideration** Safety must be a top priority when designing engine locking mechanisms to avoid unintended consequences or malfunctions. Considering the potential risks associated with stopping a running motor, provide fail-safe measures to prevent accidental activation of the motor locking system.

- **Override mechanism** Contains an override mechanism to allow authorized users.Allows the engine to be unlocked in certain situations, such as law enforcement or emergency personnel.This override may include a secure electronic key or manual override procedure.

- **Integration with Vehicle Electronic** Ensures seamless integration with vehicle electronic systems, ensuring compatibility and reliability. Understand vehicle-specific ignition systems to effectively implement engine locking mechanisms.

- **Audible or Visual Warning** Provides an audible or visual warning to the driver when the engine locking mechanism is activated. Alerts should be designed to inform the driver of the reason for the engine shutdown, thereby promoting awareness and understanding.

- **System Reset** Implements a system reset mechanism that restarts the engine if the alcohol concentration falls below a predetermined threshold. Resetting can occur automatically after a certain amount of time, or it can require manual intervention.

- **Secure Communication** Ensures that the communication between the alcohol detection system microcontroller and the engine lock mechanism is secure to prevent unauthorized tampering.

3.3 GSM Module

Integrates A7076C GSM module for communication purposes. Configure the module to send an SMS alert or an alert to a predefined contact when alcohol is detected above a threshold. Enables remote control functionality that allows an authorized user to lock/unlock the vehicle or adjust system settings via SMS commands.

3.3.1 Module Integration

Connect the GSM module to the microcontroller via UART or another suitable communication protocol.

- **Power Supply** : Provide a stable power supply to the GSM module. Consider power-saving strategies to optimize energy consumption.

- **SIM Card Insertion** : Insert a valid SIM card into the GSM module.

- **Communication Setup** : Configure the GSM module to send SMS alerts or notifications. Implement error handling for reliable communication.

- **Remote Control** : Enable remote control features through SMS commands. Define commands to lock/unlock the vehicle or change system settings.

- **Emergency Contact** : Set up emergency contact numbers to receive critical alerts

3.4 GPS Module Integration

Choose a GPS module compatible with the microcontroller. Common modules include the Ublox NEO-6M or NEO-7M.

- **Wiring and Connection**: Connect the GPS module to the microcontroller using serial communication (usually through UART). Typically, GPS modules have pins for VCC, GND, TX, and RX.Set up the GPS module by sending the necessary initialization commands. Configure the update rate based on the desired frequency of location updates.

- **Data Parsing:** Develop code to parse the NMEA sentences transmitted by the GPS module. Extract essential information such as latitude, longitude, and speed from the GPS data.

- **Real-time Tracking:** The parsed GPS data for real-time tracking of the vehicle's location. Incorporate this information into SMS alerts and the user interface.

- **Error Handling:** Implement error handling mechanisms to account for GPS signal loss or inaccuracies.

CHAPTER 4

IMPLEMENTATION

Implementing systems that include alcohol detection, engine locking, GSM communications, GPS tracking, and speed control is a complex task that requires hardware components, software development, and integration.

4.1 Hardware Components

4.1.1 ESP32

ESP32, a powerful microcontroller developed by Espressif Systems, plays a key role in implementing vehicle alcohol detection, engine interlock, GSM communication, GPS tracking and speed control systems. The ESP32 acts as the brain of the alcohol detection and vehicle control system, coordinating the integration of the various components to ensure the safety and functionality of the entire system. Its computing power, connectivity options, and versatility make it a good choice for such applications. The ESP32 serves as the system's central processing unit, controlling all of its operations. It uses predefined algorithms to process data from multiple sensors, such as the GPS module and MQ-3 alcohol sensor and then makes decisions. It establishes a connection with the MQ-3 alcohol sensor, interprets the analog signals, calculates the alcohol content and reads data from the GPS module to determine the speed and location of the vehicle in real-time and it controls a relay or additional motor control devices to regulate the motor locking mechanism. When required, it can turn off the ignition system of the car and use the detected alcohol content to modify the braking or throttle to implement speed control.

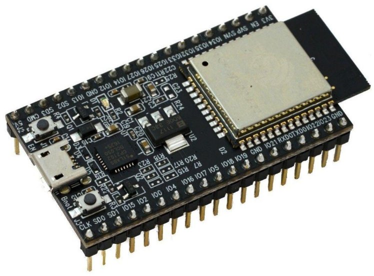

Figure 4.1: ESP32S

4.1.2 MQ-3 Alcohol Sensor

The MQ-3 sensor is a gas sensor used to detect the presence of alcohol vapour in the air. The MQ stands for 'Micro Quality', which indicates the micro quality form of measurements of the percentage of air. The MQ series of sensors were developed by the Winsen company. Below is the working of each element within the module:

Figure 4.2: MQ3 Sensor

MQ-3 Sensor Components:

- **Heating Element:** The sensor contains a heating element that heats the element and maintains the internal temperature of the element constant.

- **Gas Sensing Material:** The outer layer of the sensor is made of a Metal Oxide

Semiconductor which changes its conductivity when the alcohol vapour comes in contact with the sensor.

- **Analog-to-Digital Converter (ADC):** ADCs are frequently used to convert analog signals into digital values that microcontrollers and other digital devices can read and operate. An ADC is typically connected to the analog output of a sensor.

Principle of operation:

- **Sensor heating:** The MQ-3 sensor has a built-in heating element that is turned on to heat gas-sensitive materials. This heating is necessary for the sensor to respond to changes in gas concentration.

- **Interaction with Alcohol:** A built-in heating element in the MQ-3 sensor is activated to heat materials that are sensitive to gases. The sensor needs this heating in order to react to variations in gas concentration.

- **Change in resistance:** The gas-sensitive substance in the sensor undergoes a chemical reaction when it comes into contact with alcohol vapor, changing its electrical conductivity.

- **Output Signal:** The resistance of the sensor varies with variations in electrical conductivity. The voltage across the voltage divider circuit's load resistor reflects this shift. The ADC processes the analog output signal that indicates the amount of alcohol in the air. A microcontroller or other digital device can read this signal after it has been processed.

- **Threshold Detection:** The alcohol concentration threshold can be adjusted by a microcontroller or other digital device that is linked to the sensor. This threshold is exceeded in order to cause an alert to sound or to take certain action.

4.1.3 GSM Module - A7670C 4G SIM Modem

A device that facilitates communication between electronic systems and mobile networks is called a GSM module. These modules are widely utilized in many different applications, including embedded systems, machine-to-machine (M2M) communication, and the Internet of Things. These enable data transmission and reception across cellular networks for devices.

Figure 4.3: A7076C 4G GSM Module with Antenna

Components of GSM module:

- **Antenna:** To communicate with cellular networks, GSM modules normally feature an antenna.
- **SIM Card Slot:** The module identifies itself and gains access to cellular networks via a SIM (Subscriber Identity Module) card.
- **Power:** Power is needed for the GSM module to function. Module standards must be met by the power supply because they sometimes operate at different voltages.
- **Communication Interface:** Through a communication interface like SPI (Serial Peripheral Interface) or UART (Universal Asynchronous Receiver-Transmitter), the module can connect with a host device (such a microcontroller or computer).
- **AT Commands:** AT instructions are commonly used to control GSM modules.

Simple text commands are transmitted to the module via the communication interface, enabling it to carry out several tasks like sending text messages, placing phone calls, and establishing an Internet connection.

- **Network Registration:** Before the module may send or receive data, it needs to register with the mobile network. This involves confirming the SIM card's legitimacy within the network.

- **Data Communication:** The module can send and receive data once it has registered with the network. These could be USSD (Unstructured Supplementary Service Data) for interactive communications, GPRS (General Packet Radio Service) for data transmission, and SMS (Short Message Service).

4.1.4 GPS Module

GPS modules can be integrated into systems designed to deter drunk driving and improve vehicle safety when combined with engine interlocks and alcohol detection systems. GPS modules provide real-time location data and can therefore be used to track vehicle movements. It features a user interface to track vehicle location, monitor alcohol detection results, and adjust system settings. This interface can be a smartphone app linked to the system or display inside the car. In an emergency, police or emergency services can unlock the engine.

Figure 4.4: GPS Module

4.1.5 Motor Locking Mechanism

A safety feature called the engine interlock system keeps the car from starting or operating until a few requirements are satisfied. When combined with engine interlock and alcohol detection, this system prevents the car from operating if the driver is found to be intoxicated. We shall describe how this type of system's engine lock operates.

Motor Locking Mechanism Components:

- **Actuator or Solenoid Valve:** The motor locking mechanism typically includes an actuator or solenoid valve. It is an electromechanical device that controls the movement of critical vehicle components such as the ignition system or fuel delivery device may be physically blocked or obstructed.

- **Control Unit (Microcontroller):** The unit in charge of processing signals from different sensors, such as alcohol detection sensors, is usually a microcontroller. Based on the detected condition, it determines whether to activate or deactivate the engine locking mechanism.

- **Relays:** Relays are often used to control large currents in a vehicle's electrical system. The control unit controls the relay, which activates or deactivates the engine lock.

4.1.6 LCD Display

Integrating an LCD (Liquid Crystal Display) into an alcohol detection and engine interlock system can provide real-time feedback to the driver about alcohol sensor readings. We make use of the LCD to show the sensor values in ppm and displays an alert on the LCD if the alcohol concentration exceeds a predefined limit. Inform the driver that the driver is impaired and that the engine is about to lock up.

Figure 4.5: 16x2 LCD display

4.2 Software

4.2.1 Arduino IDE

A software platform called the Arduino IDE (Integrated Development Environment) is used to write, compile, and upload code to Arduino microcontrollers. It offers an easy-to-use interface that makes writing and uploading code for Arduino boards simpler. The Arduino IDE has made microcontroller programming accessible to a wide audience, including beginners and hobbyists, by offering a simplified and user-friendly environment.

Figure 4.6: Arduino IDE

CHAPTER 5

RESULTS

5.1 Proposed Model Circuit Diagram

The circuit diagram for the design of the Alcohol detection and motor locking system with hardware components is shown below:

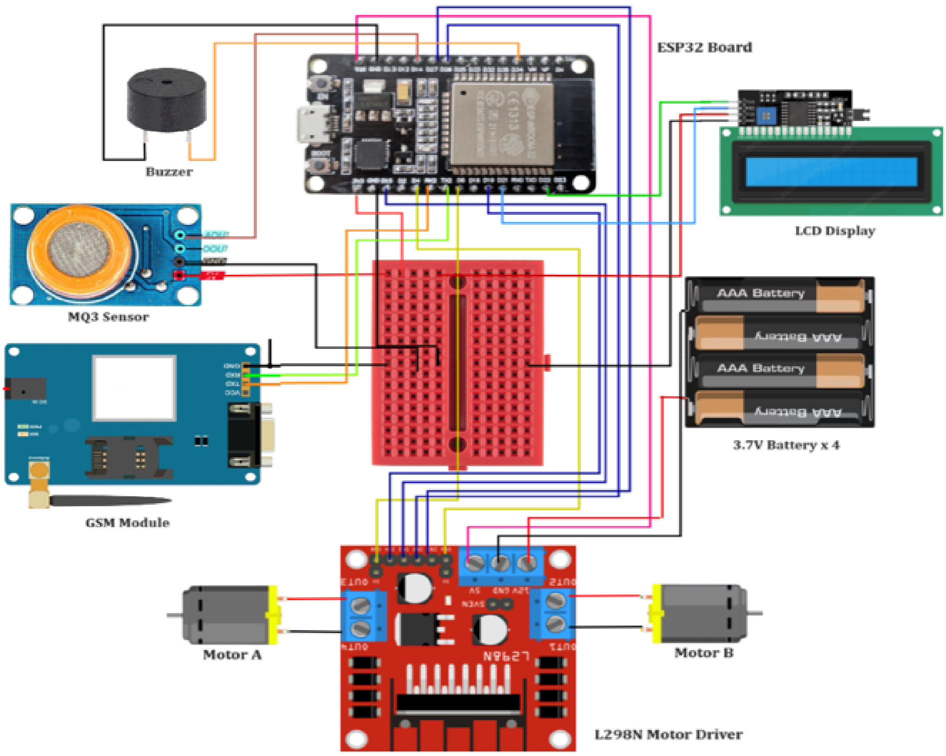

Figure 5.1: Circuit Diagram

5.2 Final Implemented Alcohol Detection Vehicle

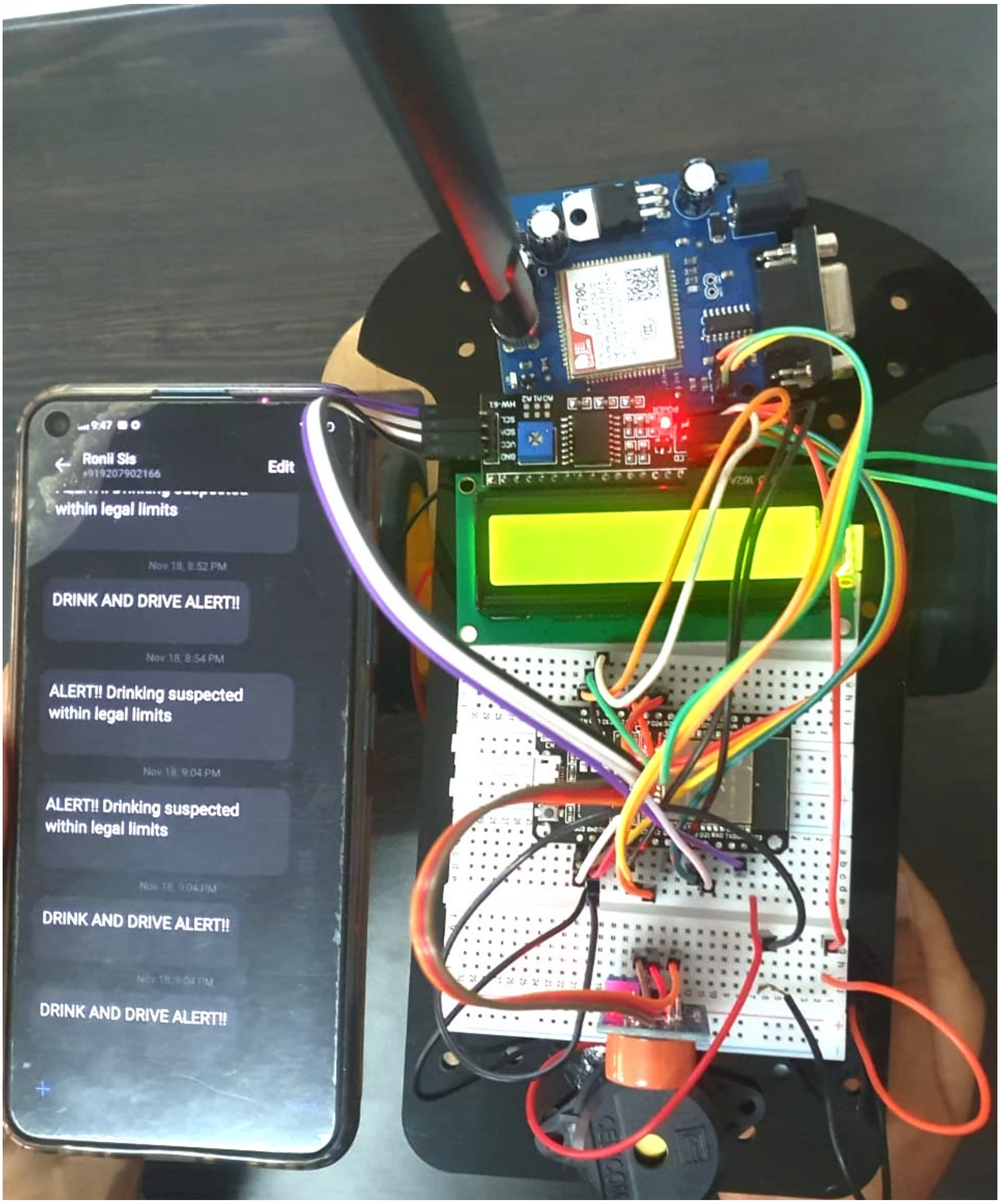

Figure 5.2: Final Prototype

The alcohol values sensed are displayed on the LCD, as shown:

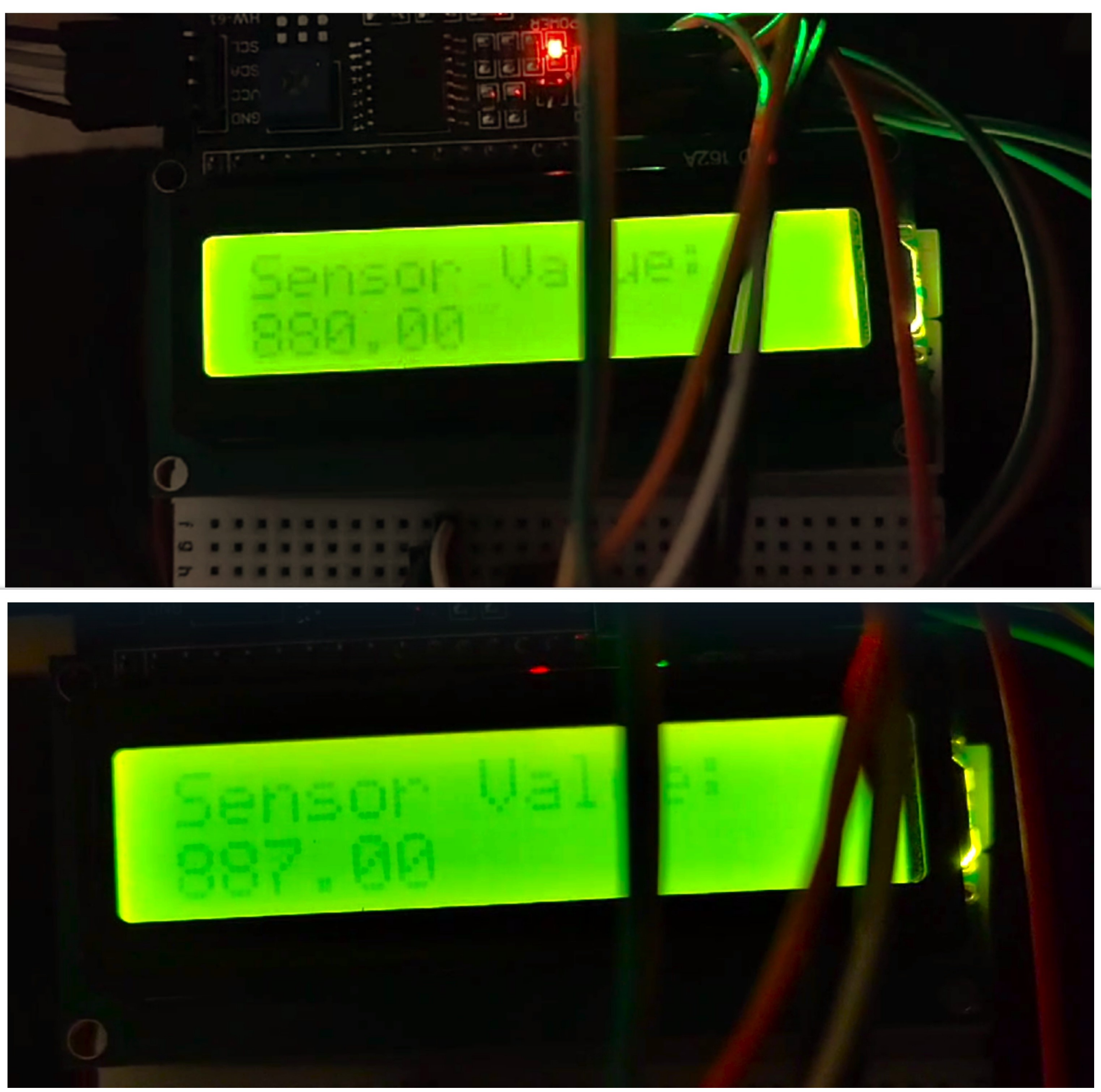

Figure 5.3: MQ-3 values displayed on LCD

Once the driver was found to be drunk, the alert was immediately sent to the respective phone, as shown below:

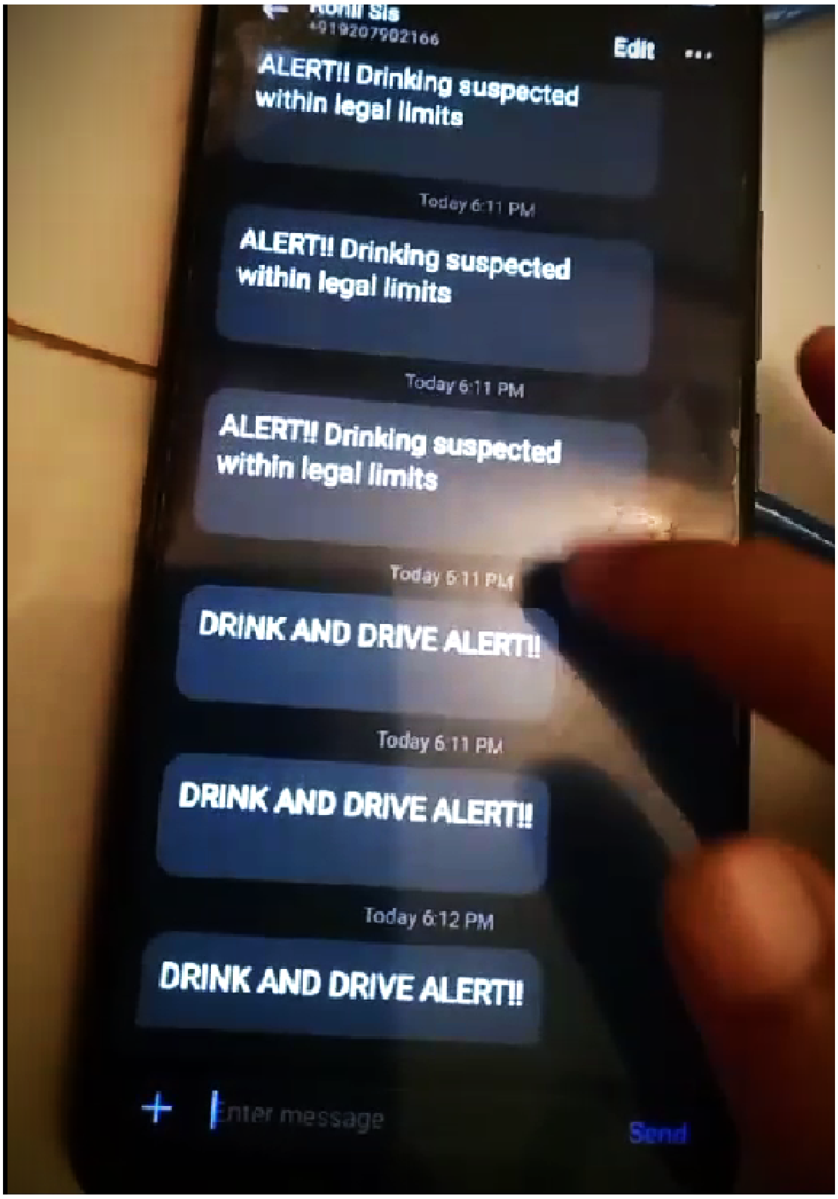

Figure 5.4: Alert Messages on Recipient's Phone

5.3 Software Code Implemented on Arduino IDE

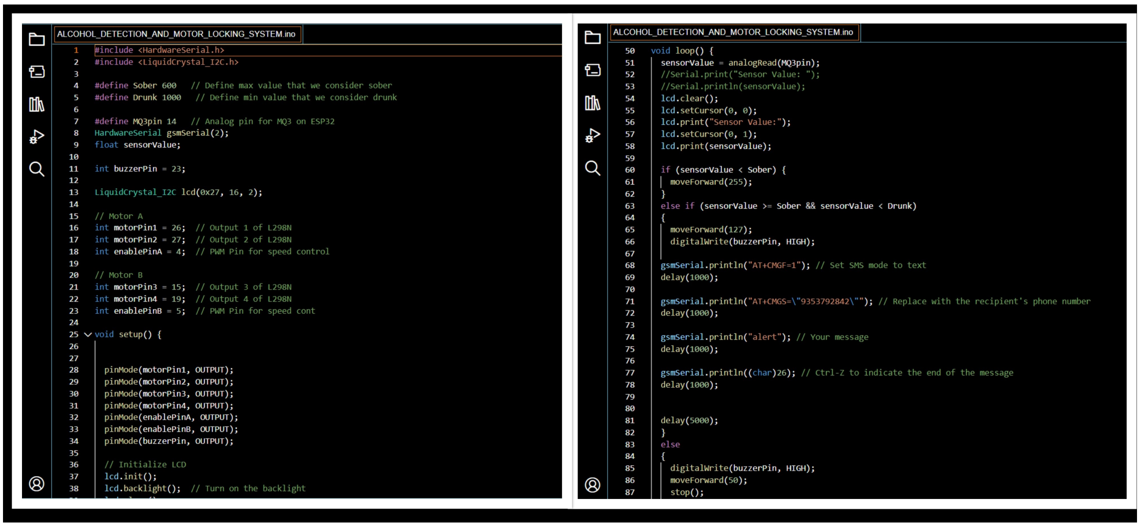

Figure 5.5: ESP32 Integrated Code

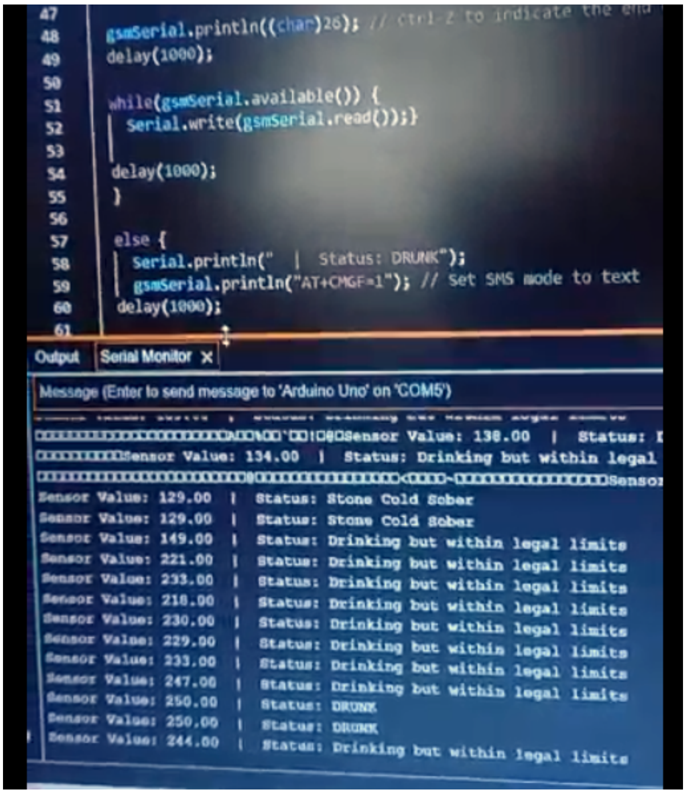

Figure 5.6: Serial Display

5.4 Features implemented in the Model

The proposed model of the Alcohol Detection and Motor Locking System was implemented successfully. The following features were implemented:

- **Alcohol Sensing:** Continous monitoring of alcohol detection while driving
- **GSM Technology:** Alert message 'Alert!! Drinking suspected within legal limits' sent immediately to the respective connected phone number, when the driver was found to be drinking. If found extremely drunk, a 'Drunk and Drive ALert' message is sent.
- **Buzzer and LED for indicating drunk and drive case to nearby vehicles:** A cautious drunk and drive signal was sent to the surrounding vehicles using a continuous beep of buzzer and Blinking of the red LED. This was done to deliver information about the drunk and driving case and to be cautious about any possible accident.
- **Motor Locking mechanism:** Once the driver was found to be drinking, we decreased the motor speed and an alert message was parallelly delivered to the phone and caution was indicated to the nearby vehicles. When the alcohol limit is exceeded and found drunk, the motor slows down and gradually the vehicle ceases to stop and the motors are locked.

5.5 Shortcoming Faced During the Implementation of the System

The incorporation of vehicle tracking utilizing GPS technology in the project was hindered by the inefficient functioning of the GPS module and encountered technical issues. This setback arose due to the inefficient performance of the GPS module and encountered technical issues during implementation. Despite earnest efforts, the incorporation of this feature was ultimately impeded, and the focus shifted towards addressing the existing challenges and ensuring the effectiveness of the core components of the project.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 Conclusions

The implementation of alcohol detection, motor locking, GSM communications and speed control systems are complex but important efforts to improve road safety. The main purpose of this system is to increase road safety by preventing drunk driving. A motor lock mechanism prevents the vehicle from starting if the alcohol content exceeds the safe limit. By integrating the user interface, the user receives real-time feedback on alcohol content, and system status, whether via the LCD or the mobile application. This increases user awareness and engagement. Implementing such a system also requires public awareness and education efforts. Users need to be informed about the functionality of the system, its role in promoting responsible driving and its contribution to road safety. Finally, a comprehensive solution to promote safe and responsible driving with the integration of alcohol detection, engine lock, GSM communication, and adaptive cruise control using the A7076C GSM module and ESP32 microcontroller is provided. This reduces the risks associated with drunk driving and contributes to general road safety.

6.2 Future Scope

A range of future applications such as alcohol detection, and engine interlocking with GSM and GPS modules require continuous innovation and development to improve system effectiveness, user experience and integration. There are several possible future directions:

- **Machine learning integration:** Implement machine learning algorithms for more accurate and adaptive alcohol detection. Continuous learning models adapt better to individual user behaviour and improve accuracy over time.
- **Biometrics:** Integrate biometric technologies such as fingerprints and facial recognition to increase security and ensure that those interacting with the system are authorized users.
- **Vehicle Communication Systems:** Describes the integration of vehicle communication systems (V2X) that enable communication between vehicles. This improves road safety by providing real-time information about the status of nearby vehicles, especially those with similar safety systems.
- **Cloud-Based Monitoring and Analysis:** Leverage cloud-based platforms for centralized monitoring and analysis. This facilitates remote updates, data analysis, and system optimization.
- **IoT Integration:** Integration with IoT devices (Internet of Things) in the vehicles, providing additional data for overall safety assessment. This improves system responsiveness and enables advanced features.
- **Self-Driving Vehicle Integration:** Describes integration with self-driving vehicle systems. In the future, as autonomous driving becomes more widespread, safety systems will work hand in hand with self-driving features to ensure an overall safer driving experience.
- **User-friendly mobile applications:** Develop user-friendly mobile applications for seamless interaction with the system. This app can provide real-time updates, historical data, and additional features such as route planning and vehicle diagnostics.

- **Public Awareness Campaign:** Conduct a public awareness campaign to educate users and stakeholders about the benefits and responsible use of alcohol detection systems and engine interlock systems.

Continued research, development, and collaboration with various stakeholders, including vehicle manufacturers, regulators, and technology providers, is essential for the future development of alcohol detection and engine interlock systems using GSM and GPS modules to create a safer and more protected driving environment for all road users.

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APPENDIX

SOFTWARE PROGRAM IMPLEMENTED USING ESP32

```

#include <HardwareSerial.h>
#include <LiquidCrystal_I2C.h>

#define Sober 600     // Define maximum value that we consider sober
#define Drunk 1000    // Define mininum value that we consider drunk
#define MQ3pin 14     // Analog pin for MQ3 on ESP32
HardwareSerial gsmSerial(2);
float sensorValue;
int buzzerPin = 23;
int ledPin = 22;
LiquidCrystal_I2C lcd(0x27, 16, 2);

// Motor A
int motorPin1 = 26;   // Output 1 of L298N
int motorPin2 = 27;   // Output 2 of L298N
int enablePinA = 4;   // PWM Pin - speed control motor A
// Motor B
int motorPin3 = 15;   // Output 3 of L298N
int motorPin4 = 19;   // Output 4 of L298N
int enablePinB = 5;   // PWM Pin - speed control motor B

void setup() {
  pinMode(motorPin1, OUTPUT);
  pinMode(motorPin2, OUTPUT);
  pinMode(motorPin3, OUTPUT);
  pinMode(motorPin4, OUTPUT);
  pinMode(enablePinA, OUTPUT);
  pinMode(enablePinB, OUTPUT);
```

```
  pinMode(buzzerPin, OUTPUT);
  pinMode(ledPin, OUTPUT);
  lcd.init();          // Initialize LCD
  lcd.backlight();     // Turn on the backlight
  lcd.clear();
  gsmSerial.begin(115200);   // Start GSM communication
  gsmSerial.begin(115200, SERIAL_8N1, 16, 17);
  gsmSerial.println("AT");
}

void loop() {
  sensorValue = analogRead(MQ3pin);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Sensor Value:");
  lcd.setCursor(0, 1);
  lcd.print(sensorValue);

  if (sensorValue < Sober) {
    moveForward(255);
  }
  else if (sensorValue >= Sober && sensorValue < Drunk) {
    moveForward(127);
    digitalWrite(buzzerPin, HIGH);
    digitalWrite(ledPin, HIGH);
    gsmSerial.println("AT+CMGF=1"); // Set SMS mode to text
    delay(1000);
    gsmSerial.println("AT+CMGS=\"9353792842\""); // Replace with the recipient's phone number
    delay(1000);
    gsmSerial.println("Alert!! Drinking suspected within legal limits!!");                        //  message
    delay(1000);
    gsmSerial.println((char)26);    // Indicate the end of the message
    delay(1000);
  }
```

```
    else {
        digitalWrite(buzzerPin, HIGH);
        digitalWrite(ledPin, HIGH);
        moveForward(50);
        stop();
        gsmSerial.println("AT+CMGF=1"); // Set SMS mode to text
        delay(1000);
        gsmSerial.println("AT+CMGS=\"9353792842\"");
        delay(1000);
        gsmSerial.println("DRUNK AND DRIVE!!"); // message
        delay(1000);
        gsmSerial.println((char)26);   // Indicate the end of the message
        delay(1000);
    }
    delay(1000);
}

void moveForward(int speed) {
    analogWrite(enablePinA, speed);
    digitalWrite(motorPin1, HIGH);
    digitalWrite(motorPin2, LOW);
    analogWrite(enablePinB, speed);
    digitalWrite(motorPin3, HIGH);
    digitalWrite(motorPin4, LOW);
}
void stop() {
    analogWrite(enablePinA, 0);
    analogWrite(enablePinB, 0);
    digitalWrite(motorPin1, LOW);
    digitalWrite(motorPin2, LOW);
    digitalWrite(motorPin3, LOW);
    digitalWrite(motorPin4, LOW);
}
```