NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

A MINI PROJECT REPORT

On

ALCOHOL DETECTION AND ENGINE LOCKING SYSTEM

Submitted

in the partial fulfilment requirements for the credit of the course on

INTERNET OF THINGS

(CC2002-1)

by

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2024-2025

DEPARTMENT

OF

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CERTIFICATE

This is to certify that **AKSHITH SHETTY (NNM22CC001)**, **G ROHAN (NNM22CC020)** and **KESHAV NAYAK (NNM22CC028)** have successfully completed the mini project work on **"Alcohol Detection and Engine Locking System"** and submitted the partial fulfilment of the requirements of the course **Internet of Things (CC2002-1)** prescribed by the **NMAMIT, Nitte** during the academic year **2024-2025.**

Project Guide	**H.O.D**
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Any achievement, whether academic or personal, is not solely the result of individual effort but is greatly influenced by the guidance, support, and cooperation of mentors, elders, and peers. Numerous individuals have contributed to the successful completion of this project, and we would like to take this opportunity to extend our heartfelt gratitude to each of them.

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ABSTRACT

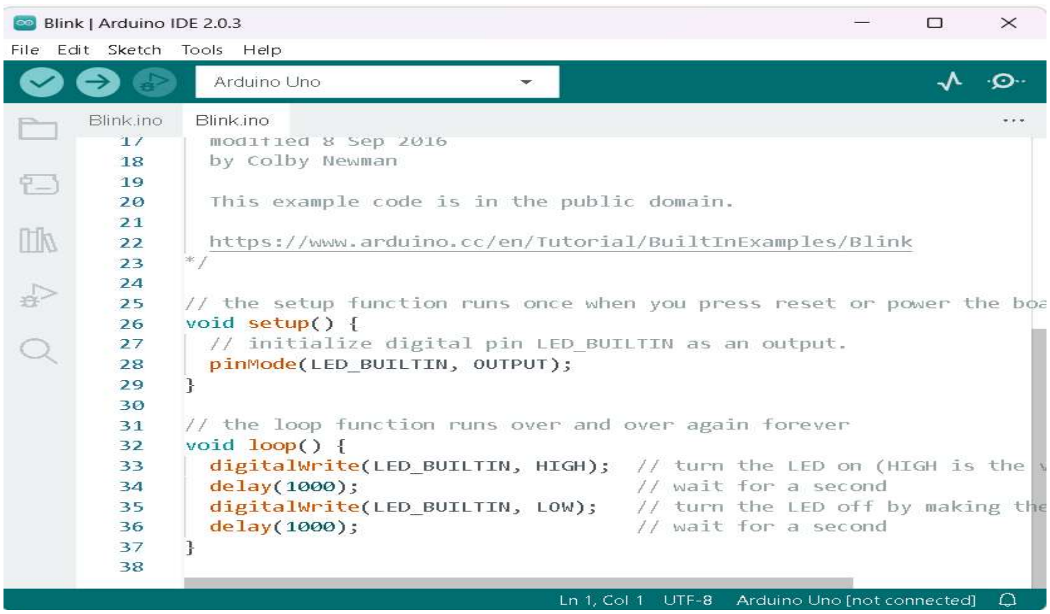
Alcohol Detection and Engine Locking System. The proposed system has been designed to enable safe driving without alcoholic thrill-seeking, which forms the basis of this project. The system is IoT-based, where it employs an alcohol sensor to detect the content of alcohol on the driver's breath. Once the system detects it, the system locks the vehicle's engine completely, which cannot be operated further. It also sends the location of the vehicle to a pre-saved emergency contact through a GSM module to enable swift response and intervention.

The system is designed to be sensitive to levels of alcohol that would put someone at risk and thus assure positive detection but reject most false alarms. The GPS module continuously tracks the location of the vehicle, therefore allowing timely response from emergency contacts or local authorities in the case of an incident. Being straightforwardly integrated into vehicles, this system offers proactive solutions to drunk driving while supporting the safety of drivers, passengers, and the community. It offers a very efficient safety countermeasure against drunk driving, thus reducing the level of injuries and deaths on the roads, through real-time feedback and alerts.

CHAPTER 1

INTRODUCTION

1.1 Introduction to Arduino IDE



(Arduino IDE with built-in Blink code)

Arduino IDE is an open-source software, designed by Arduino.cc, where IDE stands for Integrated Development Environment provides to write, compile and upload code to most of the Arduino modules. Many built-in codes are available, easy to compile makes a person who has no proper technical knowledge operate very easily.

Operating systems such as Windows, Linux, MAC etc. can support Arduino IDE which runs on the Java Platform also including built-in functions and commands available for debugging, editing and compiling code. Arduino IDE supports both C and C++. It has both editor and compiler in it.

1.2 Problem Statement

The manual operation of vehicles by intoxicated drivers poses significant risks, leading to potential accidents and endangering lives. Traditional vehicles rely on driver responsibility to avoid such risks, but this project aims to enhance vehicle safety through an alcohol detection and engine locking system. By implementing an MQ3 alcohol sensor, GPS, and GSM module, this system detects the driver's alcohol level, powers off the engine if it exceeds the threshold, and sends the vehicle's location to a registered mobile number.

While alcohol detection mechanisms are available, many lack automated responses or reliable alert systems, leaving vehicles prone to accidents caused by impaired driving. The absence of a robust system that automatically locks the engine and alerts others when alcohol is detected creates potential challenges in safety, reliability, and road security.

Key challenges addressed in this project:

- **Alcohol Detection**: Accurately sensing the driver's alcohol level using the MQ3 sensor.
- **Engine Locking**: Automatically powering off the engine when the alcohol level exceeds the safe threshold.
- **Real-time Location Tracking**: Using the GPS module to record the vehicle's location.
- **Remote Alert System**: Sending real-time alerts with location details to a registered mobile number through the GSM module.

1.3 Mini Project Description

The **Alcohol Detection and Engine Locking System** is an IoT-based solution aimed at enhancing road safety by preventing drunk driving incidents. The system integrates an MQ3 alcohol sensor, which detects the presence of alcohol in the driver's breath. When the sensor detects a certain level of alcohol, it sends a signal to the Arduino microcontroller, which then triggers the engine locking mechanism. This effectively disables the vehicle's engine, preventing it from being started or operated, thereby eliminating the risk of impaired driving. The system also includes a GPS module to track the vehicle's location, and a GSM module is used to send a real-time alert to a pre-saved emergency contact, providing immediate information about the vehicle's location. This ensures that family members, emergency responders, or relevant authorities can quickly intervene if necessary. The entire system is designed for easy integration into vehicles, making it a versatile solution for enhancing safety across different types of cars.

By utilizing IoT technology, the system continuously monitors the driver's breath alcohol concentration and ensures that the vehicle operates only when the driver is sober. The use of an Arduino microcontroller enables seamless communication between the alcohol sensor, GPS module, GSM module, and engine lock, ensuring reliable and efficient functionality. The system can also be customized for different alcohol concentration thresholds, depending on legal driving limits or individual preferences. This project highlights the potential of IoT in providing proactive solutions to public safety challenges, offering a modern approach to preventing drunk driving. It is not only a valuable tool for personal vehicles but could also be implemented in fleet management systems, rental cars, or shared vehicles to promote safe driving practices. With a growing emphasis on road safety, this system serves as a critical step toward reducing accidents caused by impaired driving and fostering a safer driving environment for everyone on the road.

CHAPTER 2

LITERATURE REVIEW

1. The paper titled "Alcohol Detection System for Vehicle Safety" by Nookala Venu presents an alcohol detection system aimed at enhancing road safety by preventing engine start when alcohol is detected. The system uses sensors to identify alcohol presence, connecting to an engine control module to disable vehicle operation for drivers under the influence. This method increases safety by preventing drunk driving incidents. The system's components include an alcohol sensor, a microcontroller, and an engine control module. While effective in promoting safer driving, the system is sensitive to environmental conditions, which may affect its reliability.

2. The paper titled "IoT Smart Locking for Vehicle Anti-Theft" by Dr. Pavan Shukla describes an IoT-based smart vehicle locking system that allows remote locking and unlocking via mobile applications. The system employs a microcontroller and Wi-Fi module, linking to an app for remote access, which enhances vehicle security and deters theft. Its advantages include ease of access and robust anti-theft functionality; however, it relies on stable internet connectivity, which may limit its usability in areas with poor network coverage.

3. The paper titled "Alcohol Detection with Real-Time Engine Control" by Pratiksha Bhuta introduces a real-time alcohol monitoring system designed to prevent drunk driving by controlling engine functionality. It employs an alcohol sensor, GPS, GSM module, and relay circuit for real-time monitoring and action, including location-based alerts. The system provides immediate response capabilities, alerting authorities if necessary, though installation costs may be high due to its advanced components.

4. The paper titled "Alcohol Detection with Cloud-Based Data Logging" by Arun Francis explores a cloud-based system for alcohol monitoring, where data is stored and accessed remotely, allowing comprehensive monitoring and analysis. This method integrates cloud storage, sensors, and a microcontroller connected via Wi-Fi. The advantages include easy data access and the ability to monitor the system remotely; however, potential privacy concerns arise from cloud data storage.

5. The paper titled "Embedded Systems in Alcohol Detection for Vehicle Safety" by Dr.M. Kumar focuses on the integration of embedded systems for alcohol detection, which activates vehicle control functions when alcohol is detected. By incorporating embedded technology, sensors, and engine lock mechanisms, this system provides a dependable solution for enhancing vehicle safety. It is reliable and effective, though the complexity of system integration can present challenges.

6. The paper titled "Alcohol Detection with GSM Notification System" by Hamamy & Danial details a GSM-based alcohol detection system that sends alerts to guardians or authorities when alcohol is detected. The system includes a GSM module, alcohol sensor, and microcontroller, facilitating communication across GSM networks. This method offers a convenient way to notify concerned parties; however, GSM connectivity limitations may affect functionality in rural areas.

7. The paper titled "Intelligent Alcohol Detection System with Smart Locking" by P. Sree Lekha & Dr. P. Venkata Prasad introduces an intelligent system for detecting alcohol and automatically locking the vehicle to prevent operation. Equipped with sensors, a locking system, and a microcontroller, it provides an automated response that minimizes human intervention. However, it may generate false positives under certain environmental conditions.

8. The paper titled "Alcohol Detection Integrated with a Mobile App for Control" by Ighalo Joshua proposes an alcohol detection system that integrates a mobile app for engine control. This approach combines a mobile application, sensor, and microcontroller to allow user-friendly access to control features. While the system is accessible via smartphones, its dependence on mobile compatibility and internet connectivity could be a limitation.

9. The paper titled "Wireless Alcohol Detection with Alert and Lock Control" by Niranjani V presents a wireless system for monitoring alcohol levels and controlling vehicle locking mechanisms. Using a wireless module, alcohol sensor, and microcontroller, this system offers remote access and efficient communication capabilities. Despite its advantages, wireless interference may reduce reliability.

2.1 Summary

Sl No	Paper Title	Author	Method Used	Limitations	Components Used
1	Alcohol Detection and Engine Locking System	Nookala Venu (2022)	Arduino Uno microcontroller, MQ3 alcohol sensor to monitor breath and automatically shut off the engine if alcohol exceeds the safe threshold	Earlier systems used unreliable sensors like MQ2, which had high false alarm rates	Arduino Uno, MQ3 alcohol sensor
2	Automatic Engine Locking System Through Alcohol Detection	Dr. Pavan Shukla (2020)	Arduino Uno, MQ3 alcohol sensor, SIM900A for sending messages to civil forces, engine locking system, and LED for indicating unsafe distance	Older systems relied on less accurate sensors (MQ2) and more expensive microcontrollers	Arduino Uno, MQ3 sensor, SIM900A, DC motor, Red LED, Buzzer
3	Alcohol Detection and Vehicle Controlling	Pratiksha Bhuta (2015)	Arduino Uno-based system with MQ3 sensor, GPS to capture location, GSM to send SMS alerts, and LCD display for alerts	Older methods were more expensive and less reliable	Arduino Uno, MQ3 alcohol sensor, GPS module, GSM module, LCD display

4	Health Monitoring with Alcohol Detection and Ignition Control using IoT	Arun Francis (2019)	MQ3 sensor at the helmet for alcohol detection, heartbeat sensor, controller for processing data via IoT and preventing ignition	Future improvements include integrating GPS and GSM for location tracking	MQ3 alcohol sensor, Heartbeat sensor, IoT, NodeMCU, WiFi, Cloud storage
5	Alcohol Detection and Automatic Drunken Drive Avoiding System	Dr. M. Kumar (2020)	AVR ATmega16 microcontroller with MQ3 sensor, ADC converter, motor driver to stop vehicle, and GSM modem to send alerts	Could benefit from integration with GPS for location tracking	MQ3 alcohol sensor, AVR ATmega16 microcontroller, ADC, LCD, L293D motor driver, GSM modem
6	Alcohol Detection Using Arduino with Motor Locking	Hamamy and Danial (2022)	Arduino Mega with MQ3 sensor for alcohol detection, motor locking, buzzer alert system, and LCD for displaying detection results	Future upgrades could include facial recognition and GPS/GSM integration	Arduino Mega, MQ3 alcohol sensor, Buzzer, LCD, Motor locking system
7	Alcohol Detection with Automatic Engine Locking System	P. Sree Lekha & Dr. P. Venkata Prasad (2021)	Arduino Uno, MQ3 sensor, DC motor, and LCD screen for engine locking based on BAC detection	Lacks real-time location tracking like GPS	MQ3 alcohol sensor, Arduino Uno, DC motor, LCD display

8	Development of Alcohol Triggered Vehicle Engine Lock System	Ighalo Joshua (2019)	Alcohol sensor MQ3 with ATmega328 microcontroller, DC motor to control engine, and LCD for alerts	Earlier systems were basic and lacked portability and real-time intervention	MQ3 alcohol sensor, ATmega328 microcontroller, DC motor, LCD, Alarm
9	Drink and Drive Detection with Ignition Lock System	Niranjani V (2019)	Arduino board with alcohol sensor, GSM module, and LCD display for locking the ignition and sending SMS notifications	Lacks comprehensive automatic intervention for vehicle immobilization	Arduino board, MQ3 sensor, GSM module, LCD display

CHAPTER 3

DESIGN

3.1 Proposed Solution

To address the dangers of drunk driving, which relies solely on driver responsibility for safety, this project proposes an **"Alcohol Detection and Engine Locking System"** equipped with an alcohol sensor for automatic impairment detection. This system combines manual control with autonomous safety features, allowing the vehicle to operate normally when the driver is sober, while integrating an MQ3 alcohol sensor that continuously monitors the driver's breath for alcohol presence. When a certain level of alcohol is detected, the system activates safety protocols: an LED indicator turns on, and the car's engine is automatically disabled to prevent operation.

This design is powered by an Arduino microcontroller that processes data from the alcohol sensor and interfaces with a GPS module, GSM module, and engine control system. Upon alcohol detection, the GPS module tracks the vehicle's location, while the GSM module sends an alert to a pre-saved emergency contact with the vehicle's location information. The system uses alcohol level detection as a proactive measure, enhancing road safety by preventing impaired driving. This approach ensures a safer driving environment by reducing the risk of accidents and enabling quick intervention in case of an incident.

3.2 Flowchart

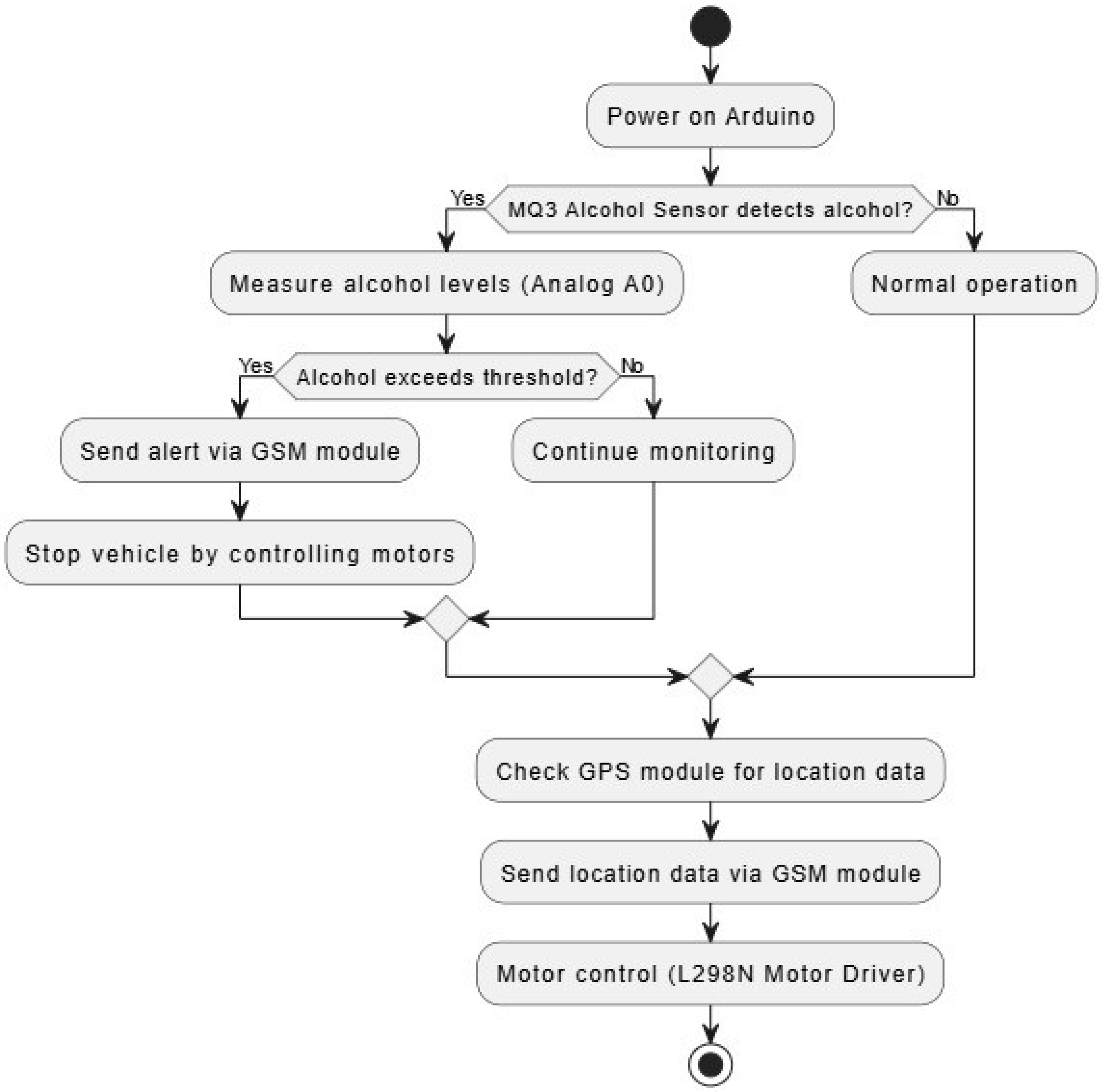
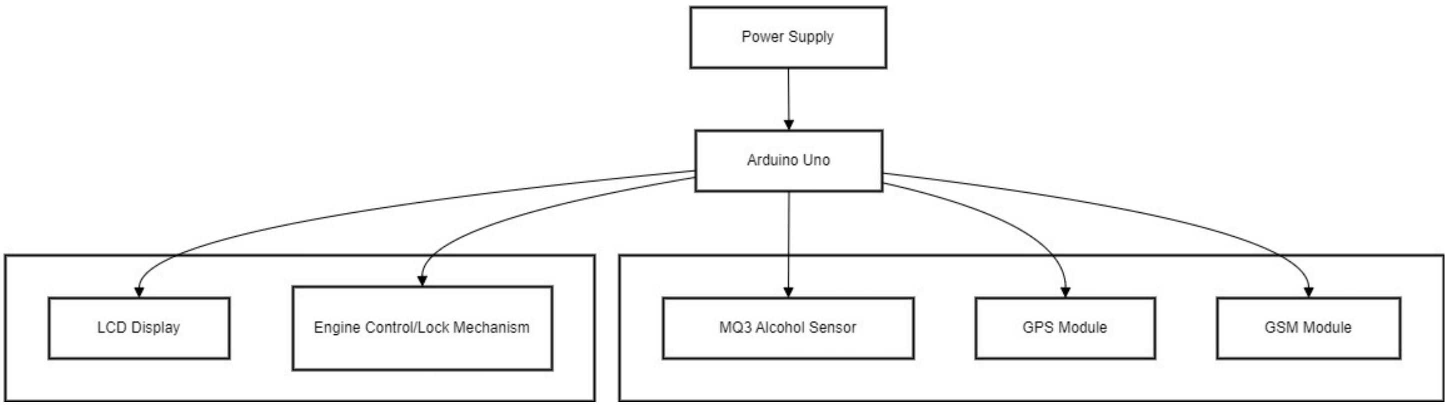


Fig 3.2 Flow Chart

3.2 Block Diagram



3.2 Block Diagram

3.3 Software Requirements

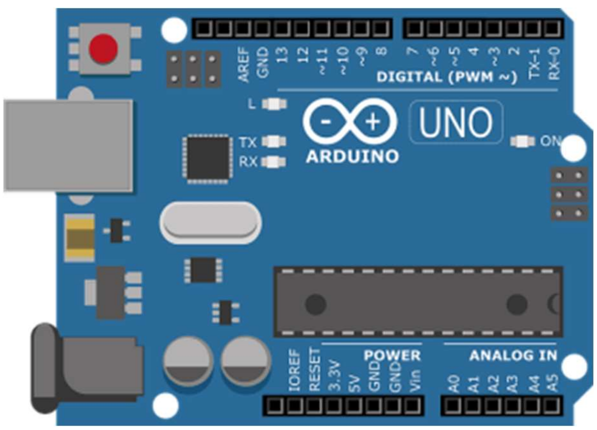
Arduino IDE

- The Arduino Integrated Development Environment (IDE) is required to write, compile, and upload code to the Arduino microcontroller. It provides the environment to program and test the project.
- **Version**: Latest version compatible with your operating system.
- **Libraries**:
  - SoftwareSerial for serial communication with external modules (e.g., GPS or Bluetooth, if used).
  - MQ3 Sensor Library (if a specific library is required for alcohol sensor data handling).
  - TinyGPSPlus or similar libraries (if GPS integration is included to send location in case of alcohol detection).

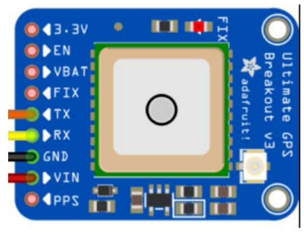
3.4 Hardware Requirements

1. MQ3 Alcohol Sensor: Detects alcohol levels in the driver's breath. Outputs data to the Arduino for processing.

2. Arduino UNO: Acts as the main controller, processing data from the alcohol sensor and controlling other components.

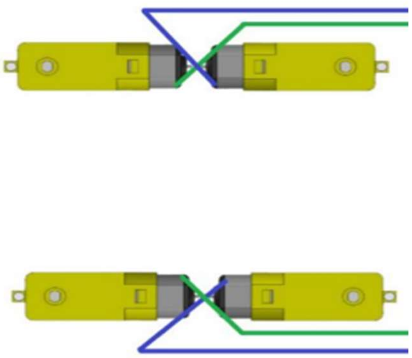


3. GPS Module: Provides real-time location data, which can be useful for tracking in case of emergency situations or for location-based alerts.

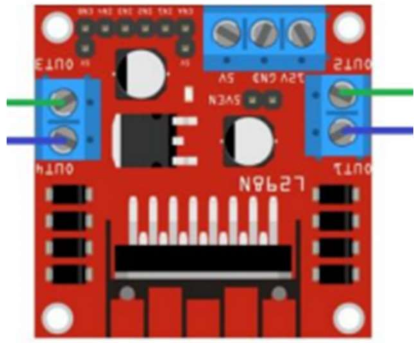


4. GSM Module: Enables communication, allowing the system to send SMS alerts or notifications if alcohol is detected.

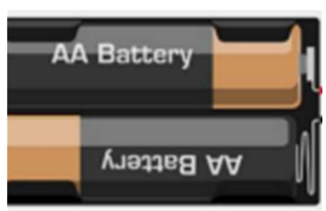
5. DC Motors: Used to simulate or control the engine locking mechanism. The motors can halt operation if alcohol is detected.



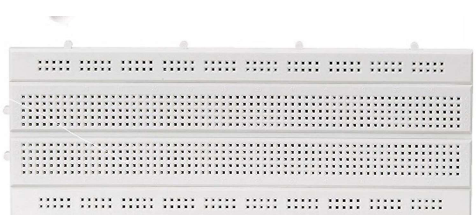
6. L298N Motor Driver: Manages power to the DC motors, enabling control over the motor's direction and speed through the Arduino.

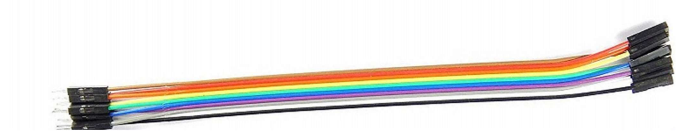


7. 12V Battery: Powers the DC motors and motor driver, providing the necessary voltage for stable operation.



8. Connecting Wires and Breadboard: Used to set up connections between components and to structure the circuit.





3.5 Circuit Diagram

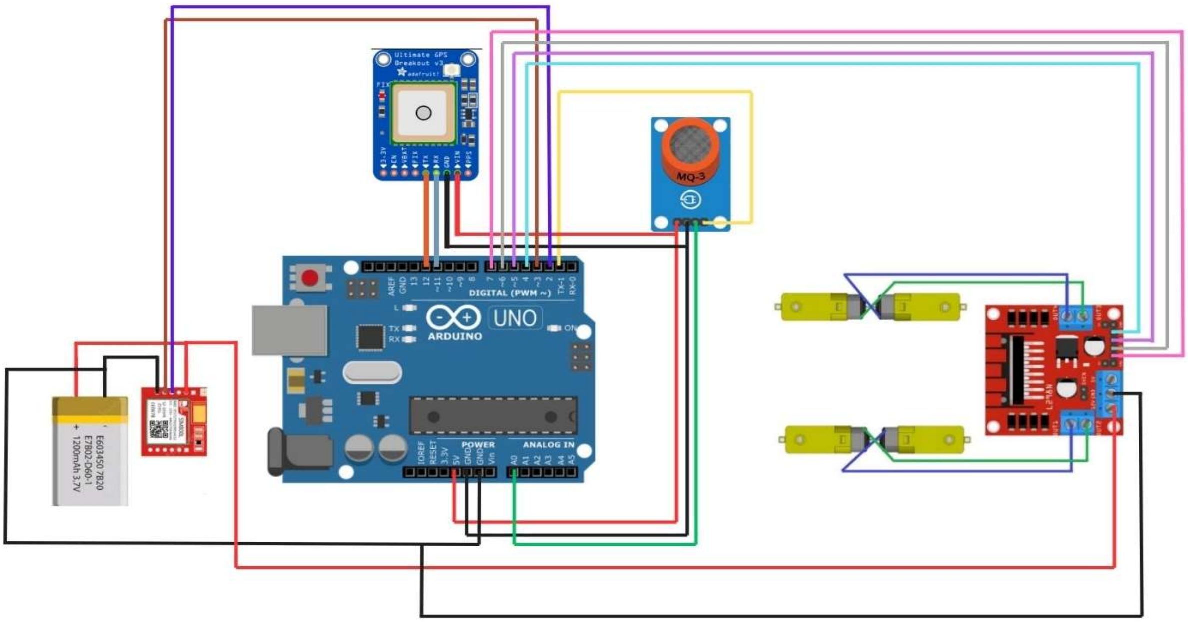


Fig 3.3 Circuit Diagram for Alcohol Detection and Engine Locking System

3.6 Connection Description

1. MQ3 Alcohol Sensor

- **VCC:** Connect the VCC pin of the MQ3 sensor to the 5V pin on the Arduino.
- **GND:** Connect the GND pin to GND on the Arduino.
- **Analog Output (A0):** Connect the A0 pin to an analog input pin (**A0**) on the Arduino to measure alcohol levels in real-time.
- **Digital Output (D0):** Connect the D0 pin to a digital input pin (**D1**) on the Arduino to detect a threshold level of alcohol. When the alcohol concentration exceeds a certain level, this pin will go HIGH, which can be programmed to trigger an action, like stopping the engine or sending an alert.

2. GPS Module

- **TX (Transmit)**: Connect the TX pin of the GPS module to a digital input pin (**D12**) on the Arduino to receive location data.
- **RX (Receive)**: Connect the RX pin to a digital output pin (**D11**) on the Arduino to transmit data. A voltage divider (using resistors) is recommended to step down from 5V to 3.3V for RX.
- **VCC**: Connect the VCC pin to the **5V** on the Arduino.
- **GND**: Connect the GND pin to **GND** on the Arduino.

3. GSM Module

- **TX (Transmit)**: Connect the TX pin of the GSM module to the RX pin (**D2**) on the Arduino.
- **RX (Receive)**: Connect the RX pin of the GSM module to the TX pin (**D3**) on the Arduino. A voltage divider can be used to step down from 5V to 3.3V for RX.
- **VCC**: Connect the VCC pin to **12V** battery.
- **GND**: Connect the GND pin to **GND** on the Arduino.

4. L298N Motor Driver

- **Motor Connections**:
  - **Motor A (for forward/backward movement)**:
    - Connect **OUT1** and **OUT2** of the motor driver to the two terminals of **Motor A**.
    - **IN1** and **IN2** on the L298N should be connected to digital pins on the Arduino (e.g., **D7** and **D6**), allowing for directional control.
  - **Motor B (for left/right movement)**:

        - Connect **OUT3** and **OUT4** of the motor driver to the two terminals of **Motor B**.
        - **IN3** and **IN4** on the L298N are connected to other digital pins (**D5** and **D4**) for directional control.

- **Power and Ground**:
    - Connect **VCC** on the L298N to an external **12V** power supply for the motors.
    - **GND** on the L298N should connect to both the **GND** of the power supply and the **GND** on the Arduino.

CHAPTER 4

METHODOLOGY

4.1 Algorithm

Step 1: **Connect according to the circuit diagram**

- Connect the MQ3 Alcohol Sensor to Arduino (pins A0 for analog and 1 for digital).
- Connect the GPS module to Arduino (pins 11 for TX and 12 for RX).
- Connect the GSM module to Arduino (pins 3 for RX and 2 for TX).
- Connect the motor driver to Arduino pins 6, 7, 4, and 5.
- Provide power to the circuit.

Step 2: **Initialize system**

- Start serial communication for Arduino, GPS, and GSM modules (9600 baud rate).
- Set pin modes for motor control (OUTPUT) and sensor input (INPUT).
- Initialize motor states: Pin 6 (HIGH), Pin 7 (LOW), Pin 4 (HIGH), Pin 5 (LOW).
- Print "System Initialized." on the serial monitor.

Step 3: **Check for alcohol detection**

- Continuously read the analog value from the MQ3 sensor (A0) and digital value (1).
- If alcohol is detected (analog value > 500 or digital value HIGH), proceed to step 4.

Step 4: **Handle alcohol detection**

- Print "Alcohol Detected!" on the serial monitor.
- Disable the motors by setting pins 6, 7, 4, and 5 to LOW.

- Call the getLocation() function to retrieve the current GPS location.
- Call the sendSMS() function to send an alert message.
- Halt the system using an infinite loop (while(1)).

Step 5: **Process GPS data**

- Continuously check for available GPS data from the GPS module.
- Use the TinyGPSPlus library to decode and process the GPS data.

Step 6: **Fetch GPS location**

- If the GPS location is valid, retrieve latitude and longitude.
- If the GPS location is invalid, return a message indicating location is unavailable.
- Print the location to the serial monitor and return the location string.

Step 7: **Send SMS alert**

- Use the GSM module to send an SMS:
    - Set SMS mode with AT+CMGF=1.
    - Send recipient phone number using AT+CMGS="<Phone Number>".
    - Send the alert message with alcohol detection and engine lock notification, followed by the location.
- Print "SMS Sent." on the serial monitor.

Step 8: **Halt system operation**

- After sending the SMS, halt further operations using an infinite loop (while(1)).
- This ensures that the engine remains locked and no further actions are performed.

Step 9: **Monitor continuously**

- If alcohol is not detected, the system will continue to monitor the sensor inputs and GPS data.

- Repeat the process of checking for alcohol and reading GPS data in the main loop.

Step 10: **End process**

- The system will continue to function in a loop, sending SMS alerts whenever alcohol is detected, locking the engine, and sending the GPS location.
- The system will not resume operation until the loop is manually reset or stopped.

4.2 Code

```
#include <SoftwareSerial.h>

#include <TinyGPSPlus.h>


SoftwareSerial gpsSerial(11, 12);

SoftwareSerial gsmSerial(3, 2);

TinyGPSPlus gps;


void setup()

{

  Serial.begin(9600);

  gpsSerial.begin(9600);

  gsmSerial.begin(9600);


  pinMode(6, OUTPUT);
```

```
  pinMode(7, OUTPUT);
  pinMode(4, OUTPUT);
  pinMode(5, OUTPUT);

  pinMode(1, INPUT);
  pinMode(A0, INPUT);

  digitalWrite(6, HIGH);
  digitalWrite(7, LOW);
  digitalWrite(4, HIGH);
  digitalWrite(5, LOW);

  Serial.println("System Initialized.");
}

void loop()
{
  int alcoholAnalogValue = analogRead(A0);
  int alcoholDigitalValue = digitalRead(1);

  if (alcoholAnalogValue > 500 || alcoholDigitalValue == HIGH) {
    Serial.println("Alcohol Detected!");
```

```
    digitalWrite(6, LOW);

    digitalWrite(7, LOW);

    digitalWrite(4, LOW);

    digitalWrite(5, LOW);


    String locationMessage = getLocation();

    sendSMS(locationMessage);


    while (1);

  }


  while (gpsSerial.available() > 0)

{

    gps.encode(gpsSerial.read());

  }

}


String getLocation()            // Function to get GPS Location

{

  String location = "";

  if (gps.location.isValid())
```

```
{
   location = "Latitude: " + String(gps.location.lat(), 6) + "\nLongitude: " +
String(gps.location.lng(), 6);
 }
else
{
   location = "Unable to fetch location!";
 }
 Serial.println("Location: " + location);
 return location;
}


void sendSMS(String location)      //Function to send SMS
{
 gsmSerial.println("AT+CMGF=1");
 delay(1000);
 gsmSerial.println("AT+CMGS=\"+918971040800\"");
 delay(1000);
 gsmSerial.print("Alcohol Detected!!\n");
 gsmSerial.print("Engine Locked for safety Purpose!\n");
 gsmSerial.print("Location:\n");
 gsmSerial.print(location);
 delay(1000);
```

```
  gsmSerial.write(26);

  delay(5000);

  Serial.println("SMS Sent.");

}
```

CHAPTER 5

RESULTS & DISCUSSIONS

5.1 Developed Model

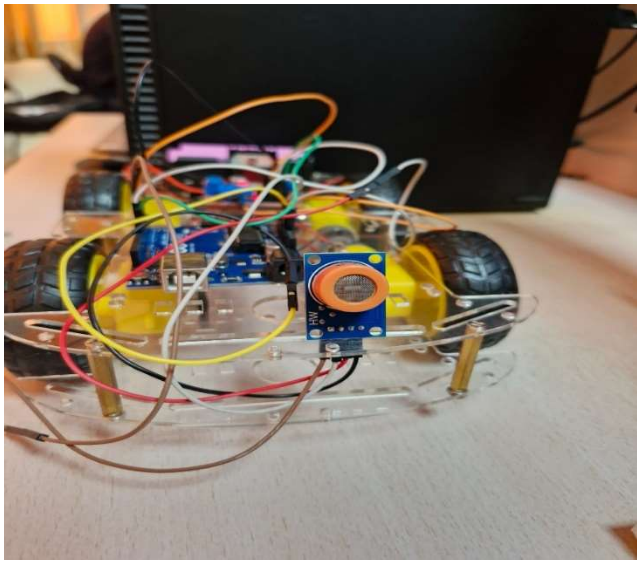


Fig 5.1 Front View of the developed model

This image displays the front view of the IoT-based Alcohol Detection and Engine Locking System. The MQ-3 alcohol sensor is prominently visible, serving as the key component for detecting alcohol levels.

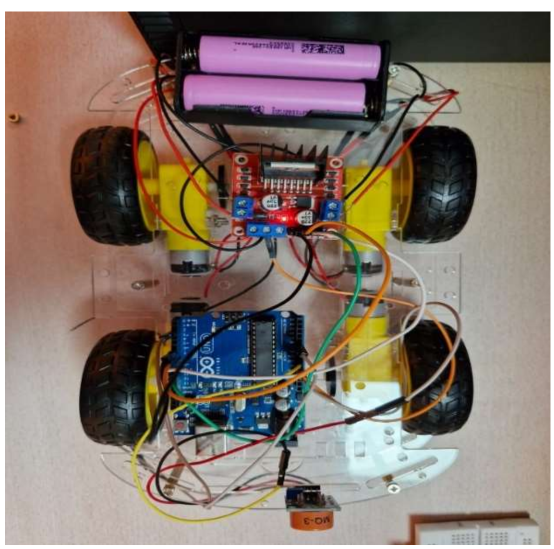


Fig 5.1 Top View of the developed model

This image showcases the top view of the IoT-based Alcohol Detection and Engine Locking System. Key components, including the Arduino, motor driver module, power supply, and MQ-3 alcohol sensor, are mounted on the robotic chassis for functionality and mobility.

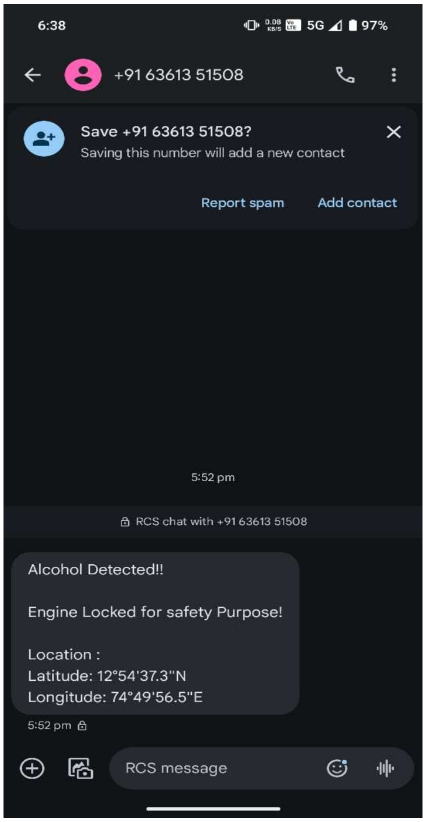


Fig 5.1 Message received in phone about alcohol detection with GPS coordinates

This image displays the notification sent through the GSM module of the IoT-based Alcohol Detection and Engine Locking System. The message indicates alcohol detection, engine locking for safety, and provides the location's latitude and longitude, obtained via the GPS module.

CHAPTER 6

CONCLUTION & FUTURE WORKS

This project presents a vital solution to enhance road safety by preventing driving under the influence of alcohol. By detecting alcohol levels in the driver’s breath and automatically controlling the vehicle's engine, this project addresses a critical issue, reducing the risk of accidents and promoting responsible behavior. The development process has provided valuable insights into sensor technology, real-time data processing, and automated control systems, reinforcing both technical and problem-solving skills. The final product is reliable, low-power, and user-friendly, making it an impactful tool for enhancing road safety and responsible driving practices.

Looking ahead, several enhancements can be made to improve the functionality, safety, and reliability of the system. Adding a heart rate sensor could provide continuous health monitoring, allowing the system to detect potential medical emergencies like heart attacks and automatically alert nearby hospitals and family members. Integrating a driver fatigue detection feature using eye-blink or head-movement sensors could prevent accidents caused by drowsiness. A real-time alert system for alcohol detection history could provide authorities or vehicle owners with access to logs, enhancing accountability. Incorporating a tamper-detection mechanism would alert users if there is any attempt to disable or bypass the system. For added user-friendliness, developing a mobile app interface would allow users to monitor and control the system remotely, providing access to health and safety features along with status updates. Durability improvements, like rugged enclosures for extreme weather resistance, would ensure long-lasting performance. These advancements would make the device even more effective, adaptable, and impactful in contributing significantly to road safety, health security, and the reduction of alcohol-related incidents.

CHAPTER 7

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10. Links :
    a. Alcohol Sensor Connection
    b. GSM Module Connection
    c. GPS Module Connection