MINI PROJECT REPORT

on

ALCOHOL DETECTION SYSTEM

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UNDER THE GUIDANCE OF

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SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF
BACHELOR OF ENGINEERING

In

TE INFORMATION TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOG
SIES GRADUATE SCHOOL OF TECHNOLOGY
NERUL, NAVI MUMBAI – 400706

ACADEMIC YEAR

2024– 2025

CERTIFICATE

This is to certify that this is a bonafide record of Mini Project of the project titled AI BASED EARLY SKIN CANCEL DETECTION carried out by the following students of second year in IT.

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The report is submitted in partial fulfillment of the degree course of Bachelor of Engineering in INFORMATION TECHNOLOGY, of University of Mumbai during the academic year 2020-21

Internal Guide Head of Department Principal

We have examined this report as per university requirements at SIES Graduate School of Technology, Nerul (E), Navi Mumbai on ____________.

Name of External Examiner: ____

Signature with Date: ______________________________

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ACKNOWLEDGEMENT

We wish to express our deep sense of gratitude to thank our project guide Prod Lalita Bhosale for providing timely assistant to our query and guidance. We take this opportunity to thank our HOD. Prof. Seema Redekar and Principal Dr.K.Lakshmisudha for their valuable guidance and immense support in providing all the necessary facilities.

We would also like to thank the entire faculty of IT Department for their valuable ideas and timely assistance in this project. Last but not the least, we would also like to thank teaching and nonteaching staff members of our college for their support, in facilitating timely completion of mini project.

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ABSTRACT

Drunk driving remains one of the major causes of road traffic accidents, leading to countless injuries, fatalities, and irreversible consequences for individuals and communities. Despite strict laws and awareness campaigns, drunk driving continues to pose a critical threat due to the absence of real-time preventive interventions. This growing concern has paved the way for exploring automated solutions that can effectively monitor and restrict vehicle access to intoxicated drivers.

With developments in sensor technology and embedded electronics, it has become feasible to incorporate alcohol detection systems directly into vehicles. This report outlines the design and implementation of a low-cost alcohol detection system using the MQ-3 gas sensor, capable of sensing ethanol vapors in the breath of the driver. By combining this sensor with a microcontroller (Arduino UNO), relay modules, buzzers, and display units, the system can successfully identify alcohol presence and take necessary preventive actions such as disabling the vehicle ignition.

The proposed system serves as an affordable, user-friendly solution aimed at enhancing road safety through real-time driver monitoring.

INTRODUCTION

Motivation

The World Health Organization (WHO) reports that nearly 1.3 million people lose their lives every year due to road traffic accidents, and a significant portion of these fatalities are caused by alcohol-impaired driving. The effects of drunk driving extend beyond immediate loss of life — they include long-term disabilities, emotional trauma for families, and a tremendous burden on healthcare systems and economies. Despite ongoing awareness programs, legal enforcements, and societal efforts, drunk driving continues to persist, often due to lapses in real-time monitoring and enforcement.

Traditional systems, like manual breath analyzers, rely heavily on human intervention and law enforcement presence, making them reactive rather than preventive. Furthermore, these methods can be bypassed, are not always consistently used, and may not be accessible in all regions. This calls for a shift toward smart, embedded technologies that can proactively stop the act of driving under the influence before it begins. The idea is to transfer the responsibility of detection from external agents to intelligent vehicle systems that monitor driver sobriety autonomously.

The motivation behind this project is to bridge the technological and practical gap by designing an embedded alcohol detection system that is cost-effective, easy to install, and capable of functioning independently within the vehicle. Such a system, leveraging affordable hardware like the MQ-3 sensor and Arduino microcontroller, aims to serve as an early-intervention tool that detects alcohol vapors in the driver's breath and blocks ignition automatically if intoxication is detected, thereby potentially saving thousands of lives.

Problem Statement & Objectives

Problem Statement:

Drunk driving continues to be a persistent and dangerous issue on roads due to the absence of embedded, real-time alcohol detection and prevention systems within vehicles. While current enforcement and testing methods are helpful, they are limited in reach and reactivity, failing to stop a driver from starting the vehicle while intoxicated.

Objectives:

- To develop an efficient and real-time alcohol detection system using the MQ-3 sensor, capable of detecting ethanol vapor in a driver’s breath.
- To interface the MQ-3 sensor with an Arduino microcontroller to enable accurate and continuous monitoring of alcohol levels.
- To implement an alert mechanism that notifies users through buzzers and display units when alcohol is detected.
- To integrate a relay-controlled circuit that disables vehicle ignition when alcohol levels exceed a predefined threshold.

- To ensure the system is low-cost, scalable, and practical for deployment in all classes of vehicles, from private cars to public transportation.
- To explore user-friendly design and automation so that the system requires minimal user interaction, enhancing usability and acceptance.
- To promote the adoption of preventive technologies in vehicular design that can contribute to reducing alcohol-related accidents significantly.

Literature Survey

- Survey of Existing Systems

Various systems have been proposed and implemented globally to combat drunk driving:

Manual Breath Analyzers: These handheld devices are commonly used by law enforcement agencies to detect alcohol levels. However, they require active testing after suspicion arises and do not serve as preventive measures.

Smart Helmets: Targeted primarily at two-wheeler riders, these helmets integrate alcohol sensors and ensure helmet usage before allowing ignition. Despite their innovative design, adoption remains limited.

In-Vehicle Breathalyzers: Installed directly in vehicles, these systems require drivers to blow into a sensor before allowing engine start. They are highly effective but are costly and typically mandated only for individuals with a history of driving under the influence.

- Limitations of Existing Systems / Research Gap

Reactive Rather than Preventive: Manual analyzers detect intoxication after the act of driving has already been attempted or commenced.

High Cost and Maintenance: Integrated vehicle systems and smart helmets are expensive, limiting their widespread adoption, especially in low and middle-income segments.

Lack of Affordable Alternatives: There is limited research into developing open-source, low-cost systems utilizing readily available components like the MQ-3 alcohol sensor.

Poor Integration with Vehicle Ignition Systems: Most low- and mid-range vehicles lack built-in safety mechanisms that can automatically prevent ignition if alcohol consumption is detected.

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Proposed System

Introduction

The proposed system utilizes the MQ-3 gas sensor, sensitive to alcohol vapors, to detect the presence of ethanol in a driver's breath. When connected to an Arduino microcontroller, the sensor's readings are analyzed, and if the value exceeds a threshold, a relay is triggered to prevent the car's ignition system from activating. This system includes a buzzer for alerting, an optional LCD screen for displaying messages, and a WiFi module (ESP-01) to enable remote notifications or logging.

Architecture / Framework

Hardware Components:

Component	Description	Approx. Cost (INR)
MQ-3 Sensor	Detects alcohol vapors with high sensitivity	120
Arduino UNO	Microcontroller that processes sensor data	170–200
Relay Module	Acts as a switch to control the car's ignition system	50–80
Buzzer	Provides audible alerts	15
LCD Display (16x2)	Shows real-time status messages	120–150
ESP-01 WiFi Module	Enables wireless communication (alerts, logs)	240
Resistors	Required for voltage regulation and pull-up settings	2 each
Jumper Wires (M-M, M-F)	Connections between modules	40 (for each type)
Power Supply	12V battery or USB source	(depends on source)

Software:

Arduino IDE

Embedded C/C++ programming

ESP-01 AT commands (or flashed with custom firmware if required)

Process Design

The MQ-3 sensor continuously monitors the air for alcohol vapors near the driver's seat.

Analog data from the sensor is sent to the Arduino.

The Arduino converts the signal into a readable value and compares it to a predefined threshold.

If alcohol is detected above the threshold:

A buzzer is activated.

The LCD displays a warning.

The relay cuts off the ignition signal, preventing the car from starting.

A WiFi signal (alert/log) is sent using the ESP-01 to a server or mobile device.
If no alcohol is detected, the ignition circuit remains active, and the system stays idle or updates the status over WiFi.

Details of Software

The software uses the Arduino IDE for code development. The primary functions include:

```
#define SENSOR_ANALOG A0  // MQ3 sensor connected to A0
#define BUZZER_PIN 8      // Buzzer connected to D8

#define WIFI_SSID "Raut-5GHonesty"     // <-- Change to your WiFi
#define WIFI_PASSWORD "gajananm75" // <-- Change to your Password

void sendCommand(String cmd, const int timeout) {
  Serial.println(cmd); // Send command to ESP
  long int time = millis();
  while ((time + timeout) > millis()) {
    while (Serial.available()) {
      char c = Serial.read();
      Serial.write(c); // Display ESP responses on Serial Monitor
    }
  }
}

void setup() {
  pinMode(SENSOR_ANALOG, INPUT);
  pinMode(BUZZER_PIN, OUTPUT);

  Serial.begin(9600); // Communication with ESP8266

  delay(2000); // Give ESP time to boot

  // Connect to WiFi
  sendCommand("AT", 2000);
  sendCommand("AT+CWMODE=1", 2000);
  sendCommand("AT+CWJAP=\"" + String(WIFI_SSID) + "\",\"" +
String(WIFI_PASSWORD) + "\"", 6000);
}

void loop() {
  int analogValue = analogRead(SENSOR_ANALOG);

  Serial.print("MQ3 Sensor Value: ");
  Serial.println(analogValue);

  if (analogValue > 300) {  // Alcohol detected threshold
    digitalWrite(BUZZER_PIN, HIGH); // Turn ON buzzer
    delay(500);

    // Send Data via ESP (you can modify to HTTP later)
    sendCommand("AT+CIPSTART=\"TCP\",\"192.168.1.34\",8080", 2000); //
Connect to server
    sendCommand("AT+CIPSEND=18", 2000);
    sendCommand("Alcohol Detected!!", 2000);
  } else {
    digitalWrite(BUZZER_PIN, LOW); // Turn OFF buzzer
  }

  delay(1000); // Delay for stability
}
```

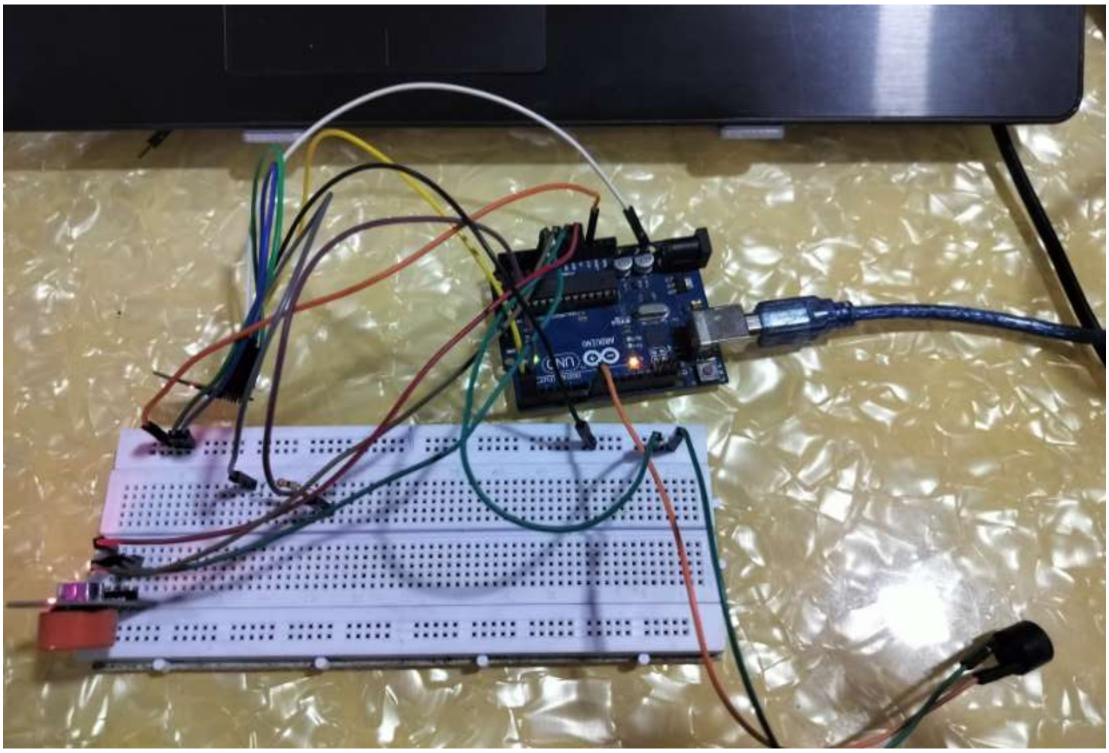

Fig 1.1

Experimental Results

Testing Conditions:

- Controlled environment with different alcohol sources.
- Sensor calibrated using baseline clean air values.
- WiFi module (ESP-01) configured to send an alert message to a predefined server or app upon alcohol detection.

Test Scenario

Test Scenario	**Sensor Output (Analog Value)**	**System Action**
No Alcohol Present	120–180	Ignition ON, WiFi: No Alert
Alcohol Spray Nearby	400–500	Buzzer ON, Ignition OFF, WiFi Alert Sent
Beer Breath	600–700	Buzzer ON, Ignition OFF, WiFi Alert Sent
Sanitizer Exposure	450–550	Ignition OFF (False Positive), WiFi Alert Sent

Observations:

- System successfully detected alcohol levels above the predefined threshold.
- WiFi alerts were correctly triggered whenever alcohol presence was detected, regardless of the source.
- False positives due to exposure to sanitizers and perfumes were noted (as they contain alcohol-based vapors).
- Sensor sensitivity and physical placement near the driver's breathing zone significantly impacted detection accuracy.
- Calibration with baseline air values helped to reduce false positives but could not entirely eliminate interference from strong alcohol-based external sources.
- Minor delay (~2–3 seconds) observed between detection and WiFi alert dispatch due to ESP-01 communication latency as shown in Fig 1.2

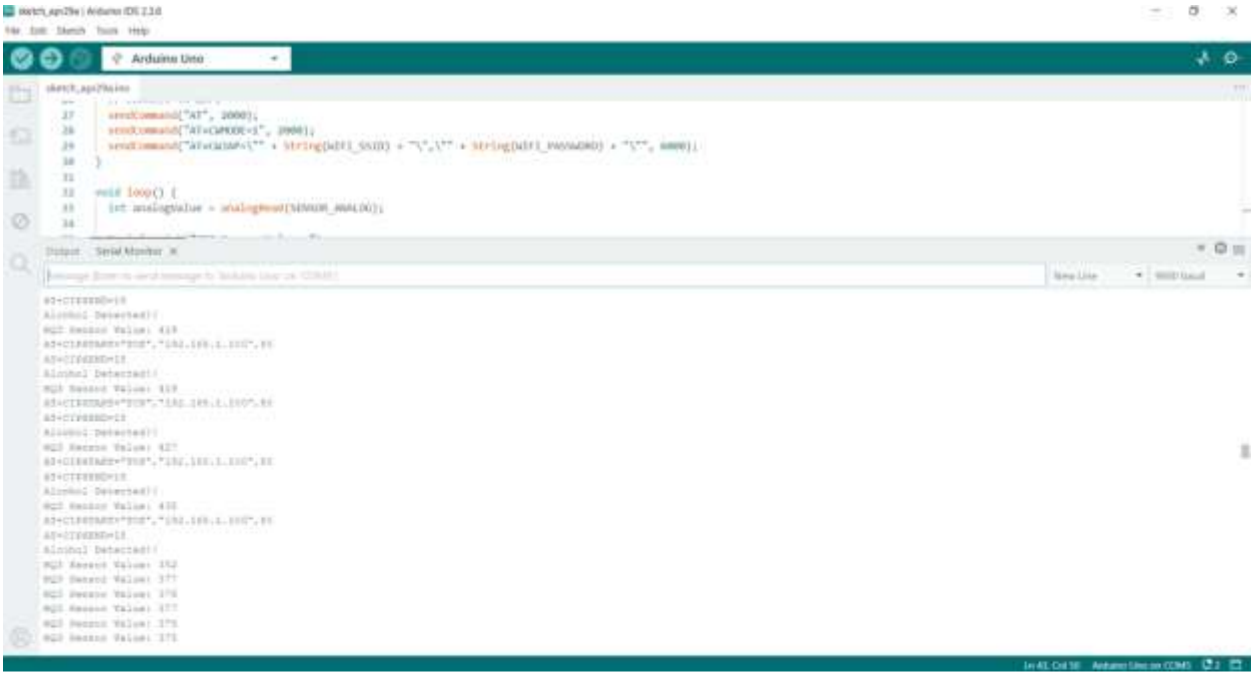

Fig 1.2

Future Work for Sem VII

1. GSM Module Integration
   Future versions of the system can incorporate a GSM module (such as SIM800L) to enable cellular communication capabilities. When alcohol is detected, the system can automatically send SMS alerts to pre-registered emergency contacts like family members or local law enforcement. This real-time alert mechanism will ensure prompt intervention, even if the driver tries to bypass the safety system.
2. Biometric Authentication
   Enhancing the system with biometric authentication methods (such as fingerprint scanners or facial recognition cameras) can personalize the alcohol detection process. This ensures that the person being tested is indeed the designated driver, preventing misuse or circumvention. Integration with a user database would allow tracking of multiple users and recording repeat offenses.
3. Data Logging
   To facilitate better record-keeping and analysis, the system can be upgraded with onboard memory (SD card modules) or cloud connectivity (via WiFi or GSM). Every alcohol detection event can be logged with a timestamp, sensor reading, and driver ID (if biometrics are used). This feature can assist in safety audits, legal reporting, and studying driver behavior patterns over time.
4. App Connectivity
   A dedicated mobile application can be developed to pair with the system over Bluetooth or WiFi. The app could:

- Display real-time alcohol levels and system status.
- Send notifications and alerts.
- Allow configuration of system settings.
- Provide access to historical detection logs.
- Enable remote vehicle monitoring for owners or guardians.

5. Machine Learning Integration
   Machine learning algorithms can be implemented to significantly enhance system accuracy. By training models to distinguish between alcohol and non-alcohol substances like sanitizers or perfumes, false positives can be minimized. Over time, the system could adapt to various environmental factors and different driver profiles, improving reliability.
6. Sensor Miniaturization
   Future versions of the system can focus on miniaturizing the hardware, embedding sensors seamlessly within the steering wheel, dashboard, or driver-side air vent. This would make the system less intrusive, more aesthetically pleasing, and easier to install in commercial vehicles, increasing market adoption.

Conclusion

The alcohol detection system using the MQ-3 sensor presents a practical and affordable solution for curbing drunk driving. Through real-time monitoring and automated vehicle control, it acts as a preventive mechanism, ensuring road safety. While the prototype shows promising results, further enhancements such as false-positive elimination and integration with communication systems can make it suitable for commercial applications. The implementation of such systems on a larger scale has the potential to significantly reduce DUI incidents and save lives.

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