IJARSCT

International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

ISSN: 2581-9429 Volume 5, Issue 5, May 2025 Impact Factor: 7.67

Alcohol Based Engine Locking System using ESP – 32

M. Naga Pranav[1], M. Deepak Reddy[2], V. Arya Vardhan[3], Mr .P. Vinod Reddy[4]

[123]Student, Electronics and Communication Engineering

[4]Assistant Professor, Electronics and Communication Engineering

Mahatma Gandhi Institute of Technology, Hyderabad, India

Abstract: *Drunk driving is a major cause of road accidents worldwide, posing serious threats to both drivers and the public. This paper proposes an effective, low-cost solution to prevent such incidents through an alcohol-based engine locking system powered by the ESP-32 microcontroller. The system employs an MQ-3 alcohol sensor to detect the presence of alcohol in the driver's breath. If alcohol concentration exceeds a predefined threshold, the ESP-32 activates a relay to disable the engine ignition, thereby preventing the vehicle from starting. The system may also incorporate visual or audio alerts to warn the driver. Designed with affordability and real-world application in mind, this system can be integrated into both personal and commercial vehicles to promote safer roads and reduce drunk driving-related fatalities.*

Keywords: Drunk driving

I. INTRODUCTION

Road safety is a critical concern in today's world, with drunk driving remaining one of the leading causes of traffic accidents and fatalities. Despite strict laws and awareness campaigns, many drivers continue to operate vehicles under the influence of alcohol, endangering lives. Traditional measures such as manual breathalyzer tests by law enforcement are often reactive rather than preventive.

To address this issue proactively, technological solutions can play a vital role. The integration of microcontrollers and sensors in modern vehicles has opened new avenues for intelligent safety systems. This research focuses on designing and implementing an alcohol detection and engine locking system using the ESP-32 microcontroller, which features built-in Wi-Fi capabilities and low power consumption.

The system utilizes an MQ-3 alcohol sensor to detect ethanol levels in the driver's breath. If the detected alcohol level exceeds a defined threshold, the system triggers a relay module to disconnect the engine ignition circuit, thereby preventing the vehicle from starting. This not only enhances road safety but also serves as a deterrent against drunk driving.

The proposed system is cost-effective, easy to install, and adaptable for use in both private and commercial transportation, making it a practical solution for improving road safety through technology.

II. LITERATURE REVIEW

Several studies have explored alcohol detection systems to reduce drunk driving incidents. Early models used Arduino with MQ-3 sensors to detect alcohol and issue warnings, but they lacked engine control features. Later designs introduced GSM modules for alert notifications but still did not prevent vehicle ignition. Recent developments with IoT-enabled microcontrollers like the ESP-32 offer better functionality, combining alcohol detection with real-time monitoring and control. However, a compact, low-cost solution that directly locks the engine based on alcohol detection remains limited. This research addresses that gap using the ESP-32 for both detection and engine locking.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 5, May 2025
Impact Factor: 7.67

III. HARDWARE REQUIREMENTS

ESP32:

The ESP32 module is a versatile and powerful microcontroller equipped with theESP32 chip, designed for a wide range of Internet of Things (IoT) applications. It features adual-core processor, integrated Wi-Fi and Bluetooth connectivity, and a multitude of I/O options. This module is commonly used in applications such as smart home devices, wearable electronics, and wireless sensor networks.

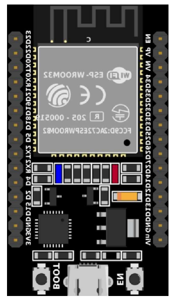


Fig 1: ESP32

ESP32 - CAM:

The ESP32-CAM is a small-sized, low-cost development board that integrates an ESP32- S chip and a camera module. It is a versatile board that combines Wi-Fi and Bluetooth connectivity with image processing capabilities, making it ideal for various Internet of Things (IoT) applications. Common use cases include surveillance cameras, facial recognition systems, home automation, and remote monitoring..

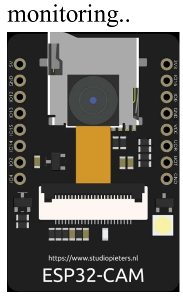


Figure-2: ESP 32 CAM

MQ-3 Breakout :

The MQ-3 Breakout is an electronic component designed for the detection of alcohol vapors in the air. It is based on the MQ-3 alcohol sensor, which provides an analog outputvoltage proportional to the concentration of alcohol vapors. This breakout module is commonly used in breathalyzers, vehicle alcohol detection systems, and portable alcohol detectors for safety and health monitoring applications.

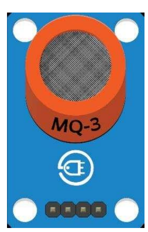


Figure-3: MQ-3 Breakout

Tilt sensor:

The SW520D tilt sensor is an electronic component that detects the tilting or inclination of an object. It is a simple and cost-effective solution for adding tilt sensing capabilities to a project. The sensor is often used in applications such as security systems, robotics , automotive devices, and game controllers to detect orientation or motion.

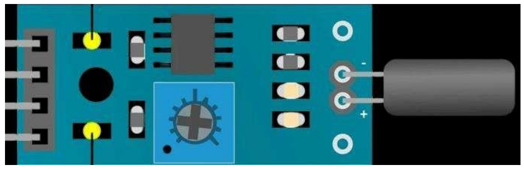


Figure-4: Tilt sensore

LCD with I2C:

The LCD with I2C is a liquid crystal display module that uses the I2C (Inter-Integrated Circuit) protocol for communication. This module simplifies the process of connecting and controlling an LCD by reducing the number of pins required, making it ideal for microcontroller-based projects. It is commonly used for displaying text, numbers, and simple custom characters in embedded systems.

Figure-5: LCD with I2C

GPS NEO 6M:

The GPS NEO 6M module is a compact, high-performance GPS (Global Positioning System) receiver with an integrated NEO 6M chipset that provides accurate positioning and navigation information. This module is widely used in various applications such as drones, vehicle tracking systems, personal navigation devices, and time synchronization..

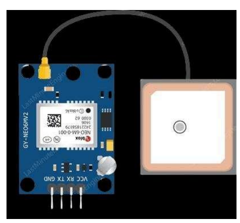


Fig 6: GPS NEO 6M

Gear motor:

A gear motor is an electric motor integrated with a gear system to reduce speed and increase torque. This combination makes it ideal for applications requiring high torque at low speeds. Gear motors are widely used in robotics, conveyor systems, industrial machinery, and automotive applications. They are particularly valued for their ability to deliver precise motion control and power efficiency.

Fig 7: Gear motor

18650 Li-Ion (Battery):

The 18650 Li-Ion battery cell is a cylindrical lithium-ion rechargeable battery that has become a standard in the electronics industry. Known for its high energy density, long life cycle, and stable performance, it is widely used in various applications such as portable electronics, power tools, electric vehicles, and even in large-scale energy storage systems.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 5, May 2025
Impact Factor: 7.67

Fig 8: 18650 Li-Ion (Battery)

LM 2596:

The LM2596, manufactured by STMicroelectronics (Part ID: UNO), is a step-down (buck) voltage regulator designed to efficiently convert a higher input voltage to a lower output voltage. It is widely used in power supply applications due to its high efficiency, ease of use, and robust protection features.

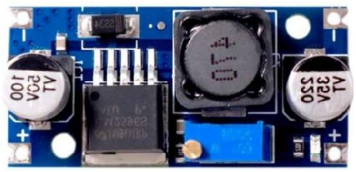


Fig 9: LM 2596

1 Channel Relay module with Optocoupler:

The 1 Channel Relay Module with Optocoupler (Manufacturer: Songle, Part ID: SRD- 05VDC-SL-C) is a versatile electronic component designed to control high-voltage devices using low-voltage signals.

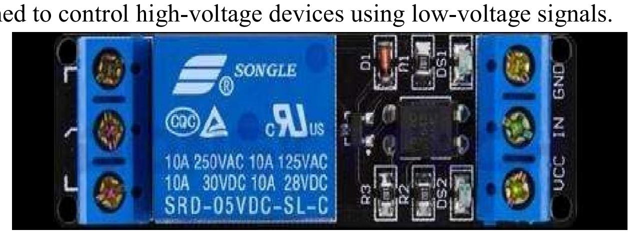


Fig 10: 1 Channel Relay module with Optocoupler

Switch:

A switch is a fundamental electronic component used to control the flow of current in a circuit

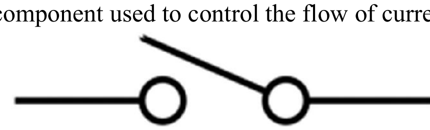


Fig 11: Switch

IV. SOFTWARE REQUIREMENTS

The software implementation plays a critical role in controlling hardware interactions, processing sensor data, and enabling IoT connectivity. The development was carried out using open-source platforms, with code written in embedded C/C++ via the Arduino IDE. The major software components used are outlined below:

Arduino IDE

The Arduino Integrated Development Environment (IDE) was used to program both the Arduino Uno and the NodeMCU (ESP8266). It provides a simplified interface to write, compile, and upload code to the microcontrollers. The software structure includes setup() and loop() functions that initialize hardware and continuously monitor sensor data. Libraries such as Wire.h, LiquidCrystal.h, OneWire.h, PulseSensorPlayground.h, and SoftwareSerial.h were used for interfacing with sensors, display modules, and serial communication.

IJARSCT

International Journal of Advanced Research in Science, Communication and Technology

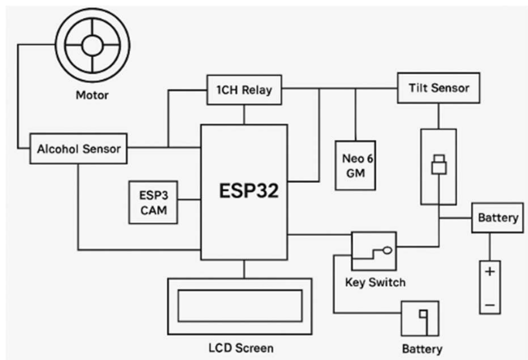
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

ISSN: 2581-9429

Volume 5, Issue 5, May 2025

Impact Factor: 7.67

BLOCK DIAGRAM



The primary component, the alcohol sensor (MQ-3), detects the presence of alcohol in the driver's breath. If alcohol levels exceed a certain threshold, the ESP32 processes this input and activates a relay to cut off power to the motor, effectively locking the engine and preventing the vehicle from starting. The system also includes a GPS module (Neo 6M) for real-time location tracking and a tilt sensor to detect any abnormal movement or accidents. An ESP32-CAM module can capture and transmit images, adding a layer of visual monitoring. The LCD screen displays system status and alerts, while a key switch is used to initiate or disable the system. The entire setup is powered by a battery, with voltage regulation managed through supporting components. This smart and compact system enhances vehicle safety by preventing drunk driving and enabling accident detection and tracking.

V. METHODOLOGY

The methodology of the Alcohol-Based Engine Locking System using ESP32 involves the integration of key hardware components and software to create a functional safety mechanism. An MQ-3 alcohol sensor is used to detect the presence of alcohol in the driver's breath. The sensor output is sent to the ESP32 microcontroller, which processes the data and compares it to a predefined threshold. If the detected alcohol level is above the limit, the ESP32 activates a relay that interrupts the ignition circuit, preventing the engine from starting. The system also includes an OLED display to show real-time alcohol levels for user awareness. Additionally, the ESP32's Wi-Fi feature can be used to transmit data for remote monitoring. The system was thoroughly tested under various alcohol exposure levels to ensure accurate detection, effective engine locking, and reliable overall performance..

VI. RESULTS AND DISCUSSION

The Alcohol-Based Engine Locking System using ESP32 successfully detects alcohol from the driver's breath and prevents the engine from starting if the alcohol level exceeds a set limit. The results show that the system accurately reads alcohol levels, displays the data on an OLED screen, and controls engine access based on those readings. Additionally, with ESP32's Wi-Fi capability, the system can send data for remote monitoring, making it a practical and efficient safety feature for vehicles.

IJARSCT

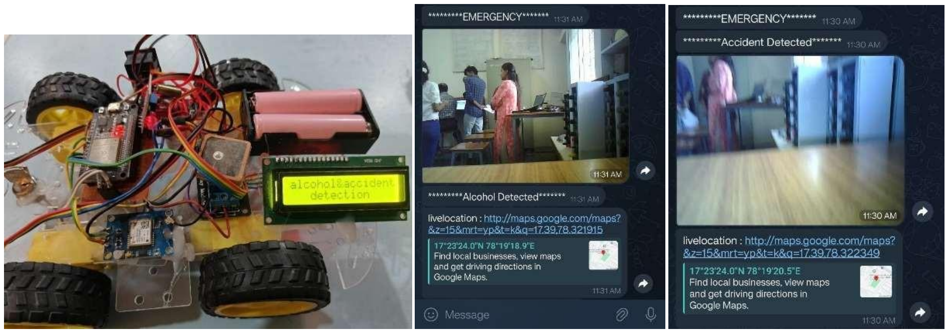
International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

ISSN: 2581-9429

Volume 5, Issue 5, May 2025

Impact Factor: 7.67



VII. CONCLUSION

The alcohol-based engine locking system using ESP32 is a smart and efficient solution designed to reduce accidents caused by drunk driving. By using an alcohol sensor (MQ-3), the system accurately detects the presence of alcohol in the driver's breath. If alcohol is detected beyond a safe limit, the ESP32 controller immediately activates a relay to disable the engine, preventing the vehicle from starting. Additional features like GPS for location tracking and a tilt sensor for accident detection further enhance the safety and monitoring capabilities of the system. Information and alerts are displayed on an LCD screen, making the system user-friendly. This project demonstrates a practical use of IoT and embedded systems to improve road safety in a cost-effective and scalable way.

REFERENCES

[1] Dr. Pravin Shukla, Utkarsha Srivastava, Sridhar Singh, Rishabh Tripathi, Rakesh Raushan Sharma, “Automatic Engine Locking System Through Alcohol Detection”, May 2020, International Journal of Engineering Research & Technology (IJERT), Vol. 9, Issue 05.

[2] Sudharsana Vijayan, Vineed T Govind, Merin Mathews , Simna Surendran , Muhammed Sabah M E, April 2014, “ALCOHOL DETECTION USING SMART HELMET SYSTEM”,International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE), Volume 8, Issue1.

[3] R. Kumudham, Jessica Valentina, Ragavi.B, Lakshmi.R, “Automatic Alcohol Detection and Engine locking System using ARDUINO NANO”, JASC: Journal of Applied Science and Computations, ISSN NO: 1076-5131.

[4] P. Manikandan, V. Muneeswarn, G. Ramesh, Ravuru Siva Rakesh, Peddysetty Chakraesh , Nagireddy Sumanth Reddy, Noorbonala Sahul , “Drunk and Drive Controller for Vehicle”, International conference on advance computing and innovative technologies in engineering (ICACITE), 2021.

DOI: 10.48175/568