

Real-time Alcohol Monitoring and Automated Engine Locking System

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Abstract— According to various sources, including the World Health Organization (WHO), the most common cause of death in fatal road accidents is drunk driving. Current approaches to breath testing and policing are generally reactive rather than proactive. This paper introduces a Real Time Alcohol Monitoring and Automated Engine Locking System that can inhibit starting of the engine of the vehicle in the event of excess alcohol levels. The proposed system utilizes an MQ3 alcohol sensor board, Arduino Mega 2560 board, GSM and GPS modules, ultrasonic sensors, MPU6050 motion sensor and NodeMCU ESP8266 for IoT connectivity to the cloud. In contrast to existing engine locking systems, the proposed system can facilitate the stopping of vehicles at roadblocks, real time tracking of the location of the vehicle and sending alerts to concerned authorities remotely. The experiments carried out confirmed the accuracy of the sensor and the quick response time of the system that can be used in ITS applications.

Keywords—Alcohol detection, Engine locking, Arduino Mega, GSM, GPS, IoT, Road safety

I. INTRODUCTION

In numerous road safety reports from all over the world, it is indicated that a high proportion of fatalities are due to drink-driving [1]. Even though roadside alcohol testing is a tool used by police to deter drunk driving, the current enforcement is reactive and based on the intervention of others, and does not prevent an intoxicated driver from entering the car.

The use of embedded systems in modern day vehicles has been increasing to ensure the safety of the vehicle [12]. Many research papers have discussed alcohol detection using the microcontrollers [2],[3]. Most of the papers deals with the ignition locking system and does not deal with real time monitoring and communication.

With the development of the times, the Internet of Things (IoT) technology in the era of artificial intelligence is developing rapidly [4], and the function of the vehicle

monitoring system is constantly changing, and is used for the remote tracking and intelligent response of vehicles in the driving process. In order to improve the level of vehicle safety, this paper proposes a multi-layer safety structure of alcohol detection, obstacle monitoring, stability monitoring and IoT technology, which is aimed at realizing the coordination and integration of hardware and software.

II. LITERATURE REVIEW

Research on Alcohol detection and Vehicle Immobilization using Arduino published in 2018 and systems were proposed based on microcontroller and gas sensors [2], [3].

Vehicle tracking systems using IoT are explained in [4]. The GSM and GPS technologies are explained in [5], [6] for vehicle tracking.

Ultrasonic sensors are often applied to the automotive obstacle detection [7]. MEMS-based motion sensors like MPU6050 are used for acceleration and tilt detection [8]. The principle of wireless sensor network (WSN) in transportation system is studied in [14], [15].

In spite of these advances, a real time integrated system that employs alcohol detection, roadside stopping, IoT and emergency services in a road network environment has yet to be established.

III. EXISTING SYSTEM

From the previous work, titled “Automatic Engine Locking System for Drunken Driver” in [16], block diagrams of Fig 1 is developed using 8051 microcontroller with MQ3 alcohol sensor.

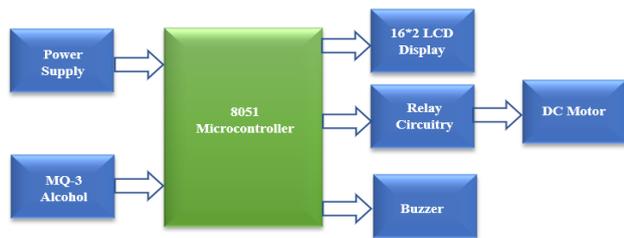


Fig. 1. Existing System

As per above block diagram the existing system is the real time alcohol detection and vehicle control system that helps in preventing the drink and drive. The alcohol in the breath is detected by the MQ-3 alcohol sensor and the detected value is given to the 8051 microcontrollers along with the threshold limit of the alcohol. The status is displayed on the 16x2 LCD. When the value exceeds the threshold limit, the buzzer and the LED are switched ON. The relay is used for the 5V DC motor (engine) circuit which is used to lock the engine if the person is drink driving. The existing system is powered by a regulated power supply.

A. Working Principle

The system performs the following:

1. MQ3 sensor detects alcohol concentration.
2. If alcohol exceeds threshold:
 - Buzzer activates.
 - LED warning is displayed.
 - DC motor (engine model) stops.
3. LCD displays system status.

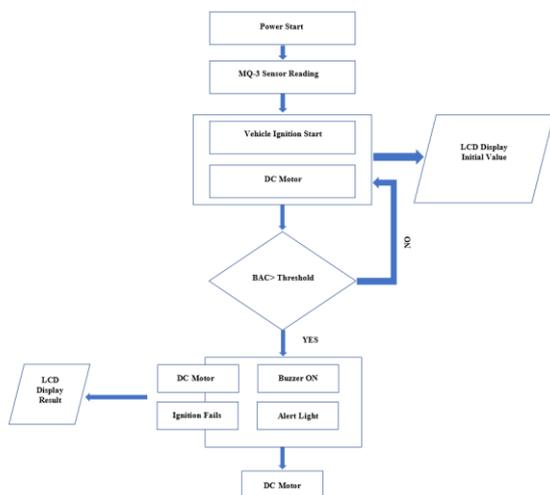


Fig. 2. How the Existing system works

B. Parts Used

- Microcontroller 8051
- MQ3 Sensor for Alcohol
- Relay Module
- Display with LCD
- Motor with DC

- LED lights and a buzzer

C. Limitations

The system works well for locking the ignition, but it doesn't have:

- Tracking your location with GPS
- Sending alerts over GSM
- Monitoring the IoT cloud
- Finding obstacles
- Keeping an eye on how the car is tilted
- Stopping on the side of the road in a controlled way

So, it only lets you lock the engine in a basic way.

IV. PROPOSED SYSTEM

The proposed system improves functionality by adding more sensors and communication modules.

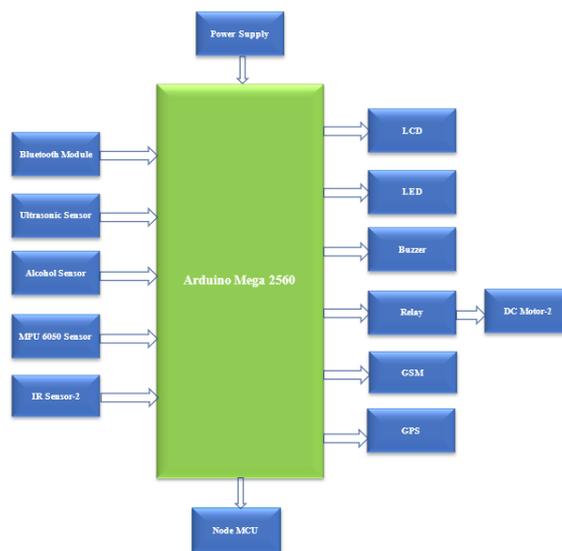


Fig. 3. Block Diagram of the Proposed System

The Arduino Mega 2560 serves as the primary controller of the system, which also incorporates a number of sensors and communication tools to guarantee the vehicle's safety. The system has Bluetooth, IR sensors, MPU6050, MQ-3 alcohol sensor, and ultrasonic sensor. It helps to find the condition of the driver, obstacles in the way of the vehicle and stability of the vehicle. The system includes LCD, LED, buzzer and relay for DC motor. If there is alcohol in the driver's breath, the engine of the vehicle will be shut down and alerts will be sent. Also, necessary measures will be taken to ensure the safety of the driver and the vehicle. The system also has GSM and GPS module to send alert messages to the driver's relatives in case of an accident and to find the location of the vehicle. NodeMCU is used in the system to send the data to the IoT platform and to remote monitor the vehicle. So, the system is a smart safety system for the vehicles.

A. The Architecture Of The System

The layer that senses

1. Sensing Layer

- MQ3 Alcohol Sensor [10]
- HC-SR04 Ultrasonic Sensor [7]
- Sensor MPU6050 [8]
- Sensors for IR

2. The Processing Layer

- Arduino Mega 2560 [9]

3. The Layer of Communication

- SIM800 GSM Module [5]
- GPS Module NEO-6M [6]
- NodeMCU ESP8266 [11]

4. Layer of Control

- Module for Relay
- Driver for the motor
- Buzzer and lights

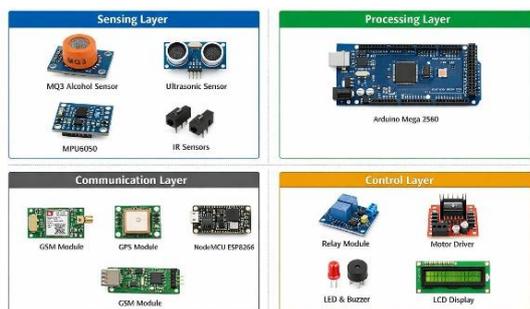


Fig. 4. System Architecture Layer and Components

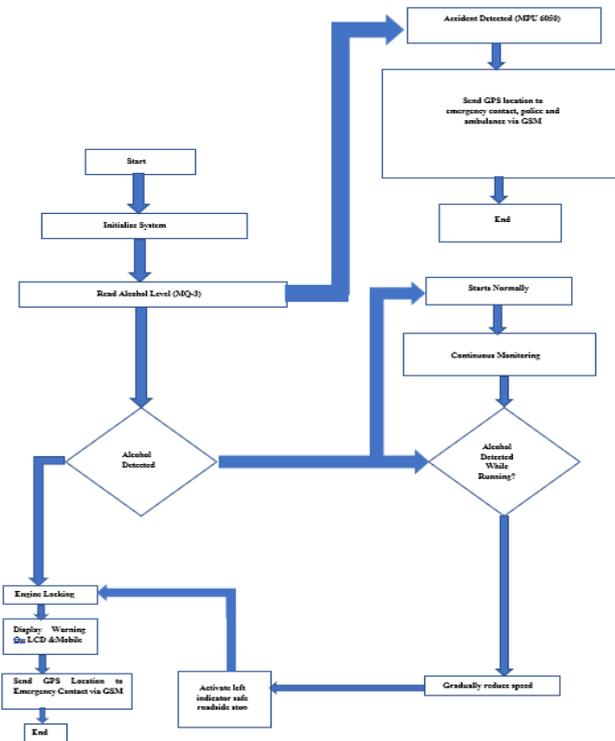
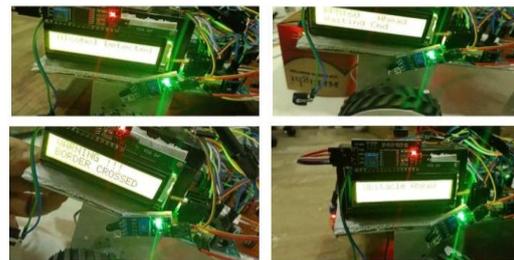


Fig. 5. Work Flow of Proposed System

B. Alcohol Detection Mechanism

The MQ3 sensor detects the alcohol vapours by the change in resistance of the tin dioxide material. The analog output voltage is converted by using the ADC of Arduino.

When alcohol concentration exceeds the calibrated threshold:

Engine speed reduces

- Warning LEDs activate
- Relay disconnects ignition
- GSM sends SMS alert
- GPS coordinates are transmitted
- NodeMCU uploads data to cloud

C. Finding Obstacles

Using echo time, ultrasonic sensors measure distance [7]:

$$\text{Distance} = (\text{Time} \times \text{Speed of Sound}) / 2$$

This makes sure that the car can safely stop when the engine shuts down automatically.

D. Stability Monitoring

MPU6050 3 Axis Accelerator & Gyro The MPU6050 module contains a 3-axis accelerometer and a 3-axis gyro. MPU6050 sensor is used in projects for shock and tilt detection. It is used to sense abnormal tilt or shock in the system during its movement. It can also be used for orientation detection of an object.

E. IoT Monitoring

NodeMCU ESP8266 enables WIFI-based cloud communication [11]. Real time vehicle status including alcohol level and location can be monitored remotely.

V. RESULTS AND DISCUSSION

Testing was conducted under controlled conditions.

- Alcohol detection response time: < 3 seconds
- GSM alert transmission: 5-8 seconds
- GPS accuracy: approximately 5 meters [6]
- Reliable obstacle detection up to 4 meters [7]

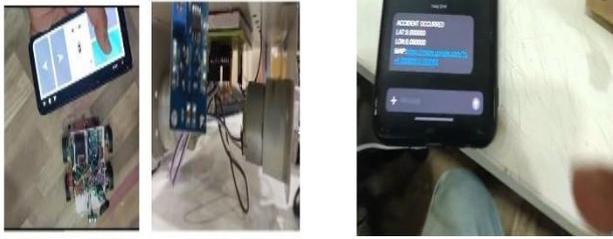


Fig. 6. Prototype And Execution Picture

The system successfully prevented engine operation during intoxicated conditions and transmitted emergency alerts.

VI. ADVANTAGES

- Prevents drunk driving
- Provides real time monitoring
- Sends emergency alerts
- Ensures safe roadside stopping
- Multi-sensor safety integration

VII. CONCLUSION

A Real Time Alcohol Monitoring and Automated Engine Locking System using alcohol detection technology [10], GSM-GPS technologies [5], [6] along with IoT architecture [4] and motion detection technology [8] is proposed in this paper. When compared with the earlier engine locking

systems [16], our proposed system would certainly improve road safety to a greater extent as our system works on real time monitoring and takes actions on an intelligent manner. Our proposed system is highly scalable and could be widely used in smart transportation systems.

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