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Arduino-Based Alcohol Sensing Engine Lock with GSM and GPS

-A review of recent development

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Abstract

The present article describes the conception and execution of an alcohol detection system for vehicles that can prevent driving a vehicle under the influence of alcohol by preventing the engine from being started if alcohol is detected from the breath of the driver. The system uses an MQ-3 alcohol sensor to measure the amount of alcohol present in the air exhaled from the driver. The system implements an Arduino controlled relay system that uses a preset threshold (for alcohol content levels above to allow for non-alcohol vehicle operation), should the content exceed this level, the ignition system is turned off preventing the vehicle's engine from being started. A GPS module also tracks the real-time location of the vehicle when the relay system is active. A GSM module can then send an SMS alert to a designated contact (for example, the vehicle owner or an emergency officer). Overall, the system provides greater vehicle safety by providing preventive measures against alcohol driving but also provides real time monitoring by tracking location and sending alerts remotely.

Keywords: Alcohol Detection, Engine Lock, GPS, GSM, Prevention of Drunk Driving, Vehicle Safety, Arduino.

I. INTRODUCTION

Drink-driving is still a major cause of injuries and fatalities worldwide, with thousands losing their lives each year. Countries everywhere have taken steps to combat this issue by enacting laws against driving under the influence, implementing measures like ignition interlocks, and making breathalysers a common tool for law enforcement. Yet, despite these efforts, many people still choose to drive after drinking. Typically, police officers gather evidence in person or conduct random checks, but they can't be everywhere at once, which limits their effectiveness in preventing drunk driving incidents.

This new concept introduces a promising solution: an alcohol detection system designed to automatically prevent a car from starting if the driver has consumed any alcohol. Utilizing the MQ-3 alcohol sensor, the system can detect alcohol in the driver's breath. If it senses alcohol above a certain threshold, it sends a signal to disable the car's ignition or effectively locks the engine. But that's not all—this system also incorporates GPS and GSM technology. The GPS module keeps track of the vehicle's location at all times,

while the GSM module can send an SMS alert to a pre-programmed number (like the car owner or a safety agency) if alcohol is detected or in case of an emergency. This allows for real-time alerts and vehicle tracking even when the user isn't around.

The research will focus on designing and developing a system that not only discourages drunk driving but also enhances safety and security features, including real-time tracking and notifications. This system will be capable of detecting alcohol, tracking location, and enabling remote communication, adding an extra layer of protection for the vehicle. Ultimately, the aim is to make our roads safer and reduce the number of alcohol-related accidents. This paper will detail the design, development, and testing of this innovative alcohol sensor system.

I. Literature Survey

1. "**Alcohol Detection Systems for Vehicles: A Review of Recent Development**" by Patel, R. et al. (2020) - This article dives into the latest innovations in alcohol breath testers designed for vehicles, particularly focusing on ignition interlocks that utilize breathalyzers. It discusses how these systems could potentially curb drinking and driving. The authors compare various sensor technologies, including semiconductor and fuel cell sensors, highlighting their strengths and weaknesses in terms of sensitivity, response time, and reliability.

2. **"Ignition Interlocks to Prevent Drunk Driving: A Systematic Review" by Smith, D. et al. (2019)** - In this comprehensive review, Smith and colleagues examine ignition interlocks that prevent a vehicle from starting if alcohol is detected on the driver's breath. The article outlines different designs of these interlocks, addresses user compliance challenges, and evaluates how effective they are in reducing alcohol-related traffic accidents. The authors also discuss the possibility of integrating interlocks with other safety features in vehicles.

3. "**Smart Vehicle Safety Systems Based on GPS and GSM Technologies" by Zhang, L. et al. (2021)** - This piece explores how GPS and GSM technologies are utilized in vehicle safety systems that offer real-time location tracking and emergency alerts. The authors explain how these technologies can enhance safety and emergency responses by sending location information to designated individuals in case of a safety breach.

4. "**Breathe Alcohol Detection with Semiconductor Sensors" by Kumar, A. et al. (2018)** - In this article, Kumar and his team delve into semiconductor sensors, like the MQ series, which detect alcohol from breath. They discuss the sensors' response times, sensitivity to alcohol vapor, and reliability under various conditions. This article provides valuable insights into the alcohol sensor technology used in their study.

5. "**Vehicle Engine Locking Systems Based on IOT and Sensor Networks" by Patel, P. et al. (2020)** - This paper dives into how Internet of Things (IOT) principles can be applied to the locking systems of vehicle engines. It proposes a system where an algorithm utilizes various sensors to keep an eye on driver behavior, ensuring that only authorized individuals can start the engine. The paper also touches on how this system can be integrated with GPS and GSM for enhanced monitoring and security.

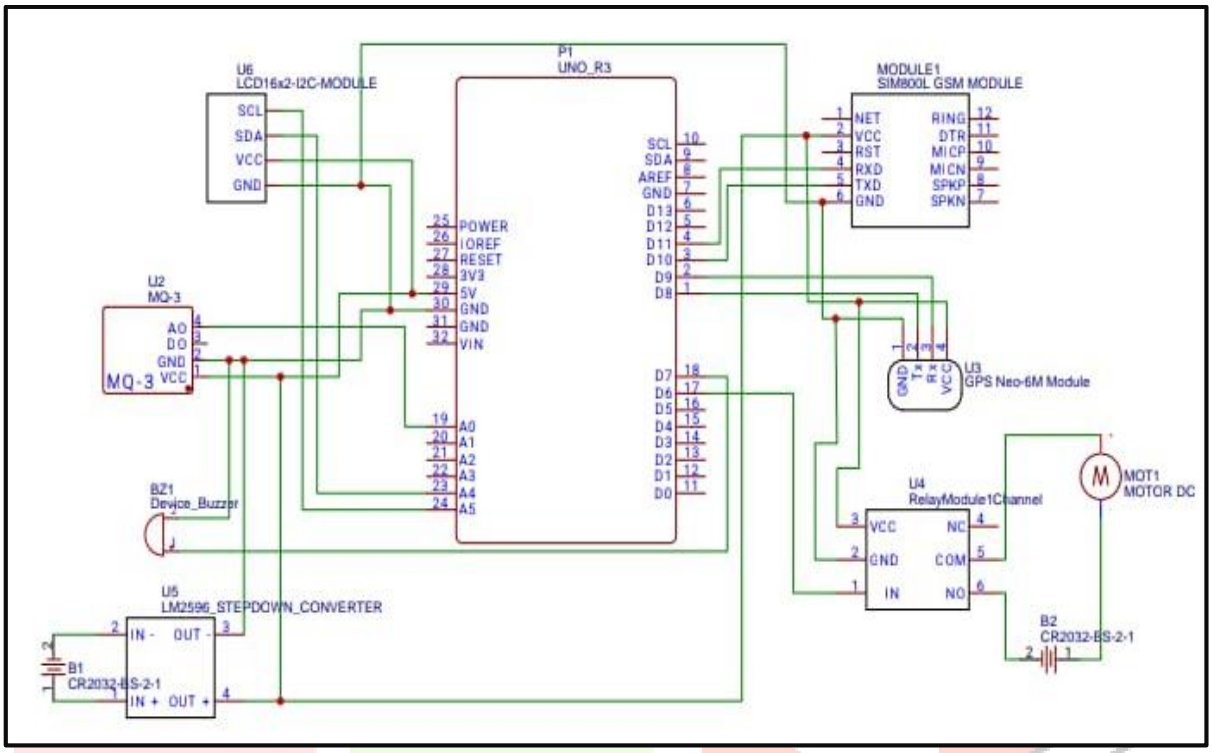
6. "**Design of a Breath Alcohol Detection System for Vehicle Safety" by Yang, J. et al. (2017)**- In this work, Yang and colleagues introduce a design for an alcohol detection system specifically for motor vehicles. They discuss how an alcohol sensor is connected to an embedded microcontroller, using an algorithm to measure alcohol levels and trigger an engine lock. The paper also addresses challenges related to power consumption and the need for real-time processing in vehicle

applications.

II. PROPOSED SYSTEM

1. Block Diagram

The following block diagram illustrates the flow of the proposed alcohol detection and engine-locking system.

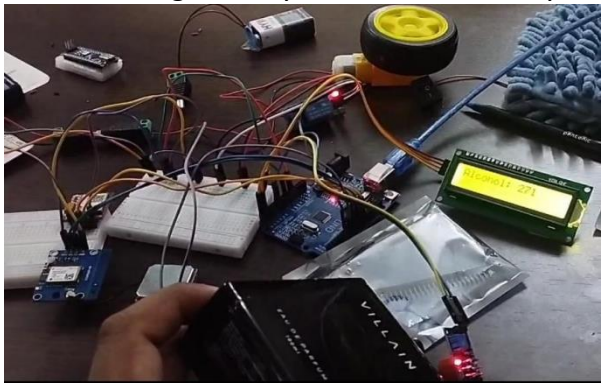


Block Dia. (1).Engine Locking System

2. Description of the Process

i. Alcohol Detection: The whole process kicks off with the MQ-3 alcohol sensor, which senses the alcohol levels in the driver's breath. If alcohol is detected, the sensor sends a signal to the Arduino microcontroller.

ii. Engine Locking Mechanism: Based on the data from the MQ-3 sensor, the Arduino figures out the alcohol level. If it goes over a certain limit, the Arduino sends a command to the relay module, cutting off the power to the vehicle's ignition system and effectively locking the engine.



Dia(2). Working Model

iii. GPS Location Tracking: Once alcohol is detected and the engine is locked, the GPS module springs into action. It tracks the vehicle's real-time location, providing latitude and longitude details.

iv. SMS Alert System: The Arduino then connects with the GSM module to send an SMS alert to a designated contact, like a supervisor or the vehicle owner. This message includes the vehicle's location, giving real-time latitude and longitude information in case of an emergency.

III. RESULT & ANALYSIS

We put the proposed alcohol detection and engine locking system through its paces under various conditions to see how well it works, how reliable it is, and how it performs overall. We tested each component of the system—the MQ-3 alcohol sensor, Arduino microcontroller, relay module, GPS module, and GSM module—individually before bringing them all together for real-world application.

1. **Alcohol detection:** The MQ-3 sensor showed impressive sensitivity, picking up alcohol vapor concentrations as low as 0.04%. It responded quickly, with the system detecting changes in alcohol levels in just 2 to 3 seconds. The Arduino microcontroller did a great job of converting the sensor's analog output and triggering the relay when the alcohol content exceeded the set limit of 0.02% BAC. This effectively prevented the vehicle's engine from starting.
2. **Relay and Engine Locking Function:** We also tested the relay module in conjunction with the vehicle's ignition system. When the system detected alcohol, the relay cut off the power supply to the ignition system, effectively locking the engine and preventing it from starting. If no alcohol was detected, the relay allowed the ignition system to operate normally, enabling the engine to start without any issues.
3. **GPS and Location Tracking:** The GPS module (NEO-6M) provided accurate location data, logging coordinates every 5 seconds. It was capable of delivering real-time latitude and longitude information with an impressive precision of up to 5 meters. During testing, the system continuously updated the vehicle's location, even while it was in motion, and sent this information via SMS using the GSM module.
4. **GSM-Based SMS Alert:** The SIM800L GSM module effectively sent out SMS notifications that included the real-time location coordinates (latitude and longitude) whenever alcohol was detected in the driver's breath. The alert message looked like this: "ALCOHOL DETECTED! Vehicle location: Latitude: 12.3456, Longitude: 78.9012." The pre-set phone number—whether it was the vehicle owner's or a supervisor's—received the alert just seconds after the engine was locked, ensuring that the vehicle's location was known immediately.

Result:

Sr. No.	Alcohol level	Alcohol detection	Motor condition
1.	0.5	Alcohol Not Detected	Motor Running
2.	2.0	Alcohol Detected	Motor Stoped
3.	2.5	Alcohol Detected	Motor Stoped
4.	3,0	Alcohol Detected	Motor Stoped

IV. Conclusion

The alcohol detection and engine-locking system, which uses GPS and GSM technology, prevents drunk driving by immobilizing the car's engine as soon as alcohol is detected. It incorporates an MQ-3 alcohol sensor, an Arduino microcontroller, and a relay module for detecting alcohol and controlling the engine. Meanwhile, the GPS tracks the vehicle's location, and the GSM sends out real-time alerts. Testing has shown that this system effectively identifies alcohol, locks the engine, and provides location-based warnings. Even with some environmental challenges, this technology holds great promise for improving road safety. Future improvements will focus on enhancing sensor accuracy and boosting GPS performance for even better functionality.

V. Future Scope

- Enhanced Sensor Accuracy: By incorporating more sensors and advanced algorithms, we can significantly reduce false positives and boost the accuracy of alcohol detection.
- Improved GPS: Upgrading GPS modules and integrating hybrid tracking technologies will lead to better accuracy, especially in urban environments.
- Autonomous Vehicle Integration: This system will be synchronized for use in self-driving cars, ensuring that intoxicated passengers can't take control of the vehicle.
- Mobile Application: A dedicated app will allow for remote monitoring, real-time location tracking, and instant alerts to keep everyone informed.
- Extended Alert System: We'll include multiple emergency contacts or authorities to ensure quick intervention and efficient location-based routing.
- Battery-Powered System: A battery-operated version will be developed for greater flexibility, allowing it to function independently of the vehicle.

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