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Alcohol Engine Locking with SMS Alert using Arduino and GSM

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Abstract: *It aims to prevent drunk driving by integrating an alcohol sensor with the vehicle's ignition system. When the driver breathes near the sensor, it detects alcohol levels using the MQ-3 sensor. If alcohol is detected above a predefined threshold, the Arduino microcontroller disables the engine ignition, effectively locking the vehicle. Simultaneously, a GSM module sends an SMS alert to a predefined mobile number (e.g., a family member or fleet manager) with the driver's status and location. This system provides real-time monitoring and proactive prevention. It enhances road safety, especially in commercial or personal vehicles. The design is cost-effective and easily integrable into existing vehicles. Overall, the project merges sensor technology, microcontroller logic, and wireless communication to create a smart, safety-oriented solution.*

Keywords: Arduino Uno, GSM Module (SIM800/900), Sensor Integration, Analog to Digital Conversion, Relay Control via Arduino, GSM AT Commands, Mobile Alert System, SMS API (GSM module)

I. INTRODUCTION

Drunk using is turning into a main motive of traffic injuries globally, main to innumerable accidents and fatalities [1] each year. Modern era affords innovative answers which can pick out and prevent such conduct earlier than a automobile is driven, which facilitates to remedy this trouble and growth road safety. Real-time tracking of drivers` alcohol intake is made feasible through the incorporation of microcontroller [2]-based devices in cars. A smart device that detects [4] whether a driver's breath incorporates alcohol via way of means of the usage of an Arduino microcontroller, a GSM module, and an alcohol sensor [3]. The tool at once turns off the engine ignition to hold the auto from beginning if alcohol ranges are observed to be better than a predetermined threshold. This preventative degree promotes secure using behavior and facilitates to eliminate human mistake [5]. The device is each less expensive and scalable for broader use through using open-supply hardware and less expensive components. Additionally, it lowers the opportunity of injuries introduced on through under the influence of alcohol using through making certain that best sober drivers are authorized to function the car.

When alcohol is discovered, the device`s GSM module now no longer best locks the engine however additionally notifies a pre-particular contact, like a family member, fleet manager, or regulation enforcement agency, through SMS. Another degree of responsibility is brought through this real-time notification, which additionally makes it viable to behave speedy if needed. The MQ-three sensor, that is sensitive to alcohol vapors, detects alcohol and sends analog alerts to the Arduino for processing. To preserve the auto immobile, the Arduino turns on a relay to reduce the engine circuit whilst the sign reaches the predetermined threshold. In addition to growing individual driving force accountability, this automatic technique helps large public protection initiatives. Additionally, it offers educational fee for builders and students analysing GSM communication, sensor integration, and protection programs in the automobile industry.

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II. LITERATURE SURVEY

According to a National Highway Safety Administration (NHTSA) research, approximately one-third of toll road fatalities in numerous countries are resulting from under the influence of alcohol drivers. Researchers have evolved and placed into vicinity some of alcohol detection and vehicle locking devices to counteract this, which prevent a vehicle from beginning whilst alcohol is discovered withinside the driver`s breath. The MQ-three and MQ-135 gas sensors, which might be touchy to ethanol vapors and supply microcontrollers real-time records for decision-making, are regularly utilized in those systems.

Microcontrollers just like the Arduino Uno had been blended with MQ-3 alcohol sensors [6] in a task created through engineering students from distinctive universities to degree the quantity of alcohol present. The microprocessor might turn off the ignition circuit through activating a relay module whilst the detected price exceeded the secure limit [7]. These structures regularly have LED warning signs or buzzers to present the driving force feedback. However, the lack of faraway notification or alarm techniques in early structures restrained their use in real-global eventualities wherein outside help can be required.

Further advancements incorporated GSM modules (like SIM800 or SIM900) to send SMS alerts to designated contacts upon detection of alcohol. Studies and projects demonstrated that the integration of GSM-based communication greatly enhanced the effectiveness of such systems by enabling real-time alerts to family members or authorities. In one such case, a system was built that sent SMS alerts [8] and included GPS [9] tracking to locate the vehicle, showcasing the potential of IoT-enabled [10] safety systems. Additionally, research has shown that using low-cost, open-source hardware like Arduino makes such systems affordable and easy to deploy in both personal and commercial vehicles.

III. PROBLEM IDENTIFICATION

Drunk driving remains one of the leading causes of road accidents globally, resulting in severe injuries, fatalities, and property damage. Despite the presence of laws and penalties against drunk driving, enforcement remains inconsistent and largely reactive, often after an accident has occurred. Most vehicles currently in use do not have built-in mechanisms to detect whether a driver is under the influence of alcohol before allowing the engine to start. This creates a critical gap in proactive safety technology. Conventional methods, such as police breathalyser tests, rely on manual intervention and are not feasible for continuous monitoring or personal vehicle use. In addition, existing alcohol detection systems are either costly or not integrated with features that can communicate the violation to concerned authorities or family members in real-time. There is a lack of affordable, automated systems that can prevent a drunk driver from starting a vehicle while also notifying a trusted contact for accountability.

IV. METHODOLOGY

The system is designed to detect alcohol presence in the driver's breath, prevent vehicle ignition if alcohol is detected, and send an SMS alert to a predefined mobile number using a GSM module. The methodology involves sensor integration, decision-making logic using Arduino, and communication through GSM as shown in figure 1.

Key Highlights:

1. **Alcohol Detection:**
   - MQ-3 sensor continuously monitors the driver's breath for alcohol vapor.
   - Analog signal is read by the Arduino and compared with a predefined threshold.
2. **Decision Logic:**
   - If alcohol level > threshold → engine is locked.
   - If alcohol level < threshold → engine ignition is allowed.
3. **Engine Locking Mechanism:**
   - Arduino controls a relay module connected to the engine circuit.
   - Relay is triggered to break the circuit if alcohol is detected, preventing the engine from starting.
4. **SMS Alert System:**
   - GSM module (SIM800/SIM900) is interfaced with Arduino.

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- On alcohol detection, Arduino sends an SMS alert to a predefined number (e.g., family, fleet owner, or authority).

5. **Real-time Operation:**
   - System runs continuously during vehicle start-up.
   - Immediate action is taken without any manual intervention.
6. **Low-Cost & Scalable:**
   - Built with affordable components (Arduino, MQ-3, relay, GSM module).
   - Suitable for integration into personal, commercial, or public transport vehicles.

Figure 1: Work Flow For Anti Drink Driving System Components

V. OBSERVATIONS

During testing of the alcohol engine locking system, several key observations were made:

1. **Sensor Accuracy**:
   - The MQ-3 sensor responded effectively to varying alcohol concentrations.
   - Sensor output increased significantly with closer or prolonged exposure to alcohol vapors.
2. **Engine Control**:
   - When alcohol concentration crossed the preset threshold (e.g., 0.04% BAC equivalent), the relay successfully disconnected the ignition system.
   - In normal conditions (no alcohol), the engine remained operational.
3. **SMS Alert Function**:
   - GSM module sent SMS within 3–5 seconds of detection.
   - Messages were consistently received on the registered mobile number without failure.
4. **Response Time**:
   - Total response time (from detection to engine lock and SMS send) was approximately 5–7 seconds.
5. **False Positives**:
   - Minor spikes in sensor output were observed due to strong smells (e.g., sanitizers), but these were below the threshold.

Alert using Arduino and GSM" using Python. Since this is a hardware-based project, we'll simulate readings from an alcohol sensor (MQ-3), and show how the system would respond based on different alcohol concentration levels are shown as in figure 2.

Simulated Observations

We assume:

- Safe alcohol threshold = **200 (analog value from MQ-3)**
- Readings above 200 → **Engine Locked**, SMS sent
- Readings ≤ 200 → **Engine Starts Normally**

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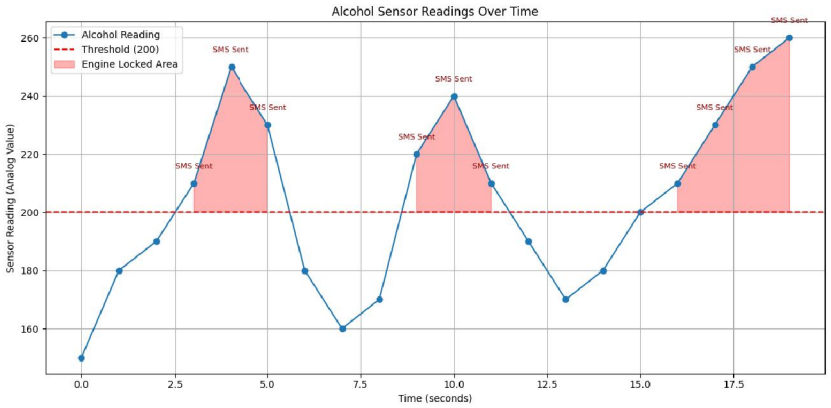

Figure 2: Alcohol Sensor Readings

VI. CONCLUSION & FUTURE ENHANCEMENT

The proposed system successfully detects alcohol in a driver's breath using the MQ-3 sensor and prevents vehicle ignition through an engine locking mechanism controlled by Arduino. Additionally, it sends an SMS alert via a GSM module to notify concerned parties in real-time. This enhances road safety by proactively stopping drunk driving before the vehicle can be operated. The system is low-cost, efficient, and suitable for integration into existing vehicles. For future enhancements, the system can be upgraded with a **GPS module** to send the exact location of the vehicle during detection. A **data logging feature** can be added to store historical records for fleet monitoring or law enforcement. Integration with a **mobile app** can provide real-time monitoring and control. Biometric verification and voice alerts could also be included for added security and usability.

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