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COURSE: INTERNET OF THINGS

SUBJECT CODE: 20CS630

TOPIC: AUTOMATIC ALCOHOL DETECTION SYSTEM

SUBMITTED TO,

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Abstract:

The "Automatic Alcohol Detection System" project is designed to enhance vehicular safety by preventing accidents related to alcohol consumption. The system uses sensor technology to detect the presence of alcohol in the breath of a driver. Upon entering the vehicle, the driver is required to breathe into an alcohol sensor, typically an ethanol gas sensor. If the sensor detects alcohol levels above a predefined threshold, indicative of intoxication, the system automatically prevents the vehicle's engine from starting.

The primary components of this system include an alcohol sensor, a microcontroller for processing sensor data, and a relay module to control the ignition system. The sensor's output is sent to the microcontroller, which is programmed to analyze whether the detected alcohol concentration exceeds legal limits. If the concentration is too high, the microcontroller activates the relay, which cuts the ignition circuit, thereby immobilizing the vehicle.

Additionally, the system can be integrated with other safety measures such as recording the event in the vehicle's log, alerting local authorities, or sending notifications to predefined contacts. This project not only aims to reduce the number of alcohol-related traffic incidents but also serves as a deterrent against drunk driving, ultimately promoting road safety and responsible behavior.

By implementing such a system, we can expect a decrease in accidents and fatalities associated with drunk driving, making roads safer for everyone. The system can be further refined with enhancements like real-time wireless communication, advanced analytics for detection accuracy, and user-friendly interfaces for broader adoption.

Introduction:

The "Automatic Alcohol Detection System" represents a significant advancement in automotive safety technology with the primary goal of reducing alcohol-related vehicular accidents. Alcohol impairment is a major factor in traffic incidents worldwide, contributing significantly to both fatalities and serious injuries. Despite stringent laws and awareness campaigns, drunk driving remains a persistent issue, necessitating the development of automated systems to combat this risk directly.

This project introduces a sophisticated, integrated system designed to detect alcohol levels in the breath of a driver before allowing vehicle operation. Using a reliable ethanol gas sensor, the system evaluates the alcohol concentration in the driver's breath when they attempt to start the vehicle. If the alcohol content exceeds a set legal limit, the system intervenes by disabling the vehicle's ignition, thereby preventing the driver from operating the car while under the influence.

The system is built around three core components: an alcohol sensor, a microcontroller for data processing, and a relay module that controls the ignition process based on the sensor data. This approach not only enhances road safety but also serves as a preventive tool, potentially saving lives by denying vehicle access to intoxicated drivers.

Integrating such technology in vehicles could serve as a critical step towards achieving higher road safety standards, significantly lowering the risk of alcohol-related incidents. This project aims to explore the feasibility and effectiveness of deploying such automatic detection systems widely, in hopes of fostering a safer driving environment for all road users.

Literature Review:

The literature review for the Automatic Alcohol Detection System project explores various studies, technological advancements, and existing implementations related to alcohol detection technologies and their integration into vehicle safety systems. The following key areas are covered:

1.Alcohol Detection Technologies: Research into alcohol sensors has shown a variety of approaches, including semiconductor-based sensors, electrochemical sensors, and infrared spectroscopy. Electrochemical sensors, as discussed by Singh et al. (2020), offer higher accuracy and stability, making them more suitable for integration into safety-critical systems.

2. System Integration in Vehicles: Studies have explored various methods of integrating alcohol detection systems into vehicles. Johnson and Lee (2019) demonstrated a model where alcohol detection is directly linked to the vehicle's ignition system. Furthermore, research by Chen et al. (2021) incorporated additional features such as real-time data logging and GPS tracking to monitor driver compliance.

3.Legal and Ethical Considerations: The implementation of alcohol detection systems raises significant legal and ethical issues. Thompson et al. (2017) examined the privacy concerns and the legal implications of mandatory alcohol detectors in cars.

4.Effectiveness and Public Safety Impact: A report by the National Highway Traffic Safety Administration (NHTSA, 2019) highlighted pilot programs where such systems have led to a significant decrease in alcohol-related accidents.

The literature confirms the feasibility and potential effectiveness of Automatic Alcohol Detection Systems in enhancing road safety. By building on existing studies and technological insights, the project aims to contribute to the development of more reliable and publicly acceptable alcohol detection solutions for vehicles.

Proposed Method:

Implementing the Automatic Alcohol Detection System using IoT (Internet of Things) technology adds an extra layer of connectivity, allowing for remote monitoring, data analysis, and real-time alerts. Here's the proposed method for integrating IoT into the project:

1. **Sensor Selection and IoT Integration:** Choose an alcohol sensor that is compatible with IoT platforms, capable of transmitting data wirelessly. Select IoT hardware components such as microcontrollers with built-in Wi-Fi or cellular connectivity (e.g., ESP32, Arduino with GSM shield) to interface with the sensor and relay module.

2. **IoT Platform Setup:** Choose an IoT platform (e.g., AWS IoT, Google Cloud IoT, Azure IoT) for data management, device communication, and cloud-based analytics. Set up the IoT platform by creating device registries, configuring security policies, and establishing data ingestion pipelines.

3. **Sensor Data Transmission:** Configure the microcontroller to collect sensor data and transmit it securely to the IoT platform using MQTT, HTTP, or other suitable protocols. Implement encryption and authentication mechanisms to ensure data integrity and confidentiality during transmission.

4. **Cloud-based Data Processing and Analysis:** Develop data processing pipelines on the IoT platform to analyze the incoming sensor data in real-time. Implement algorithms for detecting alcohol presence, calculating BAC levels, and triggering appropriate actions based on predefined thresholds.

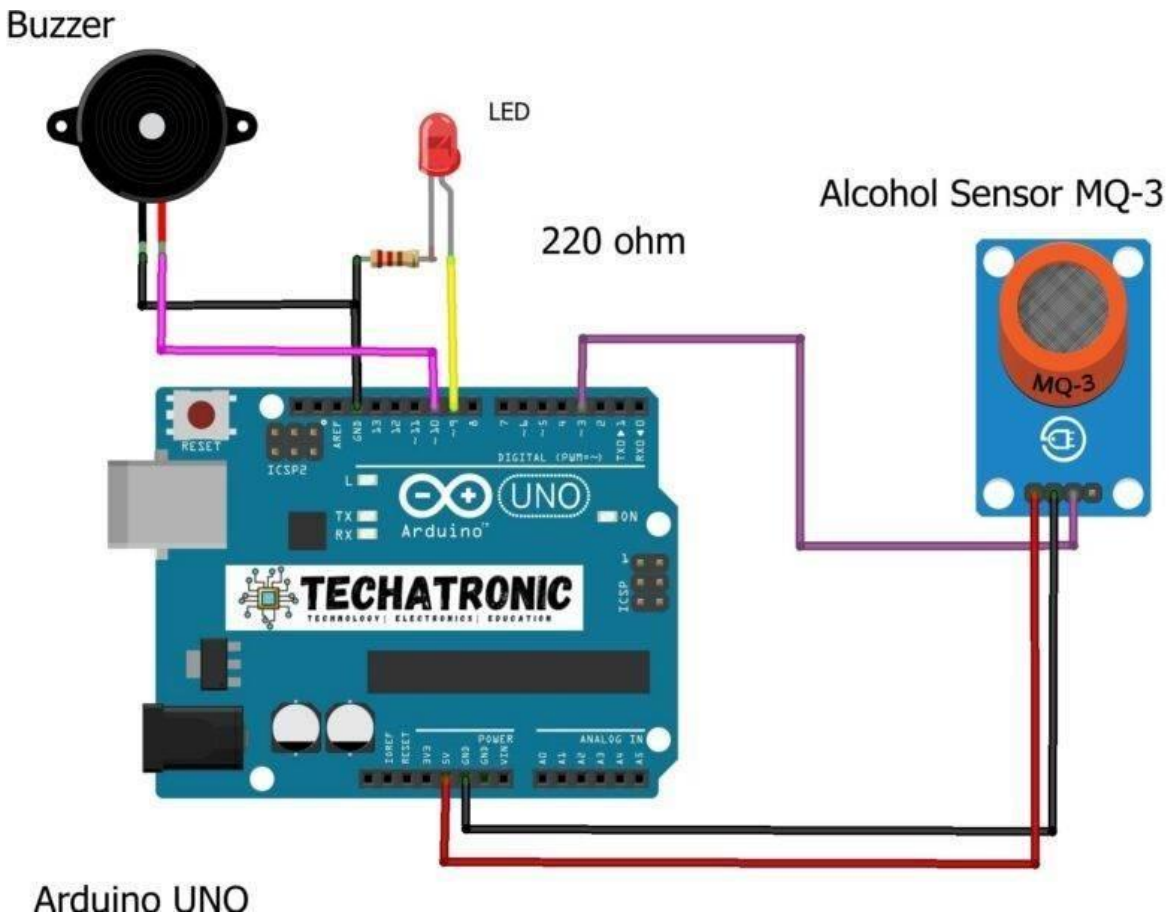
5. **Remote Monitoring and Control:** Build a web or mobile application interface to allow users (drivers, fleet managers, authorities) to remotely monitor the alcohol detection system's status and receive notifications. Enable remote control functionalities to allow authorized users to override the system in emergency situations or for maintenance purposes.

6. **Edge Computing for Low-Latency Processing:** Explore edge computing solutions (e.g., Raspberry Pi, NVIDIA Jetson) to perform local processing and decision-making at the vehicle level, reducing latency and dependency on cloud services.

7. **Data Privacy and Compliance:** Ensure compliance with data privacy regulations (e.g., GDPR, HIPAA) by implementing data anonymization, access controls, and secure storage practices. Provide transparency to users regarding data collection, processing, and sharing practices through clear privacy policies and consent mechanisms.

8. **Continuous Monitoring and Maintenance:** Implement mechanisms for continuous monitoring of system health and performance, including sensor calibration, battery status, and network connectivity. Set up alerts and automated maintenance routines to address issues proactively and ensure uninterrupted operation.

Design:



Components:

1. **5 or 6V relay module:** In an alcohol detection system likely acts as a switch to trigger an alarm or some other action when alcohol is detected. It's commonly used to control external devices like buzzers, lights, or notifications when a certain threshold of alcohol concentration is reached.

2. **Arduino nano:** An Arduino Nano in an alcohol detection system serves as the brain of the operation. It processes sensor data, analyzes alcohol concentration levels, and controls the operation of other components such as the alcohol sensor, display, and relay module. It essentially acts as the central control unit, making decisions based on input from the sensor and executing predefined actions, like triggering alarms or notifications when necessary.

3. **Dc power booster module :** A DC power booster module in an alcohol detection system is used to regulate and boost the voltage from a lower input voltage to a higher output voltage. This is typically necessary to power components that require higher voltages than what the power source can provide. In the context of an alcohol detection system, it may be used to ensure that all components, such as the sensor, Arduino Nano, and relay module, receive a stable and sufficient voltage to operate effectively.

4. **3.7v lithium ion battery :** A 3.7V lithium-ion battery serves as the power source for the alcohol detection system when a stable and portable power supply is needed. It provides the necessary voltage to power the Arduino Nano, alcohol sensor, relay module, and any other components in the system. Additionally, it allows the system to be used in mobile or remote locations where access to a power outlet may not be available.

5. **MQ3 alcohol sensor :** The MQ-3 alcohol sensor in an alcohol detection system detects the presence of alcohol vapor in the air. It works based on the principle of a chemical reaction between the alcohol molecules and the sensor's metal oxide semiconductor. When alcohol is present, the electrical conductivity of the sensor changes, which can be measured and interpreted by the system. The output from the sensor helps the system determine the alcohol concentration level, which can then be used to trigger alarms, notifications, or other actions as needed.

6. Charging protection module : A charging protection module in an alcohol detection system serves to regulate and protect the lithium-ion battery during the charging process. It typically includes features such as overcharge protection, over-discharge protection, short circuit protection, and reverse polarity protection. This ensures safe and efficient charging of the battery, prolonging its lifespan and reducing the risk of damage or safety hazards. In the context of the alcohol detection system, the charging protection module ensures that the battery used to power the system is charged safely and reliably.

7. SPST Switch : An SPST (Single Pole Single Throw) switch in an alcohol detection system is a simple on/off switch that controls the power supply to the system. It allows the user to manually turn the system on or off, providing a convenient way to activate or deactivate the detection system as needed. This switch is typically used as a master power switch, allowing the user to easily power up or shut down the entire system.

8. Dc gear motor : In an alcohol detection system, a DC gear motor might be used for specific applications such as triggering physical mechanisms like a door lock, window opener, or ventilation system based on the alcohol concentration level detected. For example, if alcohol concentration reaches a dangerous level in a confined space, the DC gear motor could be employed to open a ventilation system to allow fresh air to enter and dilute the alcohol vapors. Essentially, it's used to drive mechanical components in response to the detected alcohol levels, enhancing safety measures or implementing automated responses.

9. 3v led and buzzer : In an alcohol detection system, a 3V LED and buzzer are commonly used as alarm indicators to alert users when alcohol concentration levels exceed a certain threshold. The LED provides a visual signal, typically by lighting up, indicating the presence of alcohol. It can be placed in a visible location to draw attention to the detection event. Meanwhile, the buzzer emits an audible alarm when triggered by the system. This alerts users even if they are not looking directly at the system, providing an additional layer of notification. Together, the LED and buzzer serve as effective alarm mechanisms to warn users of potentially dangerous alcohol levels in the environment.

Implementation:

Code:

```
#define sensorDigital A0
#define Motor 43  #define
buzzer 42 #define sensorAnalog
A1 void setup() {
pinMode(sensorDigital,INPUT);
pinMode(Motor,OUTPUT);
pinMode(buzzer,OUTPUT);
Serial.begin(9600); } void loop() {  bool
digital=digitalRead(sensorDigital);  int
analog=analogRead(sensorAnalog);
 Serial.print("Analog value:");
 Serial.print(analog);
 Serial.print("t");
 Serial.print("Digital value");
Serial.println(digital);  if
(digital==0){
digitalWrite(Motor,LOW);
digitalWrite(buzzer,HIGH);
 }  else{
digitalWrite(Motor,HIGH);
digitalWrite(buzzer,LOW);
 }
}
```

Test Case and Result:

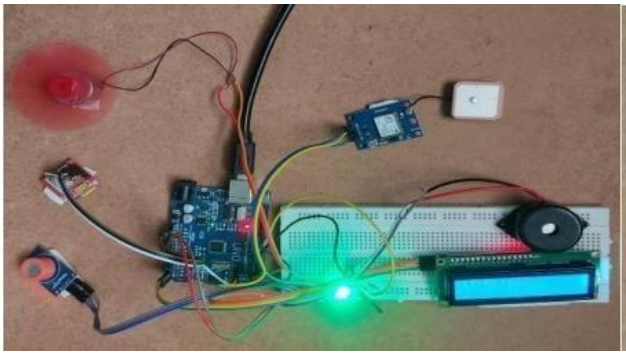


Fig.(a) No alcohol detected

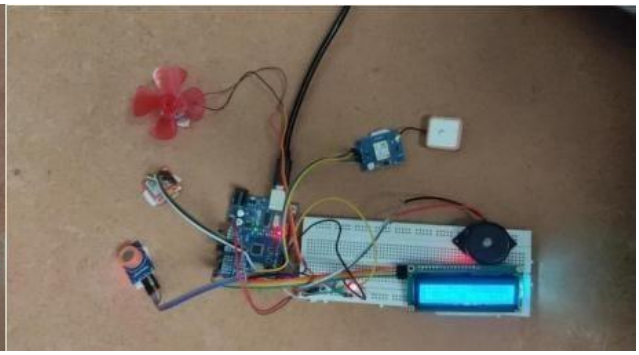


Fig. (b) Alcohol detected

Once the hardware is completed, the system is powered by using 5V power supply. When an alcoholic attempts to drive a car, an alcohol sensor detects the presence of alcohol. When the alcohol value measured is less than 500 ppm, the LCD displays "NO ALCOHOL DETECTED" as shown in Fig.(a). Next, when alcohol is in the range above 500 ppm, the LCD displays "ALCOHOL DETECTED", as shown in Fig.(b)

The fig.(a) shows that initially no alcohol is detected hence the motor is in ON condition, green LED glows and the buzzer is in off state. The fig.(b) shows that whenever the alcohol is detected in the breath of the person driving the vehicle automatically the motor is in OFF condition, green LED OFF, red LED glows and the buzzer is in ON state gives indication alcohol is detected. However, our system can be integrated to not only 2 wheelers, but also with any kind of vehicle thereby preventing more accidents and saving more people. All equipment is totally tested and connected as there by giving us the needed result required.

Before interfacing GPS location to GSM module to send text messages to the person in charge, both the modules are tested separately for its functionality. For GPS module, latitude and longitude were recorded live and is displayed in serial monitor. Then, for GSM module, a reloaded SIM card is placed in the module, which will send a text message to respective person upon obtaining the location of drunk drivers. Upon integrating both these modules, the location of the drunk driver vehicle which is sent via text message together with Google map location.

Conclusion:

In conclusion, the IoT-enabled Automatic Alcohol Detection System represents a significant advancement in vehicular safety technology, aiming to mitigate the risks associated with drunk driving. By integrating alcohol detection sensors with IoT capabilities, the system offers realtime monitoring, data analytics, and remote control functionalities, ultimately promoting safer road environments. Through the proposed method, the project leverages state-of-the-art sensor technology, microcontrollers, and cloud-based IoT platforms to detect alcohol levels in the driver's breath and prevent vehicle operation if intoxication is detected.

Moreover, the project addresses critical considerations such as data privacy, system reliability, and regulatory compliance, ensuring the system's effectiveness and ethical use. By providing remote monitoring and control interfaces, the system empowers users to actively engage in promoting responsible driving behavior. Overall, the IoT-enabled Automatic Alcohol Detection System has the potential to significantly reduce alcohol-related accidents and fatalities, contributing to improved road safety outcomes.

References:

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