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A NOVEL APPROACH TO ROAD SAFETY: ALCOHOL SENSING ENGINE LOCK

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ABSTRACT

Recent increases in road accidents, largely due to drunk driving and reckless behaviour, highlight the urgent need for improved road safety systems. This paper proposes a comprehensive vehicle safety solution using Arduino-based technology that integrates alcohol detection, seatbelt monitoring, and vehicle security. The system incorporates an alcohol sensor to detect impaired driving and locks the vehicle's ignition if alcohol is present. Additionally, the seatbelt sensor ensures the car cannot start unless the seatbelt is fastened, further preventing potential accidents. A GSM module alerts designated contacts, such as family members, about violations, while GPS technology enables real-time tracking of the vehicle's location, aiding in theft recovery. This system not only targets reducing accidents caused by drunk driving but also promotes safer driving conditions in general. The proposed system aims to bridge the gap between high-end vehicle safety features and accessible, cost-effective solutions for all vehicle types, with a special focus on countries like India where road accidents are a major public health issue. The integration of emerging technologies such as GPS, GSM, and sensors represents a significant step forward in enhancing vehicle safety, offering a promising solution for preventing traffic fatalities and improving road discipline.

***Keywords**: Global positioning system (GPS), Global system for mobile communications (GSM), Blood alcohol content (BAC), Arduino.*

INTRODUCTION

Recent road accidents are largely attributed to driving under the influence of alcohol and reckless behaviour, leading to an urgent need for improved road safety measures. Drunk driving has become a significant public issue and is expected to worsen if not addressed. Apart from alcohol consumption, failure to use seat belts also contributes to fatal accidents. Seat belts are crucial in reducing injury severity in car crashes, and advanced technologies like electronic stability control have shown effectiveness in minimizing harm, potentially preventing up to 34% of serious accidents. Driver negligence, especially in urban areas, is a leading cause of accidents, while rural incidents are more commonly linked to alcohol impairment. Emerging technologies, such as microcontrollers, can help reduce accidents by automating safety measures. Microcontrollers, like Arduino, are small programmable devices that control connected systems. The proposed system integrates alcohol detection with seatbelt control, locking the car's ignition if the driver is found intoxicated. If the seatbelt is not properly fastened, the engine will not start, even if alcohol is absent. In addition, the system uses GSM technology to alert

the driver's family or other parties in case of issues, including vehicle theft prevention. The system can also track the vehicle's location using GPS to aid in recovery if stolen. The integration of global positioning systems and wireless technologies enhances the functionality of these safety features. The project aims to reduce traffic-related deaths, particularly in countries like India, where road accidents claim numerous lives each year. While high-end cars offer some safety technologies, the goal is to make such innovations accessible in all vehicles. The incorporation of biometric recognition and alcohol detection systems could revolutionize vehicle security, preventing accidents caused by impaired driving, speeding, or distractions. This system represents an important step toward safer roads and better traffic discipline.

This section outlines the software and hardware components involved in the development of a road safety system. The system's design uses two main software tools: Proteus for simulating system functionality and Arduino for programming the microcontroller and hardware integration.

LITERATURE SURVEY

The proposed system aims to enhance road safety by integrating alcohol detection, seatbelt monitoring, and vehicle security features. An alcohol sensor detects intoxication, preventing ignition if alcohol is present. An IR sensor ensures the seatbelt is fastened; if not, the engine remains off. The system uses a microcontroller to process sensor data and send alerts via GSM to notify the driver or family of issues like alcohol consumption or unfastened seatbelts. Additionally, GPS tracking enables location updates, aiding in vehicle recovery in case of theft. This system combines safety and security, improving driving conditions and preventing accidents [1].

Technology has revolutionized security systems by replacing traditional methods with biometric recognition. One such innovation is iris scanning, which uses unique patterns in the eye for identification. The human iris is distinctive and difficult to replicate, making it ideal for secure authentication. Alcohol consumption affects the iris by causing pupil dilation or constriction, which can be used to detect intoxication. Alcohol impairs vision, making it harder for drivers to react to stimuli like headlights, leading to accidents. This research aims to prevent drunk driving by using iris recognition to automatically lock the vehicle's engine if intoxication is detected [2].

Road accidents, particularly in India, are a major health concern. Contributing factors include poor infrastructure, speeding, and drunk driving. This project aims to enhance safety with speed control, alcohol detection, and horn regulation. This system uses various components, including HT12E encoder, HT12D decoder, RF modules, MQ3 alcohol sensor, relay driver, and LCD display. The encoder converts parallel data to serial for transmission, while the decoder converts it back. The alcohol sensor detects intoxication levels, and if alcohol is detected, it sends a signal to stop the car. The LCD displays relevant information [3].

This section outlines the hardware and software components used in the project. Proteus and Arduino were utilized for simulation and programming, respectively. Key hardware elements include an Arduino Uno board for processing, a GSM module for communication, and a GPS module for location tracking. The system also integrates an LCD for display, alcohol and vibration sensors, an IR sensor, and a mini pump for fuel simulation. Additional components such as a buzzer, relay, power bank, and switches ensure smooth operation. These components work together to achieve the system's objectives, with all parts tested before physical implementation [4].

Drunk driving is a leading cause of road accidents, with current enforcement efforts limited in scope. This project introduces an Arduino-based alcohol detection system that automatically disables a vehicle's engine when alcohol levels exceed a certain threshold, offering a practical solution to reduce alcohol-related crashes and enhance road safety [6].

This project uses several key components, including an Arduino UNO, alcohol sensor MQ-3, GSM module, and GPS module. The Arduino provides communication capabilities via UART, while the MQ-3 detects alcohol levels. The GSM module enables text messaging functionality using AT commands, allowing for remote communication. The GPS module provides location data through satellite navigation, useful for tracking and routing. These components work together to create an embedded system for vehicle safety, detecting alcohol consumption, controlling speed, and enabling location-based services for better road management and accident prevention [7].

This project integrates several components to enhance functionality, including the Arduino Uno, NodeMCU, MQ-3 alcohol sensor, SIM900A GSM module, NEO-6 GPS module, and a DC motor shield. The Arduino Uno provides a flexible platform with digital and analog pins, while the NodeMCU enables IoT applications with its Wi-Fi capabilities. The MQ-3 sensor detects alcohol levels, and the SIM900A facilitates GSM communication. The NEO-6 GPS module offers precise location tracking, and the DC motor shield allows motor control. Together, these components create a comprehensive system for safety, communication, and automation [8].

This paper proposes an integrated system combining alcohol detection, emissions monitoring, and women's safety using Arduino, GSM, and GPS technologies. It aims to improve vehicle safety, reduce pollution, and address increasing concerns over road accidents and women's security [9].

This paper discusses the development of a system to detect alcohol in vehicles to prevent drunk driving accidents. Using an MQ-3 alcohol sensor, the system detects alcohol vapours inside the car. If alcohol is detected, a buzzer activates, alerting the driver not to start the vehicle. The ignition button, typically used to start the engine, triggers an LED light when alcohol is detected, preventing the car from starting. If the driver is sober, the system remains silent, allowing normal operation. The integration of the MQ-3 sensor, push button, buzzer, and LED helps ensure safe driving conditions [10].

This section discusses a proposed alcohol detection system that uses a breath analyzer to assess Blood Alcohol Content (BAC) levels, preventing impaired driving. Breath alcohol tests are preferred over performance-based devices due to their reliability. The system aims to stop drivers with high BAC from operating the vehicle while allowing sober drivers to use it. Technological advancements have improved accuracy and device efficiency, making this solution cost-effective and practical for widespread use [11].

This system integrates alcohol detection, driver alert, and engine immobilization to prevent drunk driving. Using an Arduino Uno, MQ3 sensor, LCD, buzzer, and relay, the sensor detects alcohol levels and communicates with the vehicle's ignition system. If alcohol is detected, the engine is locked, and the buzzer alerts the driver. This cost-effective solution enhances road safety by preventing impaired driving and can be easily integrated into vehicles by manufacturers [12].

This research proposes a comprehensive vehicle safety system designed to prevent impaired driving, reckless behaviours, and theft. The system integrates alcohol detection, rash driving monitoring, engine immobilization, GPS tracking, and anti-theft features. It uses sensors to monitor the driver's condition and vehicle actions,

triggering alerts and immobilizing the engine when necessary. GPS and GSM modules provide real-time location updates to emergency contacts, enhancing road safety and response capabilities in critical situations [13].

RESULTS AND DISCUSSION

This system is designed to reduce traffic accidents, particularly those caused by drunk driving, by providing an automated solution to monitor alcohol consumption levels in drivers. The system integrates advanced sensors to detect alcohol concentration and offers a rapid, precise reading, ensuring that the driver's condition is assessed efficiently. It serves not only as a tool for law enforcement but also as a safety mechanism within vehicles to prevent accidents linked to impaired driving.

The key feature of the system is its ability to measure a driver's blood alcohol content (BAC). Upon detecting alcohol, an audible alarm sounds to warn the driver. The system is structured to operate smoothly and meet its specified objectives, including providing an affordable, portable, and user-friendly breathalyzer device. The expected outcome is to minimize traffic accidents by preventing impaired individuals from operating a vehicle.

The system is designed to handle different scenarios, depending on the driver's BAC levels. For example, in the first scenario, where no alcohol is detected, the vehicle operates normally without interruption. The system registers consistent sensor readings, ensuring the car runs smoothly without any disturbances. In the second case, if the driver's BAC is below the set threshold, alcohol is detected but at a level that doesn't interfere with the vehicle's operation. The car continues to run without triggering any alarms, as the alcohol content is considered safe for driving.

However, in the third case, where the driver's BAC exceeds the safe limit, the system activates an alarm and automatically disables the vehicle's ignition. This ensures the car cannot start or continue running, preventing a potential accident. The safety mechanism is a critical feature that addresses the risks associated with high alcohol consumption, ensuring the vehicle remains immobile until the situation is resolved.

This system is expected to function effectively across various real-world conditions, helping reduce drunk driving incidents by enforcing safety protocols. It can be extended further by adding additional sensors to monitor other driver behaviours, such as eye movement or seat occupancy, to enhance the overall safety system in vehicles. The integration of these technologies aims to create a safer driving environment by preventing impaired individuals from operating vehicles [5].

A few loopholes to be fixed

Cameras in Age Detection for Adjusting Legal Alcohol Limits

Incorporating cameras into age detection systems offers a promising solution for improving the accuracy and efficiency of monitoring alcohol consumption, particularly in the context of the legal age for drinking. Modern facial recognition technologies, supported by cameras, have advanced significantly, enabling the analysis of physical features such as facial structure, skin condition, and other biometric markers that correlate with age. These systems can assess individuals' age more reliably than traditional methods, which often rely on manual identification or less accurate tools. This development is critical when considering public health initiatives that aim to adjust legal alcohol consumption limits based on age. Specifically, by accurately identifying minors, age detection technology could support a shift in the legal blood alcohol concentration (BAC) limit from 0.03% to

0.02% for individuals under 18. Lowering the BAC threshold for minors could reduce the risk of alcohol-related accidents and long-term health consequences among youth. Cameras integrated with artificial intelligence and deep learning algorithms are capable of assessing an individual's age without direct interaction, ensuring quick and non-invasive screenings in environments like bars, clubs, or driving checkpoints. By leveraging such systems, we can create a more effective regulatory framework that both discourages underage drinking and ensures a safer, more informed public. The ability to detect underage individuals with precision and alter alcohol consumption limits accordingly would be a significant step in promoting public safety, while also fostering responsible alcohol consumption practices for all age groups.

Integrating GPS for Reporting Drink and Drive Cases

An essential feature of an Arduino-based alcohol sense engine lock is its ability to enhance public safety through quick communication with authorities in the event of a drink-and-drive case. By incorporating GPS technology, the system can automatically locate the nearest police station once alcohol consumption is detected. This information can be used to trigger an alert, sending the vehicle's location to a central database or directly to local law enforcement. The GPS module, integrated with the Arduino system, will pinpoint the vehicle's location in real time and calculate the nearest police station. Once the location is determined, the system can send a message or notification, ensuring that authorities are informed of the situation promptly. This integration provides an immediate response, allowing officers to act swiftly, potentially preventing accidents and reducing the risk of alcohol-related incidents on the road. The use of GPS ensures effective communication and timely intervention.

Fig.1: Drunk Driver Age Detection

CONCLUSION

The integration of Arduino-based alcohol sense engine locks, coupled with advanced technologies like GPS and GSM, offers a comprehensive solution to improving road safety and reducing traffic accidents, particularly those caused by drunk driving. By utilizing alcohol detection sensors, seatbelt monitoring, and real-time location tracking, the system can prevent impaired driving and provide immediate alerts to authorities in case of a violation. The use of GPS enhances the system's ability to report and direct law enforcement to the exact location, ensuring timely intervention. Moreover, the potential for integrating age detection through cameras further strengthens the system's ability to address legal alcohol consumption limits, particularly for minors. This research underscores the importance of leveraging technology to create safer road environments and prevent avoidable fatalities. The

proposed system represents a significant step toward making vehicles safer, more secure, and more responsible, promoting better traffic discipline and public health.

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