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Technology for Alcoholic Detection and Accident Prevention

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Abstract: *According to risk assessments of getting into an accident, drinking, and driving are one of the leading causes of motor vehicle accidents. Eliminating drunk drivers off the road might potentially save many lives. This article proposes a straightforward in-vehicle alcohol detection system that analyses data from six MQ-3 alcohol sensors using an optimizable shallow neural network (O-SNN). The results of the experimental evaluation show a high-performance detection system, which has a detection accuracy of 99.8% and an inferencing delay of 2.22 seconds. The proposed model may therefore be successfully applied in the Driver Alcohol Detection System for Safety (DADSS) system, which seeks to broadly deploy alcohol-sensing devices, to precisely identify in-vehicle alcohol with minimum inference overhead. 75% of all crashes are the result of drunk driving. Based on recent government research, drunk driving is at fault for 75% of all accidents on the road. Every 40 to 70 minutes, an accident occurs in smaller cities. According to government estimates, not using a seat belt results in 100 accidents and 25–27 fatalities. This project is constructed using the open-source electronics platform Arduino. It can read data from light sensors and convert it into outputs that start a motor. As a result, there is limited inference regarding drinking in vehicles. The suggested approach might be used to correctly identify drivers who are under the influence of alcohol.*

Keywords: Vehicle Accidents

I. INTRODUCTION

The need for an alcohol sensor-based smart vehicle system arises from the fact that drunk driving is a major cause of road accidents and fatalities. According to the World Health Organization (WHO), around 1.35 million people die each year due to road accidents, and 15% to 30% of these deaths are caused by drunk driving. In addition, the economic cost of road accidents is estimated to be around 1% to 2% of the gross domestic product (GDP) of most countries.

Therefore, it is important to prevent drunk driving to minimize the number of accidents and fatalities on the roads. The alcohol sensor-based smart vehicle system is an effective way to achieve this objective. The system can detect if the driver is intoxicated and prevent the vehicle from being driven, thereby minimizing the chances of accidents caused by drunk driving. This system not only ensures the safety of the driver but also the safety of other road users. The system can also help reduce the economic cost of road accidents by minimizing the damage caused to vehicles and infrastructure.

Thus, the alcohol sensor-based smart vehicle system is a necessary technology that can make our roads safer and reduce the number of accidents caused by drunk driving.

Alcohol detection is the primary factor in this topic. 75 percent of traffic accidents, according to a recent government assessment, are caused by intoxicated drivers. Yet between 40 and 70 percent of accidents occur in small cities. Due to this topic's dependence on the Internet of Things (IoT), the government reports that 100 accidents and 25 to 27 fatalities occur on roads each year. I thus employ Uno Arduino in this topic. Moreover, Arduino is an open-sourceelectronics platform with user-friendly hardware and software. The usage of GPS is the final crucial component.

We made an effort to meet the goals of detecting the driver's alcohol consumption and comparing it to the established threshold value that took into account the research on BAC (Body Alcohol Content) and other factors. If the value is greater than the threshold value, the ignition should be turned off, and the opposite should be true in all other states.

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Alcohol is a dangerous and addictive drug that can cause addiction, impairments, and ill health. It is the leading cause of early mortality and disability among adults between 20 and 39, with hospitalizations and fatalities more frequent in underprivileged and vulnerable populations.

II. LITERATURE REVIEW

Author name	Paper Title & Publishing Year	The goal of the existing system
Qasem Abu Al-Haija, Moez Krichen	A Lightweight In-Vehicle Alcohol Detection Using Smart Sensing and Supervised Learning 2022	This research sets out to evaluate the accuracy of several classifications and machine learning methods in predicting alcohol consumption and associated functional states. The results demonstrated that ensemble tree-based algorithms performed better than traditional machine learning methods.
Pramod Dhayarkar Pallavi Bankar, Shivani Shitole Swapnil Deshmukh	Alcohol detection and accident prevention 2022	The proposed system uses wireless, cloud, and soft computing technologies to detect alcohol and IR sensors and reduce vehicle speed to promote road safety.
Celaya-Padilla, J.M. Romero-González, J.S. Galvan-Tejada, C.E. Galvan-Tejada, J.I.	In-Vehicle Alcohol Detection Using Low-Cost Sensors and Genetic Algorithms to Aid in the Drinking and Driving Detection 2021	The proposed approach employs several inexpensive alcohol MQ3 sensors and produces an SVM classification model with an area under the ROC curve of 0.98 and a sensitivity of 0.979 to identify the presence of alcohol inside a car.

Many research studies in the literature, as was previously indicated in the introductory section, focused on the investigation of alcohol detection for drivers using various devices and approaches. Just 10 pieces of research on this subject are taken into account here. Table 1 provides an overview of the key conclusions of these publications.

The research discussed in [20] aimed to discourage drivers from starting their vehicles after consuming alcohol and from using seat belts. The MQ-3 alcohol sensor used by this device is fastened to the driver's seatbelt. The Raspberry Pi makes a comparison between the sensor unit's reading and the permitted threshold value. If the drivers are intoxicated, the ignition locking device prevents them from starting the vehicle. The system also has a Raspberry Pi camera mounted to detect the presence of the driver. The selected solution was not sufficiently technical described by the authors of the study, and no experimental findings were included.

A driver alcohol detection system based on breath sample testing was also suggested by the authors of [33]. With the help of the Arduino Compatible Compiler for LabVIEW (ACCL), which enables Arduino boards to be programmed using LabVIEW, the recommended system was created. To stop drunk driving, the system may evaluate the quantity of alcohol in a breath sample and regulate the ignition system's operation. The proposed solution's greatest estimate error for alcohol concentration was over 31%.The authors of [34] presented a portable alcohol detection system that consists of a data cloud system, a smartphone that manages the sensor device, and a breath sensor unit. You may utilize the detecting system to keep an eye on the driver from a distance. The breath sensor unit is made up of four distinct sensors. A water vapor sensor is the first, which determines if the Human breath is the gas being applied. The remaining ones are semiconductor gas sensors that can pick up ethanol, acetaldehyde, and hydrogen. The findings of the driver's breathalyzer test are sent to a data cloud system to be automatically processed, which may be problematic if a link were to break.

A vehicle-based IoT-based alcohol detection system is presented in [35] [42]. The core controller used is a STC12C5A60S2 single-chip microcomputer with an MQ-3 alcohol sensor for collecting data on air alcohol concentration and a GU900E GPRS module for wireless connection. When the driver takes the wheel, the device

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performs automated alcohol detection. When the drunk driving threshold is met, the system activates the relay, disables the car, activates the sound and light alert, and utilizes the Human breath as the applied gas. Hydrogen, acetaldehyde, and ethanol may all be detected by the other semiconductor gas sensors. The findings of the driver's breathalyzer are immediately sent to a data cloud system for analysis, which may be problematic if a link were to break.

Using IoT technology, [35] presents a vehicle-based alcohol detection system. The core controller utilized is a STC12C5A60S2 single-chip microprocessor with an MQ-3 alcohol sensor for gathering information on air alcohol content and a GU900E GPRS module for wireless communication. The gadget runs an automatic alcohol detection when the driver gets behind the wheel. When the threshold for drunk driving is reached, the system activates the relay, disables the vehicle, turns on the sound and light alarm, and makes use of the camera that continuously checks the driver for indicators of sleepiness and informs the sleepy driver via the car's sound system or a buzzer. The experimental findings presented in this article only included a small subset of drivers (only three).

The authors of the article [37] suggested a non-invasive method for finding alcohol inside a car. The suggested method makes use of a series of MQ-3 alcohol sensors that are mounted inside the vehicle. A genetic algorithm was used to carry out a feature selection technique. This method's features were used to create an SVM classification model that can identify the presence of alcohol. The proposed methodology is described in detail. However, it is unclear how alcohol detection will be achieved once the ML As a result, many sensor values obtained from the CAN bus are either closely related to one another or have no bearing on identifying driving behavior. Ensemble tree-based algorithms, such as decision trees and random forests, perform better than conventional machine learning methods when compared to alternative strategies. The authors took a broad view and did not focus especially on the issue of alcohol detection.

The authors of the publication [40] presented a real-time, low-cost, non-intrusive alcohol testing system paired with a driver sleepiness detection system. In this system, alcohol is detected using the MQ-3 sensor. The webcam positioned on the dashboard of the vehicle is then used for face detection. A warning is sent based on the threshold values of four extracted important facial features when drowsiness is detected. With an Arduino UNO and a Raspberry Pi 3, both systems are linked. Just a small number of ML approaches were tried in this paper.

[41] Suggested a case-based classification technique for alcohol detection using physiological indicators. A case-based reasoning method uses four physiological indicators, including skin conductance, finger temperature, respiration rate, and heart rate variability, to identify an alcoholic condition. There are separate groups of sober and drunk drivers in this study. Only one ML approach was tried in this study.

III. OBJECTIVE

The objective of this project is to design an alcohol sensor-based smart vehicle system that can detect if the driver is intoxicated and prevent the vehicle from being driven.

1. Increase safety on the roads: By preventing drivers from operating a vehicle while under the influence of alcohol, an alcohol sensor-based smart vehicle system can help reduce the number of accidents caused by impaired driving.
2. Reduce the risk of legal and financial consequences: Driving under the influence of alcohol can lead to legal and financial consequences, such as fines, legal fees, and increased insurance premiums. By preventing drivers from driving while intoxicated, an alcohol sensor-based smart vehicle system can help reduce these risks.
3. Improve public health: Drunk driving is a public health issue that can result in injuries, disabilities, and deaths. By reducing the number of accidents caused by drunk driving, an alcohol sensor-based smart vehicle system can contribute to overall public health.
4. Provide a cost-effective solution: Installing an alcohol sensor-based smart vehicle system can be a cost-effective solution compared to the costs associated with accidents caused by impaired driving.
5. Avert drunk driving: Knowing that their vehicle has an alcohol sensor can deter drivers from driving while under the influence of alcohol, contributing to a safer and more responsible driving culture.

IV. MATERIALS AND METHODOLOGY

The alcohol sensor-based smart vehicle system consists of an alcohol sensor, Node MCU, and a motor driver. The alcohol sensor is used to detect the alcohol content in the driver's breath. The Node mcu processes the information from

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the alcohol sensor and sends a signal to the motor driver to disable the vehicle. The App module sends an email to the registered authority of the vehicle owner informing them about the vehicle being disabled.
The system is implemented by interfacing the alcohol sensor, nodeMCU, and motor driver. The alcohol sensor is connected to the microcontroller, which reads the alcohol content in the breath. If the alcohol content is above the permissible limit, the microcontroller sends a signal to the motor driver to disable the vehicle.

4.1 Advantages

Alcohol sensor-based smart vehicle systems can provide several advantages, including:

1. Improved Safety: The alcohol sensor can detect if the driver is under the influence of alcohol, and prevent the vehicle from starting or alert the driver if they attempt to drive while intoxicated. This can reduce the risk of accidents caused by impaired driving.
2. Increased Accountability: The alcohol sensor can record the driver's blood alcohol level, providing a record of whether the driver was intoxicated or not. This can be useful in cases of accidents, legal disputes, or insurance claims.
3. Cost-effective: Compared to the cost of accidents caused by drunk driving, the installation of an alcohol sensor-based smart vehicle system can be relatively inexpensive.
4. Deterrent to drunk drive: Knowing that their vehicle has an alcohol sensor can deter drivers from driving while under the influence of alcohol.
5. Customization: Alcohol sensor-based smart vehicle systems can be customized to suit the needs of different types of vehicles, such as commercial vehicles, personal vehicles, or public transport.

4.2 Expected Result

The alcohol sensor-based smart vehicle system was successfully designed and implemented. The system was tested by blowing air into the alcohol sensor and the system was able to detect the alcohol content in the breath. If the alcohol content was above the permissible limit, the vehicle was disabled by the motor driver.

V. CONCLUSION

The alcohol sensor-based smart vehicle system is an effective way to prevent accidents caused by drunk driving. The system can detect if the driver is intoxicated and disable the vehicle, preventing any accidents from happening. This project can be further improved by incorporating GPS technology to track the location of the vehicle and to notify the authorities in case of any misuse.

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