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A Survey on ADCS-Alcohol Detection and Control System

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A B S T R A C T

Driving under the influence of alcohol is one of the leading causes of car accidents, according to risk analysis. If drunk drivers were deterred from operating vehicles through the deployment of alcohol-detecting systems, many lives could be spared. In this investigation, a sensor called the MQ-3 is used to measure the amount of alcohol in human breath. A prototype spark plug-producing ignition system is constructed to act as the ignition starter for the engine. Depending on the blood alcohol content (BAC) of a person's breath, the alcohol sensor will decide how the ignition system operates.

Keywords: Alcohol-detecting systems, MQ-3 sensor, Optimizable Shallow Neural Network (O-SNN), NI LabView, Gabor Filter.

1. Introduction

The present predicament of circumstances demonstrates that drunk driving is the primary cause of most traffic accidents. Drunk drivers frequently drive erratically on roads due to their instability, jeopardizing everyone on the road including themselves. The extent of reckless driving exceeds all boundaries. India now has laws that make it illegal for drivers to consume alcohol and operate a car. Police officers and representatives of the road safety community might have difficulty recognizing drunk drivers because most people lack the ability to be in two or more places at once. Due to the competence of enforcement officers, every manual initiative to lower drinking and driving at the margin fails. Hence, a system that can detect alcohol anywhere and at any time must be devised.

Statistics on traffic fatalities have been published by the World Health Organization (WHO). According to data acquired, low-income and middle-income countries had higher fatality rates per 100K individuals in 2013 (24.1% and 18.4%, respectively), with many economic vehicle drivers in India admitting to drinking alcohol during their working hours. Globally, 1.25 million vehicular homicides were recorded in 2013. This demonstrates how drunk driving is a customary practice among drivers, especially those operating heavy-duty trucks and commercial vehicles.

Driver's cognition, vigilance, attention, judgment, and reaction are all impaired by alcohol, and these factors are related to their ability to drive. It has been discovered that alcohol consumption, even in insignificant amounts, significantly affects skills necessary for driving, such as vision, braking technique, and concentration. The car's engine locking feature prevents inebriated drivers from starting it.

2. Literature Review

2.1 Automatic Engine locking system through alcohol detection.

As implied by the project's name, it focuses on the engine locking system by looking for alcohol. This article describes how to develop and execute engine locking for automobiles utilizing ultrasonic sensors and an Arduino UNO as the Master Control Unit (MCU) [1].

According to the project's creators, this system will use alcohol detection sensors to continuously monitor the amount of blood alcohol content and will turn off the vehicle's engine if the level is higher than the set threshold. Also, this system has a distinctive feature that uses SIM900A to transmit a message containing the location of the car.

The MQ-3 sensor in the model determines whether alcohol is present in the area around the mounted site. The sensor then generates an output based on the level of alcohol present; if the concentration is higher, the sensor's conductivity increases and sends the results to Arduino.

To alert other drivers that the vehicle in front of them is unsafe, the Arduino will immediately halt the DC motor and turn ON the red LEDs if the separation distance is not safe and if the level of the reading surpasses the permissible value.

2.2 Automatic vehicle engine locked control system to prevent drunken driving using virtual Instrumentation.

According to the authors of this research publication, the major drawback is that the information collected is not stored for further communication. They used Virtual instrumentation to create a novel system to address this disadvantage. Designing a system that could determine if the person operating the car is fully conscious or not was the primary goal of the effort. Further actions are carried out automatically based on this condition, i.e., when the driver is heavily intoxicated, the vehicle's engine is turned off furthermore an email is also sent via IOT to the individual in question [2].

The number of LEDs lighting up fluctuates according to the amount of alcohol concentration. The LEDs will blink if the blood alcohol level is between 1 and 5, but the engine will still be running, and the buzzer will not be activated. The engine shuts down, the buzzer goes on and off repeatedly, and an email is also sent to the user if the blood alcohol level is between 6 and 8.

The back panel of NI LabView was used to connect to Arduino and establish communication. For serial connection with the Zigbee transceiver, they employed the VISA (Virtual Instrumentation Software Architecture) toolbox. The sensor's measured alcohol level is stored using LabView.

2.3 Alcohol detection and automatic engine locking system.

The authors of this paper have a unique method of solving the issues caused because of drunk driving. They say that detecting the presence of alcohol above a tolerable limit and turning off the engine is not a big task, but people find diverse ways or mechanisms through which they can prevent it from working the way it has to work. One can short-circuit the ignition terminals directly and prevent it, but this is a disadvantage and might lead to fire accidents. To overcome this problem, they have shifted the task of controlling the ignition system to the fuel pump system [3].

A relay is used, which is an electromagnetic switch, used to turn ON and OFF a circuit by a low-power signal. According to their research, in the present days, automated systems have a minimal manual operation, reliability, flexibility, and accuracy. The demand for these features of automated systems in every domain prefers automated control systems.

2.4 A Lightweight In-Vehicle Alcohol Detection Using Smart Sensing and Supervised Learning.

In this paper, the authors convey that this model is a trivial alcohol detection system in vehicles. This system uses six alcohol sensors which give the data to be processed. The processing of this generated data is done with the help of an O-SNN. The results of this analysis show the high performance of the system, which scored a 99.8% accuracy rate in detection, with a shortened inference hold-over of 2.22μs [4].

This System's hardware module constitutes six MQ-3 sensors and a memory unit coupled using an ARM Cortex M4 Microcontroller. Since Analog resistive output is produced by sensors based on the alcohol concentration, it was anchored to the Microcontroller using the Analog-to-Digital Converter unit. A large amount of data was collected and stored as a CSV file that incorporated 14,400 samples for the experiments. These test data were then divided uniformly for the in-vehicle with alcohol and without alcohol and were then deployed in a balanced dataset for facilitating the investigation and modelling. The software module of this system was a Supervised machine learning problem that was developed as a classification system using Shallow Neural Networks with their designated modules and algorithms.

For the data cleaving and distribution, they arbitrarily divided the dataset into a number of folds, each being 70% for the purpose of training and the remaining 30% for testing. A 5-fold cross-validation operation was used. The overall performance was produced by taking an average of the performance of the five experiments. The evaluation of this system was done in terms of five vital performance indicators. These five indicators include the Binary confusion matrix analysis, Predictive accuracy, Harmonic predictive average, Predictive kappa index, and Predictive time. Since this model comprises a computational intelligence model, it demands top-notch computational power in both the implementation and experimentation stages.

2.5 Alcohol Detection of Drunk Drivers with Automatic Car Engine Locking System.

The study and figures used to support the article are from Nigeria. WHO reports that more than 1.25 million road fatalities occurred worldwide in 2013. Here, the classification of whether or not driving is safe depends on the computation of the driver's blood alcohol content (BAC). The MQ-3 alcohol sensor, DC motor, buzzer, and ATmega328 microcontroller are all combined to produce the prototype. Proteus VSM simulator is used to mimic the hardware implementation, and the Arduino board contains the embedded software [5].

Several tasks are carried out in each step depending on the driver's level of intoxication. The engine state is shown by green and red LEDs. The passengers are alerted by the buzzer. The microcontroller and a DC motor are used to demonstrate how the vehicle engine functions. After the alcohol content exceeds 40%, the engine will not start. The microcontroller checks the sensor's analog values, which must be greater than 2 volts, to the predetermined limit; if they do not match, the microcontroller will stop.

2.6 Automatic Engine Locking System for Drunken Driver.

The objective of this paper is to promote both general public safety and road safety in particular. Because of its extensive open-source community and affordable price, the Arduino Uno, which is based on the ATmega328P microcontroller, is used. The MQ-3 sensor, which uses the SnO_2-sensitive material, offers an analog resistive output driven by alcohol concentration. To find the location of a person who has been discovered to be heavily intoxicated, GPS and GSM modules are used. The BC547 transistor, which makes up the driver IC, is coupled to the motor and buzzer. Last but not the least, the 16X2 LCD is used to display alarm messages to the vehicle's passengers and fellow riders, advising them to take the appropriate safety precautions [6].

2.7 Intelligent Alcohol Detection System for Car.

This project paper claims that a streamlined version of the breathalyzer used by police is intended to keep drunk drivers off the road. By testing the Blood Alcohol Concentration (BAC) with this breathalyzer, the frequency of traffic accidents brought on by many drivers' reckless behaviour is decreased [7].

For this streamlined breathalyzer, a 16F877A microcontroller is interfaced with an MQ2 alcohol gas sensor to measure the blood alcohol content of the car driver. A threshold value of 400 BAC is set for the breathalyzer using the microcontroller's keypad.

The system will send control to the motor and start the automobile if the value it detects is below the threshold value. The buzzer sounds, the BAC value is displayed on the LCD screen attached to the microcontroller, and the car will not start if the sensed value is higher than the threshold value. The microcontroller signals the L293D motor driver to direct the motor to stop the automobile if it is moving and if the BAC value is high.

2.8 Design of Alcohol Detection System for Car Users thru Iris Recognition Pattern Using Wavelet Transform.

According to this study, iris scans of the driver are taken into account when determining whether or not the motorist is intoxicated. Also, an algorithm for iris identification is developed, and its implementation is based on the Gabor Filter [8].

A Charge-coupled device(CCD) camera with infrared light is used to take pictures of the driver's iris when the driver logs in to the system using his or her credentials via the Graphical User Interface (GUI). In order to process the iris images and determine whether or not the driver is intoxicated, the driver must first click the Recognition Process button. This converts the analog iris images to digital images that can be used by the MATLAB program to distinguish between pupil sizes before and after alcohol consumption. Later, depending on the outcome, the microcontroller either starts the car if the system determines that the driver is not intoxicated or does not start the car if the system determines the opposite. Should the pupil photos not work, there is another bypass option for facial recognition.

One of the project's limits is that the driver's eye and the device's CCD camera should be close enough to each other for the device to take superior iris photos with less noise and reflection. To improve accuracy, the camera needs to be able to see more of the iris pattern in the driver's eyes. To position the iris correctly for better plotting of the full image of the iris, the driver must move the eyes appropriately while taking the picture.

2.9 Study of the Effects of Alcohol on Drivers and Driving Performance on Straight Road.

This research paper claims that a study was conducted on drunk drivers to determine the impact of alcohol consumption on their ability to drive. For this study, 25 drivers with an average age of 25 and a minimum of three years of driving experience are taken into consideration. For the study, which took the dangers of intoxicated driving into account, these drivers had to operate AutoSim driving simulator systems. The stimulator setting was made to be as similar to really operating a vehicle as possible. Several driving scenarios, including urban straight roads and some curve roads, were provided to the drivers. The drivers were operating their vehicles at various blood alcohol concentrations, and the Beijing traffic police's detector was utilized to determine the drivers' BAC levels. To reduce measurement mistakes, the BAC level was measured five times for each test. According to the result, 60% of the drivers were more adventurous, 68% of them were driving faster, 88% of them declined vigilance, 84% of them gave divided attention towards driving, 64% of them felt that the speed at which they were driving was slower, 72% of them declined the sense of direction, 84% of them lacked judgment ability, 72% of them were not able to control the direction of the car and 84% of them lost the capacity to react to instances that were occurring [9].

2.10 Effect of Different Alcohol Dosages on Steering Behavior in Curve Driving.

In order to determine the impact on steering behaviours when driving on curved roads, a study was done on drunk drivers with varying alcohol dosages. Alcohol can affect a driver's ability to steer while they are driving, which can lead to accidents. This article ensures to provide information about the effects of drinking alcohol on driving conduct from other articles [10].

This study reportedly recruited 25 male drivers with at least three years of driving experience who were between the ages of 20 and 35. Taking into account the dangers of drunk driving, they were researched with the aid of a simulator that was created with a realistic design. The driver's Breath Alcohol Concentration (BrAC) was measured at various levels during the trial. For the drivers to navigate in the simulator, various scenarios were offered. In addition to curved roads with varying radii that bent both left and right, there were also some straight roads. For the purpose of gathering data for the study, the following factors were considered: the speed of the car before a curve occurred, the speed on straight roads, the number of crashes while driving around curves, the steering speed, the steering angle, the steering reversal rate, and the peak-to-peak value of the steering angle.

According to the study's findings, drivers' alcohol consumption had an impact on their steering speed, steering angle, steering reversal rate, and peak-to-peak value of the steering angle. These parameters were rising in tandem with the rise in BrAc levels. The number of lane violations per kilometer was similarly impacted by the high BrAC level. In smaller curves, the same alcohol concentration resulted in higher steering speed, steering angle, steering reversal rate, and peak-to-peak values of the steering angle.

3. Conclusion

Driving under the influence of alcohol is a major contributing factor to accidents, hence every car must have an automatic engine locking device to keep intoxicated drivers from driving. We must focus on adopting it in both combustion engine cars and electric cars if we are to make a difference in the current situation. To prevent the car from stopping when it is not necessary, it is crucial to include many techniques for identifying the presence of a drunk driver. The proximity of the alcohol sensors to the driver's face is a key factor to be considered. Most projects employ MQ-3 sensors since MQ-2 sensors lack the sensitivity needed to detect alcohol on a driver's breath. As analyzed from the studies, police deploy breathalyzers to catch intoxicated drivers on the roadways, but accidents can happen even before they pass the traffic police officers. Driving on roads carries a risk directly proportional to the driver's BrAC level, and curve driving carries a higher risk than straight driving. When alcohol is detected in the driver, the BAC level must be reported to the appropriate authorities in order to take necessary action. To avoid accidents, it is important to warn other drivers, especially on crowded lanes.

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