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Alcohol Drunk and Drive Accident Prevention System

G. Adarsh, Rahul P.R, Vishnu Santhosh, Assistant Professor Prof. Simi M.S
Department of Computer Science and Engineering
Adishankara Institute of Engineering and Technology,
Kalady, Ernakulam,Kerala,India

Abstract **-Every year, people are injured or killed on the road because of drunk driving. In this prototype, we are making an attempt to prevent users from starting the car if they have consumed any alcohol and if they haven't worn their seat belt. This system will take advantage of an MQ3 alcohol sensor, which is mounted on the seat belt of the driver seat. The reading from the sensor unit is compared with the allowed threshold value by the Raspberry Pi, if the driver is found drunk, the ignition locking system will prevent the driver from starting the car. The system is also mounted with a camera (Raspberry Pi Camera) to detect the driver's presence so that the user may be prevented from trying to compromise it. The engine is started only when the user clears the alcohol test and the seat belt is engaged. The project is aimed to be implemented in real life to reduce the number of accidents caused by drunk driving and the carelessness of the driver to engage the seat belt.**

Keywords-**Ignition control, Internet of Things, MQ3 sensor, Pi camera, Raspberry Pi.**

I.INTRODUCTION

Road safety has always been in the center of attention. The signboards, direction arrows and lanes have made following rules much easier and served as an excellent guide, nevertheless, uncontrollable factors such as careless drivers exist and thus accidents still happen. In the United States of America alone during 2014 nearly "9,967 people died of alcohol-impaired-driving"[1], that is one alcohol-impaired driving fatality every 53 minutes. The list goes on and on for other countries too [2]. In a survey that has been done recently it was found that nearly 70% of the road accidents are caused by drunk driving. It is further noted that out of 56 accidents 15 or so deaths occur from not wearing the seat belt. Therefore it is necessary to enhance and improvise new techniques.

The automatic detection perspective using sensors is closely related to the Internet of Things (IoT). The Internet Of Things is the network of physical devices embedded with sensors, electronics, computing modules, and network connectivity using which they share data. The Internet of things has been used to propose solutions for a variety of problems[12].

Here a system is proposed to prevent the accident by conducting a breath analysis of the driver to see if he is capable of driving the car. This is done by taking the input through the MQ3 alcohol sensor and processing it using the raspberry pi module. Face detection is also used in the system to ensure that it is indeed the driver itself who is being checked by the system.
The system should make a significant leap in terms of public awareness and this project pushes towards public safety in general and roads safety in particular.

Using IoT for the detection of drunk driving is not a new concept. Few models can be found in the literature. However, no specific model has been adopted for large scaleproduction. The different methods proposed face issues such as difficulty in implementation, scalability,and complexity. Therefore,new models need to be cost efficient, easy imple-mentation along with accuracy.

II. LITERATURE SURVEY

Xiaoronget [3] proposed an alcohol detection system based on IOT and MQ3 sensors. The components were STC12C516A microcontroller, MQ3 Alcohol sensor which together performed the same as that of a breathalyzer and other components like LCD display, GPRS module, a buzzer alert. The functioning is as follows : Alert is given if the alcohol content is over the previously set threshold value. A buzzing sound is produced to alert. LCD Display will show the range of the blood alcohol content in breath. At the same time, the system alerts the nearby cops with the exact location of the vehicle and also the driver's relatives. If the concentration of the alcohol content exceeds '200 mg/L', then the engine is shut down and the vehicle is immobilized.

K Sandeep et al. [4] proposed a system that relies on theIoT device Raspberry Pi 3 model B. The system includes a variety of modules including face recognition, alcohol sensor etc., to check for the sobriety of the driver and to further take the necessary precautions. When the driver pushes the start button, the system gets powered up and the touch based technology reads Blood Alcohol Content (BAC) from below the skin surface. A touch sensor shines a beam of light to the finger to check the blood alcohol level. The output from all these devices are

integrated together to check whether the ignition should be turned on or off.

Scott et al. [5] suggested Blood Alcohol Concentration (BAC) remains the standard for calculating the amount of alcohol content in the body. They performed a series of experiments on healthy volunteers, by taking passive samples through touch and breath. The objective was to check whether the passive samples of alcoholic content varied significantly in different real life scenarios.

Theyfinally found out that the passive sampling of alcohol content through breath and tissue proves just as similar to that of venous blood alcohol content. This experiment gives evidence that the alcohol testing can be done remotely in a vehicle without having to draw blood samples for coming up with a result.

Pallavi et al. [6] created an experimental setup where the driver is checked for alcohol content when the car is supposedly in motion. They used raspberry pi, MQ3 sensor, relays, cloud network with GPS and a DC motor to mimic the car engine. When the car is in motion and the MQ3 sensor detects alcohol in the breath analysis, the raspberry pi system reduces the power to the DC motor thereby reducing the speed by half.

This reduces the risk of causing fatal accidents due to a combination of speed and drunk driving. After reducing the speed, the GPS is configured to track the location (latitude and longitude) of the concerned vehicle to further ensure safety to self and others.

Another paper reviewed was proposed by Dai et al [7]. In this simple idea, a smartphone is chosen as a device for the detection and avoidance of alcoholic driving. An android application makes use of a smartphone equipped with an accelerometer and an orientation sensor, to decide in real time whether a driver is drunk. The most part of the study mainly relates sudden changes in speed, acceleration,arbitrary turns, abrupt slowing down as signs of drivingunder influence(DUI). To this end the system classifies these as parameters of lateral acceleration and longitudinal acceleration.

This data is constantly gathered in real time and checked against a pattern, provided by an algorithm. If the condition is satisfied, an alarm is triggered. If not monitoring is continued.

One previous study of Sahabiswas et al [8]. proposed another model. In this model, they used incremental clustering techniques to transform the raw data set into any number of clusters. These clusters roughly represent the correlation among data points for several drivers, in drunk and in normal states. They also proposed the Classification method such as Support Vector Machine, which provides a much simpler approach to the problem. Given a training set with outputs as drunk and not drunk, use classifiers on the data to decide whether the particular person is drunk or not.

III. TOOLS USED

1. Raspberry Pi

The Raspberry Pi is a series of small single board computers developed by Raspberry Pi Foundation.Its main aim is to promote basic computer science in schools and also in developing countries.After the success of their first version, they began releasing a series of upgraded versions with more processing power and capabilities. The model used for this project is the Raspberry Pi 2 Model B v1.1.

Fig.1 Raspberry Pi Model B V1.1.

The specifications of the model of the RPi used are as follows:

- A 900MHz quad-core ARM Cortex-A7 CPU
- 1GB RAM
- 100 Base ethernet
- 40 GPIO pins
- Full HDMI port
- Camera Interface
- MicroSD slot

The Raspberry Pi kit is used to process the input from the MQ3 sensor. It also ensures that the seat belt is worn by the driver. The pi camera connected to the kit will take images/video and that data is sent to cloud services for face detection application. The result is returned to the raspberry pi kit and decides whether the driver can start the car or not.

2. MQ3 Alcohol Sensor

MQ3 Alcohol Sensor is a low-cost semiconductor sensor which is able to detect the presence of alcohol gases. It has high sensitivity and fast response time. The sensor outputs its values in terms of varying voltage (Analog output); therefore, the data can be obtained via the

microcontroller using its built-in Analog-to-Digital converter.

Fig.2 MQ3 Alcohol Sensor Specifications.

- Power Supply needs : 5V
- Interface type : Analog
- Fast response and High sensitivity

Here the sensor is attached to the seat belt of the car so as to detect alcohol concentration on our breath, just like the common breathalyzer. The alcohol concentration detected by the MQ3 sensor is passed to Raspberry pi, as thismodule can be easily interfaced with Raspberry Pi. The sensor provides an analog output based on the alcohol concentration, which is then converted into digital value to obtain the exact BAC content.

3. Raspberry Pi Camera

The Pi camera module is a portable lightweight camera which supports Raspberry Pi. It is normally used in machine learning, image processing or in surveillance projects. The Pi camera module, mounted on the dashboard of the car, enables facial recognition. The module recognizes the face and ensures that there is only one person operating the vehicle. This gives them access to predefined functionalities such as the permission to start the car else the motor doesn't start.

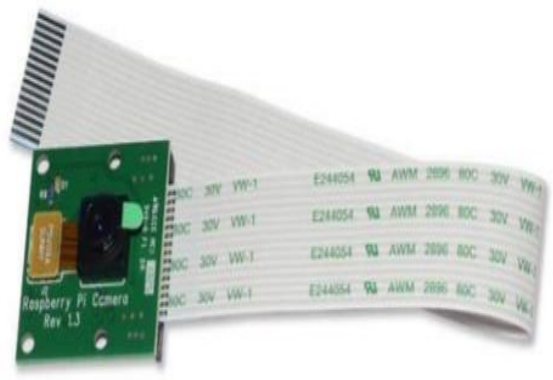

Fig.3 Raspberry Pi Camera.

Features:

- Supports both Raspberry Pi Model A and B
- Supports: 1080p, 720p and 480p
- MIPI Camera serial interface
- Omnivision 5647 Camera Module
- Resolution: 2592*1944
- Lightweight and portable

4. Cloud Services

The cloud service being used in this project is Amazon Web Services(AWS). It provides free cloud storage for a year and access to some of it's online processing tools. Here, the live images of the driver are collected by Raspberry pi and are sent to the cloud for processing. The Cloud service receives the image data and analyses it to detect faces. If only a single face is detected, then a response is given to raspberry pi indicating that the driver is only present during the alcohol test. If multiple faces are detected, then raspberry is sent a response indicating the same.

Traditional storage options differ in performance, durability, and cost, as well as in their interfaces. Architects consider all these elements while identifying the right storage solution for the job needing to be done. AWS offers various cloud-based storage options. Each has a unique blend of performance, durability, accessibility, cost, and interface, as well as other characteristics such as versatility and elasticity. These additional qualities are critical for web-scale cloud based solutions. As with traditional on-premises applications, we can utilize different cloud storage options together to frame an exhaustive information storage hierarchy [9].

IV. IMPLEMENTATION

Driving under the influence (DUI) is the crime of driving, operating, or being in charge of a vehicle while hindered by liquor or different medications, to a level that renders the driver incapable of handling a vehicle securely. It has been realized that alcohol use impedes driving abilities and increases accident risk. It has been discovered that while driving affected by liquor, the danger of having an accident causing injury or death increments exponentially [10]. Drunk driving has a high likelihood of serious accidents. Even with a small amount of alcohol presumption, drivers are twice likely to be involved in traffic accidents than calm drivers[11].

We propose a novel method to combine various factors and personalize for testing people, other than the normal approach.

The various parameters considered for the proposed project are:

- Alcohol Content
- Face Detection
- Seat Belt Check

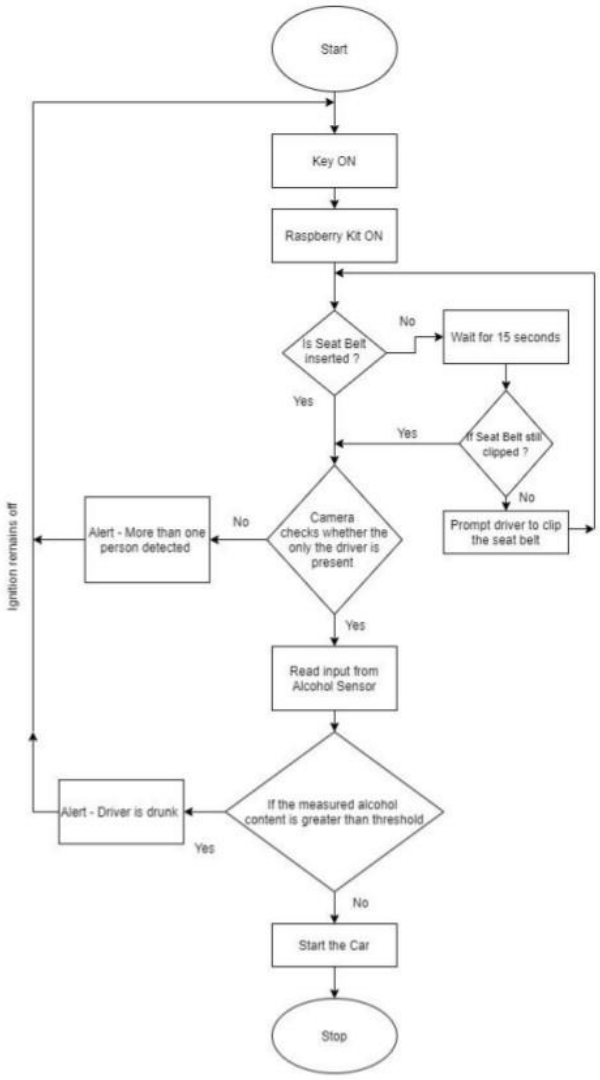

Fig.4 Process Chart of Proposed System.

In this proposed system, the system requires the use of raspberry pi to collect necessary data for alcohol testing. The raspberry pi is interfaced with the car's ignition system to prevent the user from starting the car if he fails the alcohol test. Seat belt of the car is set in such a way that putting the seat belt activates the alcohol sensing mechanism. Once that is set, i.e, the seat belt is put in place,the Alcohol sensor collects the Blood Alcohol content once the user turns the key. Simultaneously, the Pi camera captures the driver's image to verify the presence. This data is sent over to the cloud to process the information to check whether the driver is in a state to ride the car. The output after the calculation is sent back to the raspberry pi.

1. Seat Belt Check

The seatbelt of Maruti 800 is modified to inculcate some changes to make it capable for the purpose of seatbelt checking mechanism. The inside of the seatbelt is made a connection which is completed when the metallic part of the seatbelt is inserted into the seat belt buckle. Once the key of the car is turned on, the alcohol sensing circuit is activated only when the seatbelt is buckled in place. This circuitry acts a switch to the raspberry board as unbuckling results in turning off the system and thus the engine. The connection is made for raspberry to check whether the seatbelt is on / off. Once the car starts, and at any point of time, if the user tries to unbuckle the seat belt, the car is turned off as said above. This is to ensure that the driver is safe during the course of his/her travel. Air bags are only activated if the seatbelt is properly in place.

2. Display

The display unit provides notifications to the driver with short,timely information about the events to be performed. A set of instructions are to be followed to get the engine started. The pre-programmed messages are displayed on the display screen and are mounted on the dashboard of the car. As soon as the driver initiates starting, a message will be displayed on the screen to wear the seat belt. Unless they are buckled properly within a time frame, the user cannot go to the next step.

3. Driver Presence Check

During the alcohol testing, it is necessary to ensure that it is indeed the driver who blows into the alcohol sensor. This is ensured by a face detection mechanism. The camera/pi camera is installed on the dashboard facing the driver, framing the driver's seat and adjusted in a way to ensure that the driver is in the frame. The camera captures the driver's image during the breath analysing phase and the raspberry pi kit sends the image over the cloud along with the alcohol level to check for the test. The face detection model provided by the cloud platform analyses the received image and checks if there is only a single person in the frame. The results are sent back to the raspberry and further decisions are made as to whether the car can be started or not.

4. Alcohol Checking Mechanism

The alcohol detection system is connected with the raspberry pi processor to obtain the status of the person who operates the car. The status is determined when the driver takes the alcohol detection test. The system detectsalcohol content in the driver by using MQ3 alcohol sensor attached to the seat belt of the car. For this, the driver has to blow to the sensor to detect the ethanol content in his breath. This provides an output based on the alcohol concentration. The sensor outputs its values in terms of varying voltage (analog output); therefore, the data needs to be obtained using a microcontroller with built-in analog-to-digital converter. Resistance value of MQ3 is different for various concentrations of gases; therefore the sensitivity adjustment is necessary. We calibrate the detector for 0.4mg/l (approximately 200ppm) of alcohol concentration in air. If the alcohol is detected, then the ignition is shut off.

5. Ignition

The car is turned on once the user passes the alcohol test. The raspberry pi is connected to a relay, which is connected to the ignition of the car. The ignition is controlled by the raspberry pi, which gives the green light if and only if the user passes the alcohol test.

V. FUTURE WORK

The system is extended further to prevent drinking while driving the car. This may be done by taking breath samples periodically even while the car is in motion. With the advancements made in automating a car, the technology can be extended to automatically park the car safely if the driver is drunk. Further alerts may be given to close contacts or maybe find a cab to the location of the driver.

VI. CONCLUSION

The growing number of accidents inspires us to find solutions that are simple, elegant and effective. The expected result of this project is that it would ensure that only a sober person would drive a car and thus reduce the number of accidents caused by drunk driving. The proposed project also ensures that the driver is wearing the seat belt at all times while driving the car.

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