Automated Security System for Automobiles

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Abstract - *Nowadays accidents are increasing tremendously due to the consumption of alcohol and drowsiness. According to the National Crime Records Bureau, about 1.5 per cent of all the total 4.64 lakhs road accidents were caused by drunken driving or driving under influence of drug or alcohol, resulting in injuries to 6,295 people as in 2018. The death rate due to drink and drive is in high rate, especially in countries like India. So, we propose a system which can authenticate the driver and detect the presence of alcohol consumption. Thus, accidents and theft of vehicles can be reduced. In this project we have employed two modules namely face detection module and alcohol module. Face detection module is used to authenticate the driver and to detect whether the driver is fatigue, while the alcohol detection module having a MQ-3 sensor which detects the usage of alcohol. If both the detection modules give a satisfactory result, then only the ignition system will be activated. This smart vehicle system is powered by raspberry pi circuit. Thus, this project provides an improved vehicle or automotive anti-theft or security system along with the prevention of alcohol consumption of drivers.*

Key Words: detection, ignition, authentication, image, authorize.

1. INTRODUCTION

There is an immense increase in the use of automobiles in recent years and along with that problem created due to drowsy driving as well as driving under the influence of alcohol have become multifarious as well and the theft of vehicles has been increased rapidly. In India, the motor vehicle population is growing at a faster rate than the economic and population growth. Due to the increase in road accidents, the death rate is increasing, and it is a major concern than one can't imagine. The reason for road accidents is the driver's alcohol consumption. The death rate due to drink and drive is high in rate due to this, especially in countries like India. According to the World Health Organization (WHO), road traffic injuries are the sixth leading cause of death in India with a greater share of hospitalization, deaths, disabilities and socio-economic losses in the young and middle-aged population. Driver drowsiness and fatigue drunk driving reduces the driver decision making capability and perception level. These two situations affect the ability to control the vehicle. Traffic survey shows that driver fatigue may be a contributory factor in up to 20 percentage and due to alcohol drinking it is about 31 percentage of all road accidents.

Along with road accidents due to drink and drive, theft of vehicles is also increasing. Vehicle manufactures are attaining the security features of their products by introducing advanced automated technologies to avoid the thefts particularly in case of cars. Biometric and non-biometric methods usually provide such security features. Sometimes these systems fail due to hacked passwords and encryption of decrypted data, but it is almost impossible to make replica of distinctive characteristics. Biometric systems are modern and use techniques like fingerprint recognition, iris recognition and face recognition. Of these face recognition and detection systems are more sophisticated, easy to deploy and people can be identified without their knowledge. It is more convenient, sensed as soon as one is seated in position, low cost and a better approach to be used with existing methods. And the main benefit is that it doesn't require active part of the user. The below Figure shows the rate of road accidents v/s death rate due to driving under the influence of alcohol from 2008 to 2017.

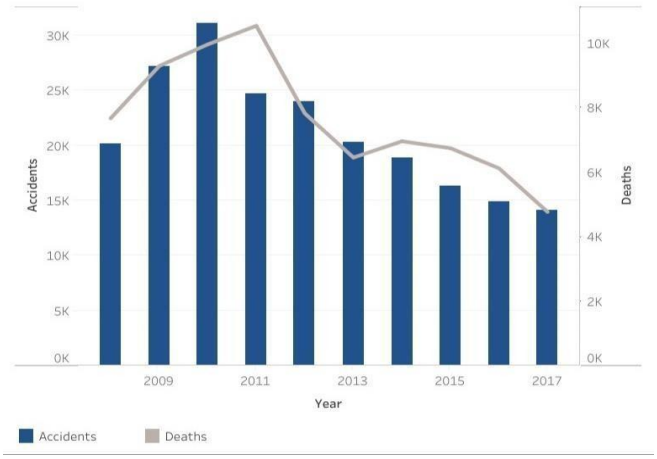

Fig -1 Graph showing accident v/s death rate from 2008 to 2017.

So, an efficient automotive security system is proposed for alcohol detection and anti-theft of the vehicle using an embedded system consisting of the Driver Authentication module and Alcohol Detection module. The main objective is to ensure safety of vehicle by authentication of driver through face recognition system that authenticates a user being an authorized person to have access to the ignition system and to minimize accident rates due alcohol consumption by the use of a breath analyzer alcohol sensor.

2. LITERATURE SURVEY

Vaishnavi M, Umadevi V, Vinothini M, Bhaskar Rao Y, Pavithra S proposed the project, where vehicle accident prevention by method of alcohol detector in an effort to reduce traffic accident cases based on driving under the influence alcohol [1].This project is developed by integrating the alcohol sensor with the microcontroller 16F877A. The alcohol sensor used in this project is MQ- 2 which to detect the alcohol content in human breath. An ignition system which will produce spark plugs is build up as a prototype to act like the ignition starter over the vehicle's engine. The ignition system will operate based on the level of blood alcohol content (BAC) from human breaths detected by alcohol sensor. The main purpose behind this project is "Drunk driving detection".

C Nandakumar, G Muralidaran and N Tharani proposed vehicle security system, performs image processing based real time user authentication using face detection and recognition techniques and microprocessor-based control system fixed on board with the vehicle [2]. As the person enters the parked car overcoming the existing security features, the infrared sensor attached to the driver's seat of the vehicle activates the hidden camera fixed in appropriate position inside the vehicle. As soon as the image is acquired from the activated camera, face of the person is detected using Viola Jones algorithm. The extracted face is recognized using the enhanced Linear Discriminant Analysis (LDA) algorithm which discriminates much of the features rather than looking for exact pattern based on Euclidean distance and reliable to be used with large samples of data. Performing authorization involves setting the threshold value and comparing with that of Euclidean distance above which the person is not authenticated. The face of the person which is classified as unknown is sent to the mobile of the owner as a MMS through the operating GSM modem. This would be effective to authenticate the person under different environment and to have an efficient way of vehicle security.

Pranjali Ingalepatil, Priyanka Barhate, Bhagyashri Nemade, Vijay D Chaudhari proposed a project which makes human driving safer and to overcome accidents. This project is developed by integrating alcohol sensor with Arduino board. Arduino processor ATmega328 is able to handle more functions than conventional microcontrollers [3]. The alcohol sensor used in this project is MQ- 3 which to detect the alcohol content in human breath. Since sensor has fine sensitivity range around 2 meters, it can suit to any vehicle and can easily be hidden from the suspects. This project is fitted inside the vehicle. The project is designed for the safety of people sitting inside the vehicle.

Lea Angelica Navarro, Mark Anthony Dino, Exechiel Joson, Rommel Anacan, Roberto Del Cru suggested to develop a system that captures the Iris image of the driver by detecting if the person is drunk and likewise to develop a reliable algorithm for Iris Recognition. This paper is composed of hardware and software system which focuses on the implementation of an algorithm based on Gabor Filter [4]. The system consists of CCD Camera and Analog-to-Digital Converter, which is linked into a MATLAB program to simulate the captured image which then provides a signal going to the microcontroller and a relay circuit to manipulate the car ignition. If the MATLAB program detects that the driver is under the influence of alcohol, a bypass system follows through a password which is recognized by the MATLAB program then the car/vehicle starts.

Pandurang N Kathar, Prof. D L Bhuyar proposes a real time detection of driver's drowsiness as well as alcohol intoxication and subsequently alerting them [5]. The main aim of this proposed system is to reduce the number of accidents due to driver's Drowsiness and alcohol intake to increase the transportation safety. This proposed system contains 8-megapixels digital USB camera, Raspberry-pi loaded with Raspbian-OS, MQ-3 sensor is used to detect the intake of alcohol in percentage if the intoxication matching fails GSM get triggered on and transmits warming message. The Raspberry-pi system board is serially interfaced with Arduino Uno. GSM, Bluetooth, relay circuitry and buzzers are interfaced with Arduino Uno. This will perform some task like the alarm notification and switching off the car power source.

Anu K L, Dr.Yasha Jyothi M Shirur, Mr.Prasannakumar Y discussed a new approach for the real time detection of car driver drowsiness, rear end collision and alcoholic intoxication and more number of accidents are causes due to these reasons [6]. Survey of traffic shows that driver drowsiness may be a contributory factor, around 31% of all road accidents are causes due to drunk and drive. The development of new technologies for detecting driver drowsiness is a major challenge in the field of accident avoidance systems. Aim of the project is to develop a prototype and avoid accidents by driver assistance system (DAS) using raspberry pi to enhance driver safety.

Dhivya M and Kathiravan S proposed different techniques like alcohol detection methods, personal identification methods to minimize the frequency of accidents [7]. For alcohol detection, gas detecting sensors are used. In a heart rate monitoring system, the pulse is checked by an IR sensor.

To identify the driver, a passive infrared sensor is used. It is also possible for a vehicle to identify the number of people inside of it and automatically disengage the locks in an emergency so a person's life can be saved. In an accident avoidance system, drunk driving prevention, person detection, and heart rate measurement methods are all used. These preventative methods are mainly used for avoiding accidents. Accidents mainly occur due to the large number of private vehicles. These vehicles create a serious problem in day-to-day life. If a driver consumes any alcohol or drugs, they can lose consciousness and create an accident. Accidents can also occur due to health conditions such as chest pain or high blood pressure. Finally, if a person is inside vehicle without the owner's knowledge this can also lead to death, if there is not enough oxygen inside the vehicle. The three methods of drunk driver prevention, person detection, and heart rate measurement methods are used. These three methods are mainly used to avoid accidents and thus save human life. Human identification method checks the identity and number of humans inside the vehicle and sends a warning to the driver. The main goal of the human identification method is to identify the people inside the vehicle. A passive infrared sensor is used to identify the humans. When the vehicle is not in use, by default the windows of the vehicle close. If any person gets inside the vehicle without the driver's knowledge, the person may not have enough air to breathe and the situation can be fatal. To prevent this, MQ-7 sensor is set up to detect carbon dioxide level. If the level is fatal, a switch will automatically open the window and send a warning to the driver.

Dwipjoy Sarkar and Atanu Chowdhury proposed real time detection of car driver drowsiness and alcoholic intoxication detects large numbers of road accidents which takes place due to fatigue or alcohol drinking of driver [8]. Computer vision and alcohol gas sensor application is combined to an embedded system to achieve this goal. This system consists of Drowsiness detection, alcoholic intoxication, Raspberry Pi, Arduino UNO, Open CV and Embedded System.

Varsha E Dahiphale and Prof. Sathyanarayana R proposed a system that can actively monitors driver vigilance level and alert the driver for any insecure driving condition [9]. This drowsiness detection of driver is based on viola jones algorithm for face and eyes detection. System is developed using video camera, Raspberry Pi hardware, and open source computer vision library (OpenCV) and Microsoft visual studio.

Saeid Fazli and Parisa Esfehani proposed eye states tracking where Images are captured using a camera and used for tracking as input. In first step we use color space for drivers' face detection and crop the face from background [10]. In the next step, we estimate the area of the eyes and crop image from this region.

Then top and bottom coordinates of the eyes are located using retrench the face pixels from this area and canny operator for edge detection. In the last step we count the number of white and black pixels and compare the distance between these coordinates for recognition of the driver's fatigue.

Ashutosh U Jadhav and N M Wagdarikar proposed finger vein recognition-based driver authentication and alertness system using GSM, when a person wants to drive, will just press their finger in the biometric system [11]. When the finger vein is match automobile get ignited, this will be keyless authentication system. If the matching fails GSM get triggered on and transmits warming message. Same automobile has the facility to detect fatigue and intake of alcohol by the diver. GSM, camera and buzzers are interfaced with Raspberry Pi. Raspbian OS is loaded with python and open CV. Arduino is interfaced with alcohol gas sensor.

QiangJi, Zhiwei Zhu and Peilin Lan proposed ARM based face Recognition system using OpenCV library, the authors have implemented a system using ARM 7 based microcontroller and OpenCV based machine [12]. This is interfaced to USB camera for continuous images are captured and these images are processed with help of OpenCV and compared with existing database. If the current images are matching with any of the existing images the system generates commando the output unit to perform the location identification using GPS and forward the necessary information about the identified person using GSM/GPRS to concern authorities.

T D Prasanthi, K Rajasekhar, T V Janardhanarao, and B V V.Satyanarayana proposed Computer Vision System for Driver Fatigue Detection [13]. In this system can actively monitors driver vigilance level and alert the driver for any insecure driving condition. In this drowsiness detection of driver is based on viola jones algorithm for face and eyes detection. System is developed using video camera, Raspberry Pi hardware, and open source computer vision library (OpenCV) and Microsoft visual studio.

Naveen M and Sudarvizhi S proposed advance vehicle control and safety system using face detection, the design is based on computer vision and embedded system application principles. System work is a combination of face detection, eye region detection and eye closing rate detection in real time environment [14]. The proposed system is realized with a digital camera supported by embedded system board Raspberry Pi loaded with Raspbian-OS and Python-IDLE with OpenCV installed. Also, different vehicle control functions like centre locking and unlocking, opening and closing of windows, bonnets etc. can be controlled by using Android mobile phone.

Srinivasu Batchu and S Praveen Kumar developed drive

behavior analysis using non-invasive sensors system uses an ARM7 (LPC2129) controller as the main control unit and CAN bus within a car [15]. ARM7 is used to obtain high performance. Use of CAN makes high speed communication in control networks and also helps sharing of data between all nodes which results in enhancing their collaborative work. With the help of this system we can detect ECG, eye blink and alcohol detection.

L Nikitha, J Kiranmai, B Vidhyalakshmi, proposed finger vein recognition-based driver authentication and alertness system using GSM, where when a person wants to drive, will just press their finger in the biometric system [16]. When the finger vein is match automobile get ignited, this will be keyless authentication system. If the matching fails GSM get triggered on and transmits warming message. Same automobile has the facility to detect fatigue and intake of alcohol by the diver. GSM, camera and buzzers are interfaced with Raspberry pi. Raspbian OS is loaded with python and open CV. Arduino is interfaced with alcohol gas sensor.

3. PROPOSED MODEL

Proposed model mainly consists of two modules which are face recognition module and alcohol detector module. Detection of drowsiness can be done in several ways like remotely measuring facial expression of the person to be tested. This work is the combination of face detection, eye region detection and eye closing rate detection in real time environment. Making a computer vision application in real time is a challenging task and it needs efficient processing power. Raspberry-pi is an ARM11controller based small sized open source CPU with 512 MB RAM and supports 700 MHz processing speed. It supports interfacing of various low level and high-level peripherals including digital camera. In the following figure, it clearly shows the sensors used in the proposed design Alcohol sensor which is going to detect whether the driver is drunk or not if he drunk then automatically ignition will off. Raspberry pi camera is also interfaced to raspberry pi board, which will detect the drowsiness of the driver and continuously monitor the driver and give alert, if felt drowsy. Face detection module detect the persona is its authorized driver and if it is not the ignition system is turned off. The proposed system initiates its works with authorization of person as driver and then alcohol detection to decide whether the ignition can be turned on or not. If both the detection is positively obtained then only the system ignition will start.

The core functions modules are Raspberry Pi, alcohol sensor module (MQ-3), LCD display, buzzer. The Raspberry Pi is the central unit of the system. All the components are interfaced to the board and programmed as per their functionality to operate in synchronization. Thus, the proposed system creates an effective way to ensure safety of vehicle and minimize death rate due to drink and drive.

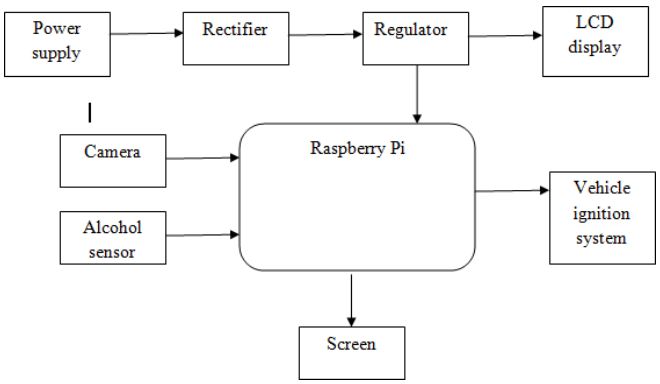

Fig - 2 Block diagram of proposed model

4. METHODOLGY

The main objective of our project is to reduce the number of accidents due to driver's drowsiness and alcohol intake to increase transportation safety and to prevent the theft of vehicle and ensure safety of vehicle by avoiding the means of theft. Also, another main factor is that when this system is implemented in vehicles will not only avoid the deaths and property loss due to drunken driving but will also help in reducing the total number of accidents which occur due to this. Moreover, people in other vehicles or pedestrians will be much safer because the vehicle give access to the ignition system only after driver authentication and alcohol detection. Face detection techniques have been heavily studied in recent years, and it is an important computer vision problem with applications to surveillance, multimedia processing, and consumer products. Many new face detection techniques have been developed to achieve higher detection rate and faster. All process is controlled by the Raspberry pi control as central module which includes obtaining images, face detection. Drunken drivers are in an unstable condition and so, rash decisions are made on the highway which endangers the lives of road users, the driver inclusive. Effective monitoring of drunken drivers is a challenge to the policemen and road safety officers. There is therefore the need for an automatic alcohol detection system that can function without the restriction of space and time.

The basic concept of this project is to recognize and authorize the owner of a particular vehicle with the help of facial recognition. So as to reduce thefts and also to check if the driver has alcohol content in his blood with help of an alcohol sensor so as to bring a decline in the accident rates due to drunken driving, if both the processes gives a positive output, the vehicle will be granted access for ignition or else the ignition will not start. Here we propose a framework where the driver is authenticated and alcohol content is detected in order to reduce theft of vehicle and to identify alcohol level in his body to stay away from accidents. The proposed system uses Pi-camera, Raspberry Pi 3 loaded with Raspbian OS, alcohol sensor MQ-3, DC motor to achieve the purpose

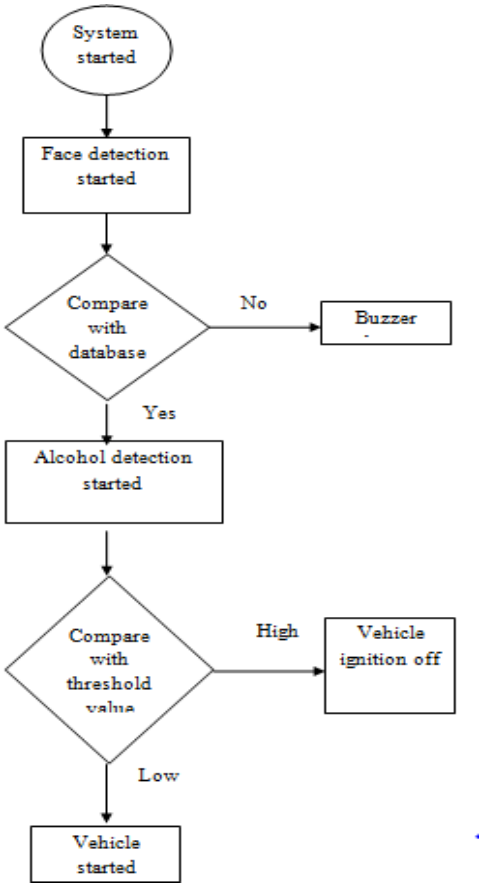

Fig - 3 Flowchart of proposed system

The above Fig.3 shows the proposed system. Driver authentication start with capturing input image using Pi camera. And this captured image is then compared with the database stored in Raspberry Pi. If the input image matches with the database face is detected otherwise the buzzer will be triggered. If the face detection condition Satisfies If the face detection condition satisfy then it will go for Alcohol detection using MQ3 sensor the buzzer will be triggered if the alcohol detected is above the threshold value otherwise not.

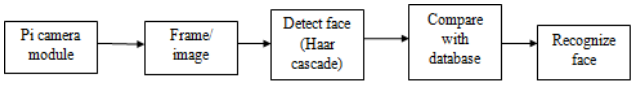

Fig - 4 Face detection techniques

In the proposed system, image captured using Pi camera is processed by Raspberry Pi. This in turn follows face detection using Haar cascade transform.

The Fig.5 shows the flowchart of face detection using haar cascade classifier to detect the feature and perform several comparisons from dataset of matching and unmatching images and returns rectangle over detected area of matching. The database of system consists of set of eye images. Capturing real time images of eye gets compared with the eye images in the database. Thus, if the database matches with the input features face is detected

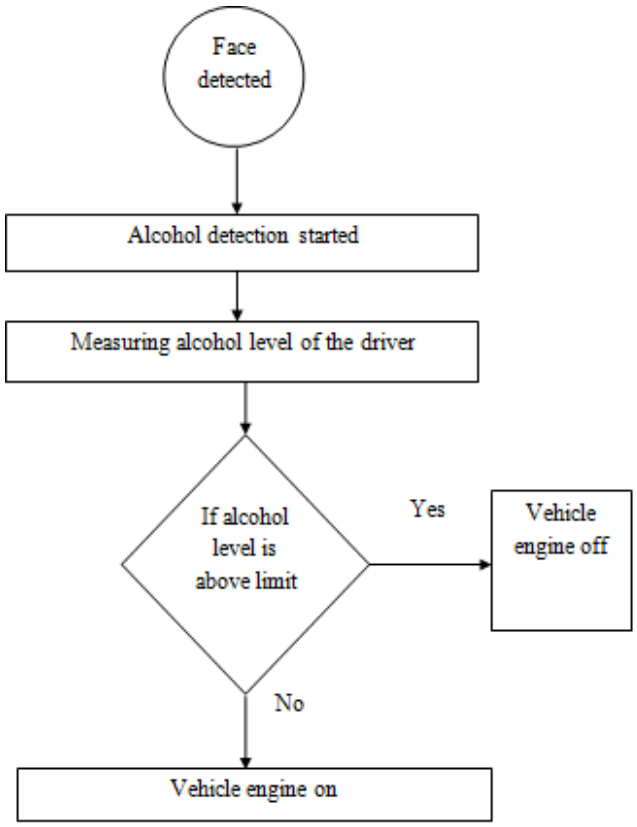

Fig - 5 Flowchart of face detection technique

The proposed system uses an alcohol sensor (MQ-3) interfaced with Raspberry Pi. If the driver is drunk the system will turn off the ignition and if the alcohol is not sensed in high intensity the system let the ignition to perform.

This Raspberry Pi interfaced MQ-3 alcohol sensor is a low-cost semiconductor sensor which, used to detect the presence of alcohol vapor gas at concentrations 0.05mg/L to 10 mg/L. It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor and gas. Its conductivity increases as the concentration of alcohol vapor gas increases. This module provides both digital and analog outputs. The sensitive material used for this sensor is SnO2, whose conductivity is lower in clean air. MQ-3 has a simple drive circuit with fast response, stability and long life. On the sensor, port pins 1, 2 and3 represents the output, GND and VCC respectively.

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Flowchart of alcohol detection technique-This Raspberry Pi interfaced MQ-3 alcohol sensor is a low-cost semiconductor sensor which, used to detect the presence of alcohol vapor gas at concentrations 0.05mg/L to 10 mg/L. It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor and gas. Its conductivity increases as the concentration of alcohol vapor gas increases. This module provides both digital and analog outputs. The sensitive material used for this sensor is SnO2, whose conductivity is lower in clean air. MQ-3 has a simple drive circuit with fast response, stability and long life. On the sensor, port pins 1, 2 and3 represents the output, GND and VCC respectively.

5. REQUIREMENTS

5.1 Hardware Requirements

a) Raspberry Pi

The Raspberry Pi 3 shown in Fig. 6.1 is a single chip small PC. The Raspberry Pi foundation developed it in the UK in the year of 2009. The Raspberry Pi 3 model B is the third generation of Raspberry Pi. In the tear of 2016 February, the Raspberry Pi 3 model B replaces the Raspberry Pi 2 model. In the middle of the chip we have Broadcom chip, this is 1.2

GHz Broadcom 4 (quad-core) CPU. It is based on Broadcom chips and supported by UCCL and Broadcom. The Raspberry Pi 3 has four inbuilt USB ports are used to connect mouse, keyboard or anything that need to connect to the Raspberry Pi. Providing power to Raspberry pi is very easy, just plug any USB power supply into the micro-USB port.

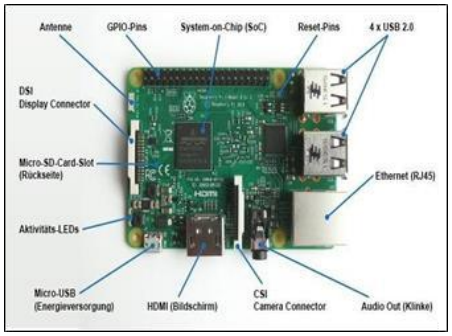

Fig - 6 Raspberry Pi

There is no power button in Raspberry pi board so it will start boot when it connects to power supply, to turn it off simply remove power. It could run Linux, C, C++, Java, Python.

b) Alcohol sensor (MQ3)

Module shown in Fig.6.2 is made using Alcohol Gas Sensor MQ3. It is a low-cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. The sensitive material used for this sensor is SnO2, whose conductivity is lower in clean air. Its conductivity increases as the concentration of alcohol gases increases. It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor and gasoline. This module provides both digital and analog outputs. MQ3 alcohol sensor module can be easily interfaced with Microcontrollers, Arduino Boards, and Raspberry Pi etc.

This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple, all it needs is one resistor. A simple interface could be a 0-3.3V ADC.

Fig - 7 MQ-3 sensor

c) Camera interface

The camera plugs directly into the USB connector on the Raspberry Pi. It's able to deliver clear 8MP resolution image, or 1080p HD video recording at 30fps.

Fig - 8 Camera interface

Above figure is a USB camera which has no infrared filter making it perfect for taking infrared photographs or photographing objects in low light (twilight) conditions.

d) Buzzer

Buzzer shown in Fig. 6.4 is the convenient sound generator utilized as a part of electronic circuits to give sound sign. It is broadly utilized as caution generator in electronic gadgets. It is accessible in different sorts and size to suit the prerequisites.

Fig - 9 Buzzer

A recurrence around 2 to 4 KHz and the Piezo component vibrates as needs be to deliver the sound. A simple buzzer can be powered using a DC power supply ranging from 4v to 9v. a simple 9v battery can also be used, but it can be recommended to use a regulated +5v or +6v DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval. A conventional Piezo bell works between 3 to 12 volts DC. The PS series are high performance buzzers that employ uni-morph piezoelectric elements and are designed for easy incorporation into various circuits. They feature extremely low power consumption in comparison to electromagnetic units. Because these buzzers are designed for external excitation, the same part can serve as both a musical tone oscillator and a buzzer. They can be used with automated inserters. Moisture-resistant models are also available.

e) LCD display

A liquid-crystal display (LCD) shown in Fig. 6.5 is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizer's.

Fig - 10 LCD display

Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements.

5.2 Software Requirement

In this proposed system there is some necessary software tools required for the system includes Raspbian operating system, Python IDLE, Open CV, computer vision software extension for python with Haar cascade classifier for face detection.

6. CONCLUSION

We have proposed a very effective solution to develop an intelligent system for vehicles for driver authentication and alcohol detection. Since sensor has fine sensitivity range around 2 meters, it can suit to any vehicle. The whole system has also an advantage of small volume and more reliability. As the growing public perception is that vehicle safety is more important, advances in public safety is gaining acceptance than in the past. Hence the project provides solution to prevent accidents caused by drowsy driving and alcohol intoxication to a great extent. Future scope of this system is to control the accidents causes due to alcohol consumption and to prevent theft of vehicle through face recognition system that authenticates a user being an authorized person to have access to the ignition system. This system improves the safety of human being.

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