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Driver Drowsiness and Alcohol Detection with Car Tracking System using IoT

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Abstract—The Internet of Things is most useful in communicating devices (things) with each other by using the internet nowadays. Most of sensor device is connected with IoT is more popular in recent times. In this paper a model based in IoT is proposed with aim to prevent accidents due to drink-driving and drowsiness of driver. It includes analysis of alcohol concentration, eye-blinking rate, coordinates of car, alert system at which the car is made to detect a drunken or drowsy state and hence undertake protective measures include ignition off, triggering an alarm, alert to family members etc.

Keywords—IoT, drunk-driving, drowsiness detection, Alcohol sensor, GPS system, Image processing.

1. INTRODUCTION

There are huge worries regarding the road accident it can happen anytime anyplace, it is an enormous problem in India. According to the Association for Safe International Road Travel, about 1.24 million die and 50 million are injured on the roads of the world every year. Artistically, they are treated the second leading source of death. Nowadays, most of the road disaster basis on drink-driving. This is a severe problem which possibly would appear as one of the most essential threats in the future. The alcohol level in breath is measured by the traffic police but this does not break the chain of drinking and driving. Police check the alcohol levels but they cannot stop drivers to drink.

Another crucial aspect is sleeping on the wheel. A sleepy driver who falls in sleep and fails to handle a car, it is not possible to catch the situation and handle the position and consequences of an accident. It is important to prevent these types of accidents and detects the drowsiness of the driver. It is an important challenge to solve this type of problem. To avoid accidents it is crucial to develop a system. There are preventive methods that need to be developed. It is mandatory to alert the driver to stop road accidents.

It is also very important to track car if driver detected drunk and send message and location to family member. Car tacking is also useful in case of theft. For theft prevention, car tracking systems are famous among the public as a betterment deice. The important advantage of vehicle tracking systems is the safety function by monitoring the location of the car which can be used as a conservation approach for the vehicles that are stolen. A tracking system is also useful in case of theft to send coordinates to family members, police centers, etc.

We all know accidents occur anytime. Many people among us lose their life in road accidents and while driving if accident detects then it is necessary to alert driver's family members.

This system aims to prevent accidents due to drink-driving and drowsiness of driver. If driver is drunk then system turns off the ignition and alert send to the family members. Family members can track vehicle through web site. While driving if driver feels sleepy then system alerts driver through buzzer and vibration. Drowsiness detection technique is possible through image processing. In addition, system will continuously monitor accidents and if accident is detect then it will send alert to family members through GPRS. Vehicle tracking is important feature of project. It is used in case of theft and other critical condition.

2. EXISTING METHODOLOGIES

Several approaches have been proposed related to this issue in papers. Of these, some specific papers have been analyzed in the following paragraphs.

1. K.Seijayathi and M.Vedachary proposed a model for automatic drowsiness detection based on the IR sensor and IoT[1]. The authors use the ARM7LPC2148 chip, Eye blink sensor and buzzer. System is able to detect drowsiness while driving and if drowsiness is detected then buzzer start buzzing. The author also used LCD display and DC motor for ignition off. Eye blink sensor is programmed and if any anomalous situation arises, the vehicle is stopped with an buzzer indication, this operation was enabled by means of the driver circuit connected to the vehicle motor and signal is transmitted via RF-transmitter at the frequency of 433.92MHz.

Advantages:

- It is cheap and easy to implement.
- IR sensor is cheap and widely available.
- The car ignition system off if the sensor detects drowsiness.

Disadvantages:

- It is compulsory to wear eyeglasses for drowsiness detection.
- Wearing the sensors can be annoying for the driver and may cause distraction while driving;therefore effective implementation is challenge.
- It is very risky to ignition off while driving.

2. The second was reviewed and proposed by Elie Nasr, Elie Kfoury, David Khoury implemented by using smart phone which is equipped with the NFC(Near Field Communication)[2].Mobile application is used for registration form for passenger's personal data. When a passenger gets in the car and taps the Near Field Communication (NFC) handheld device (mobile phone), the passenger's ID and the vehicle's ID are transmitted and stored into the headquarters' database. In the situation of the vehicle's accident, the shock detection mechanism activates the shock sensor and therefore a Hypertext Transfer Protocol (HTTP) request alerting the circumstance of an accident and its present location is sent to the server. When an accident occurs, a shock sensor catches it. Then, an algorithm is applied to process the sensor signal and send the geographic location along with some ancillary information to the PSO(Public Safety Organizations)headquarter.

Advantages:

- NFC tags are cheap and easy to implement.
- No external monitoring is required for this system to work.

Disadvantages:

- In case of server load, it is difficult to response.
- It is completely sensor based system, sensors may work inefficiently.

3. ARCHITECTURE AND DESIGN

3.1 Architecture

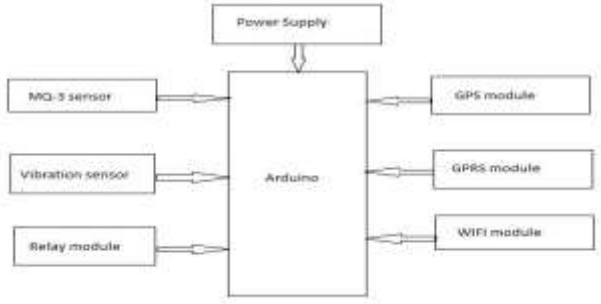

Fig-1: Driver drowsiness and alcohol detection with car tracking system using IOT.

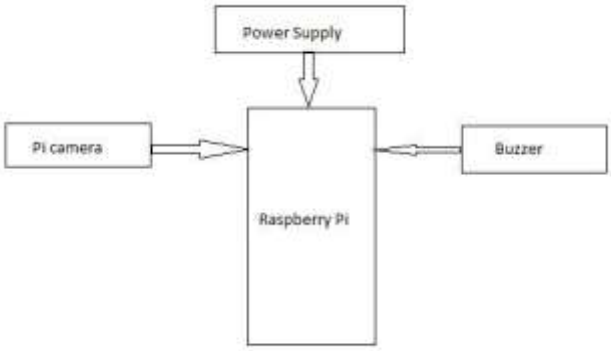

Fig-2: Driver drowsiness and alcohol detection with car tracking system using IOT.

3.2 Components

Arduino Mega

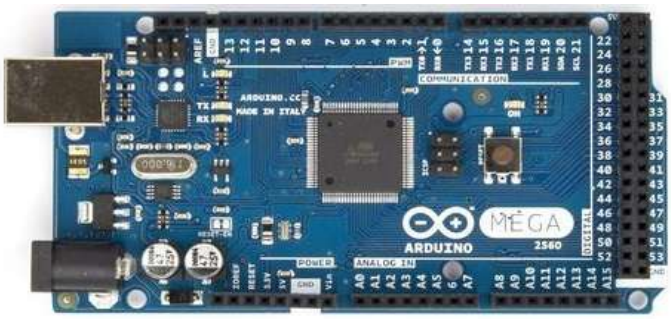

Fig-3: Arduino MEGA

The Arduino Mega 2560 is a microcontroller board which is based on the ATmega2560. It has 54 digital input/output pins, 16 analog inputs, 4 UARTs (hardware serial ports), a USB connection, a power jack, an ICSP header, and a reset button. It contains everything required to support the microcontroller; easily connect it to a computer with a USB cable or power it adapter or battery to get started. It contains larger space for sketch. For data transmission Arduino is connected with Wi-Fi module.

Raspberry Pi 4

Fig-4: Raspberry Pi 4 for drowsiness detection

The Raspberry Pi is a cost effective, small sized computer that plugs into a computer or TV, and uses a standard keyboard and mouse. It is a capable small device that facilitate community of all ages to explore computing, and to learn how to program in languages like Python, Java. The Raspberry Pi 4 Model B is the latest device in the pi all products, boasting a 64-bit quad core processor running at 1.5GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 5.0/BLE, true Gigabit Ethernet. In this system raspberry pi is used for drowsiness detection using image processing.

MQ-3 Sensor

Fig-5: MQ-3 sensor for alcohol detection

This module is built using Alcohol Gas Sensor MQ3. It is a low cost semiconductor sensor which can detect the presence of alcohol gases at levels 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 boost as the concentration of alcohol gases upsurges.MQ3 alcohol sensor is module that can be easily interfaced with Microcontrollers, Arduino Boards, Raspberry Pi etc. This alcohol sensor is suitable for detecting alcohol concentration on breath, the drive circuit is very simple, all it needs is one resistor. A simple interface could be a 0-3.3V ADC. In proposed system MQ-3 sensor is used for alcohol detection.

Vibration sensor

Fig-6: Vibration sensor for accident detection

The vibration sensor is also called a piezoelectric sensor. These sensors are flexible products which are used for mapping different processes. This sensor uses the piezoelectric effects during measuring the changes within acceleration, pressure, temperature, force any other way strain by altering to an electrical charge. The sensitivity of these sensors normally ranges from 10 mV/g to 100 mV/g, and there are lower and higher sensitivities are also usable. This sensor is used for accident detection.

GPS sensor

Fig-7: GPS sensor for tracking vehicle

NEO 6M GPS is navigation System which provides the location and timing services. Main advantage of GPS is to track the location of any devices like car, tuck, and other materials. Which has these GPS devices. It runs based on satellites to get the coordinates. In our project these is used for tracking the location of the vehicle. GPS sensor requires DC power supply. GPS receiver module gives result in standard (National Marine Electronics Association) NMEA string format. It provides output serially on Tx pin with default 9600 Baud rate. Power required for this module is 3.3-6 v. It is used for vehicle tracking in our system.

GPRS Module

Fig-8: GPRS module for sending alert to family members

GPRS is General Packet Radio Service which operates on mobile network with the support of IP transmissions. GPRS provides the transmission of IP packets by current cellular networks. It provides internet services. The SIM900 is a Quad-band GSM/GPRS solution in a SMT device which can be installed in the customer applications. Featuring an company-standard interface, the SIM900 outputs GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with small power

utilization. SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design. This module is used for sending alert to family members.

Pi Camera

Fig-9: Pi camera for detecting drowsiness

The Pi camera device is a flexible light weight camera that supports Raspberry Pi. Its interconnects with Pi using the MIPI camera protocol. It is basically utilize in image processing, machine learning or in surveillance projects. It is widely used in inspection drones since the cost of camera is very less. Apart from these modules Pi can also use normal USB webcams that are used along with computer. Pi camera is used for detecting drowsiness using raspberry pi.

Relay

Fig-10: Relay for ignition off

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. When a relay contact is normally open (NO), there is an open contact when the relay is not energized. When a relay contact is Normally Closed (NC), there is a closed contact when the relay is not energized. In either case, applying electrical current to the contacts will change their state. Relays are generally used to switch smaller currents in a control circuit and do not usually control power consuming devices except for small motors and Solenoids that draw low amps. In proposed system relay is used for ignition off when alcohol is detected.

3.3 Flowchart

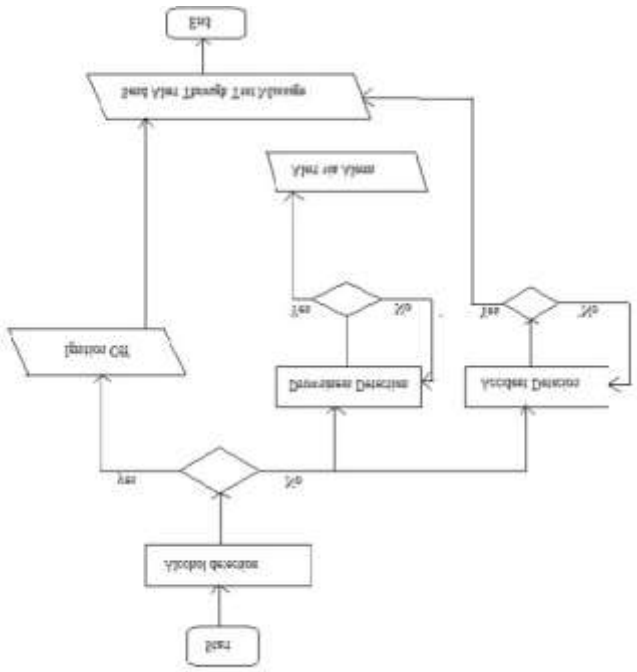

Fig-11: Flowchart of system

4. METHOD

In this section, our proposed system method is described.

This system is composed of the following phases: (a) User registration (b) Alcohol detection and ignition system (c) Monitoring drowsiness and alert system (d) Accident detection and tracking system (e) Website for tracking and previous activity record.

(a) User Registration: This phase deals with process of user Registration. The vehicle's owner must prepare the vehicle for installing this system. After that, user must register vehicle details, user details and family member's details. User can register these details on website. This would lead the system to send alert to family members when some accidents or alcohol detected. Using same website, user and their family members can track vehicle and they can also watch pervious alcohol concentration and activity.

(b) Alcohol detection and ignition system: This module aims at detecting alcohol at the time of user entering in vehicle. When user enter in car then MQ-3 sensor analyses alcohol concentration in breath of vehicle user and if alcohol is detected then system would not let start car ignition system. At that time system send alert to user's family member, so

they can help the vehicle owner. Using website they can track car any time. When family members receive alert then they can know vehicle location using website and they can also help driver. This method is very useful to prevent drunk-driving and accidents.

MQ-3 sensor is connected with Arduino MEGA board. It is placed in car at near of driving steering so, when user enters in car first, he/she can contact with MQ-3 sensor and this sensors detects alcohol concentration in breath of user. Ignition system is most important part when alcohol is detect. For ignition system, there is a relay in between key wire and ignition coil. Relay would not pass electric current to the ignition coil if alcohol is detected.

(c) Monitoring drowsiness and alert system: When driver feels sleepy while driving then driver is alerted by buzzer so, driver can handle vehicle properly and prevent accident. Drowsiness detection is done by raspberry pi through Pi camera. If camera detects driver's eye closed for more than 3 second then it start buzzer so driver can wake up and control vehicle. This phase is very important for preventing accidents due to drowsiness of driver. Raspberry pi is most important component for detection of drowsiness and we use raspberry pi 4 model. It is capable for handling complex programming like image processing.

Image processing is used for drowsiness detection, because in existing methodology IR sensor is used[1] which is not capable for perfect detection of drowsiness. For better and improved result we used image processing. In image processing Open CV is used. Facial landmarks detection model is used. Python's Dlib library outputs a 68 point on a face which is showed in Figure 12. This method does not require complex facial shapes, and appearances for modeling is simple and efficient and achieves good positioning effects in controllable scenarios and no controllable scenarios.[4]

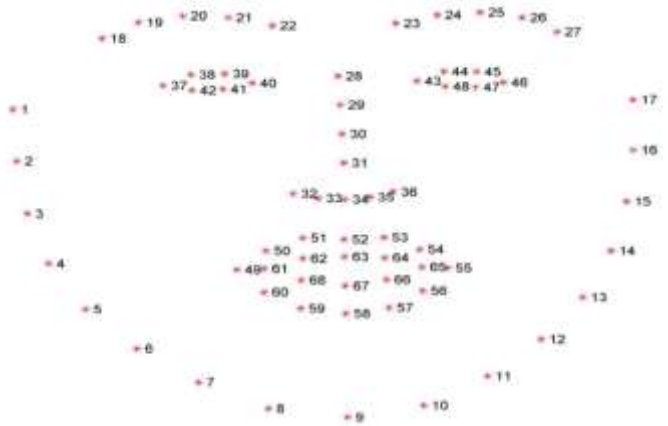

Fig-12: The 68 points mark-up used for actual landmark distribution

The Eye Aspect Ratio is a constant value when the eye is open, but speedily drop to 0 when the eye is closed. Eye blinks need to pay attention to points 37-46, the points that characterize the eyes. In Real Time Eye Blinking Using Facial Landmarks, Soukupová and Čech derive an equation that represents the Eye Aspect Ratio. The Eye Aspect Ratio algorithm is an appraise of the eye opening state. EAR invoke to the aspect ratio of the eye region, which is generally use to count the temporal consistency and speed of left and right eye blinks.[4]

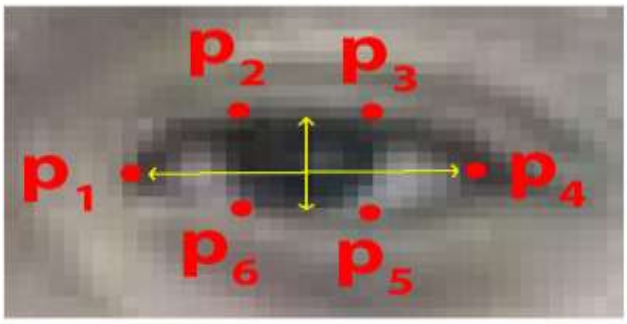

Fig-13: Eye Facial Landmarks

$$\mathrm{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Fig-14: Eye Aspect ratio Equation

(d) Accident detection and tracking system: This phase is detects accident. If in worse case some accident detects the alert is send to the driver's family members. Vibration sensor identify the accident and through GPRS module send SMS to the family members. User's family members can track car using website. When they get alert of accident then they can go to website and track vehicle so, they can try to reach accident spot immediately and try to help driver.

(e) Website for tracking and previous activity record: This phase is software based. For website HTML, Java script, php is used. This website is connected with database. All data are stored in database. User can register on website and then user and his family members can log in into website. When accident is detected and alcohol is detected then driver's family members can use website for tracking of vehicle. Google map API is used for access google maps. Users can also show their previous activities in this website. Through ESP8266 WIFI module all data transfer to website from Arduino.

Circuit diagram of system

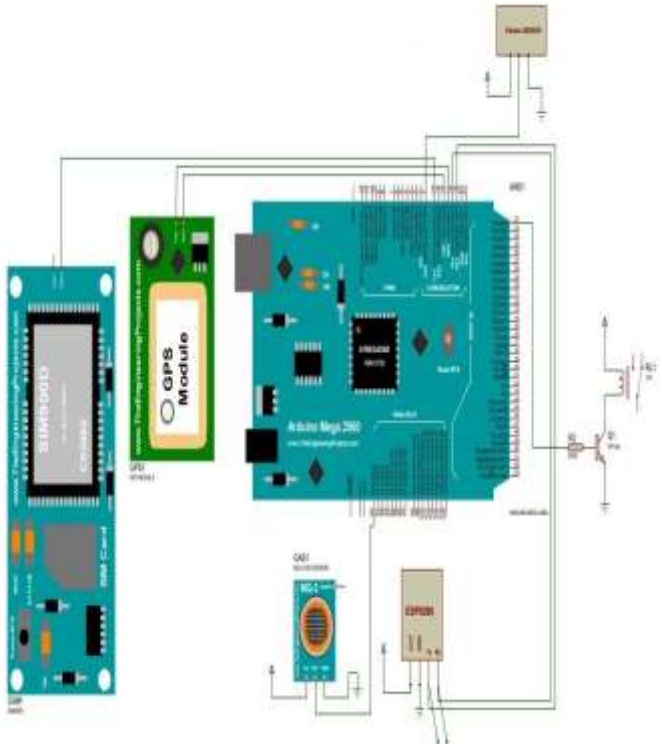

Fig-15: Circuit diagram of system exclude drowsiness detection.

5. RESULT

The three subjects A,B and C were tested separately on different occasions and the instrument's performance was found to be consistent.

The following table I shows the readings for Subject A which contains alcohol readings and ignition system status. The response of different samples is in part per million (PPM).In between 400 to 1000ppm alcohol level is high.

Alcohol Level in breath	200-300ppm low	300-400ppm medium	400-500ppm high
Ignition system	on	off	off
Alert	Not sent	sent	sent

Table 1: Result of alcohol level in PPM

In result, we analyze three different levels of alcohols and successfully system works. When alcohol is detected then successfully ignition system is off and alert sent to the family members.

The following tables II shows the readings for subject B which contains vibration readings.

Vibration range	500Hz	900Hz	1500Hz
Alert	Not send	sent	sent

Table 2: Result of vibration level for accident detection

Vibration ranges crosses 900 hz then system successfully sent alert to family members.

The following tables III shows the readings when eyes were open and close for drowsiness detection.

Eye close duration	2 sec.	3.Sec	4.sec
buzzer	Off	on	on

Table 3: Result of image processing

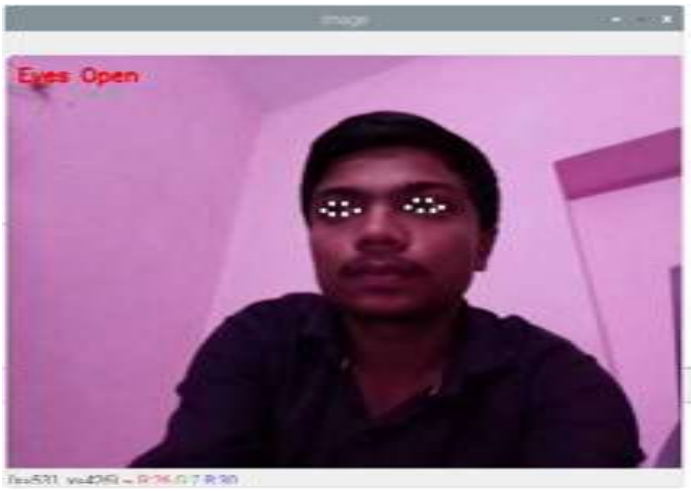

Fig-16: Result when eyes are open

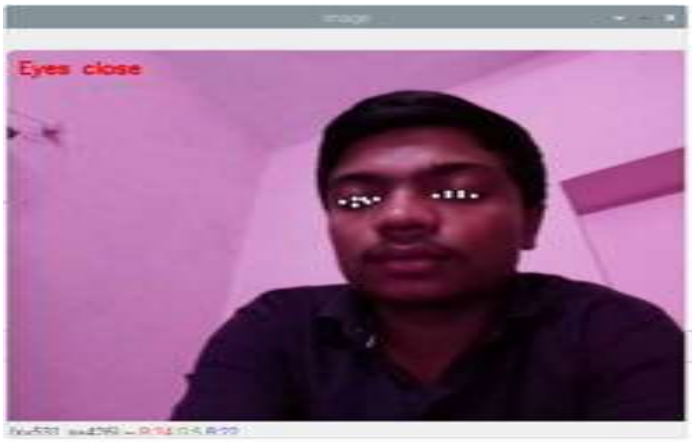

Fig-17: Result when eyes are close

These two images 15,16 and tables 3 shows the result of image processing for detection of drowsiness. Many attempts were performed to test image processing and they were 80% accurate.

6. CONCLUSION AND FUTURE SCOPE

In this paper, we proposed and implemented an IoT system which is very useful to preventing accidents. An effective solution is provided to develop a system for vehicles will sense the alcohol present in the breath of the driver and take action immediately ignition off and send alert to family members. Another problem is solved is sleeping on wheel a driver who feels sleepy while driving then system turn on buzzer and prevent dangerous accidents. System also detects accidents and send alert to driver's family members so they can track the vehicle location and try to help them. The communication with family members system is designed with GPRS and GPS module. For alcohol detection MQ-3 sensor is used and for accident detection vibration sensor is used. Ignition off module is important module which is done by putting relay. The whole control system has the benefit of small volume and high reliability. Future scope of this system is to decrease accidents numbers and providing useful emergency solutions as fast as possible. We will try to get accurate measurements of sensors and their response time. This system brings modernization to the existing technology in the current vehicles and also improves safety features.

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