# DRIVER ASSISSTANCE SYSTEM

An Internal Funded Project Report

Submitted By


| | |
|---|---|
| Aravind P | 185001021 –III Year |
| NachammaideviPooja S | 185001096 –III Year |
| Prathyush S | 185001112 –III Year |
| Praveen Kumar V | 185001113 –III Year |


Academic Year 2019-20


Computer Science Engineering

SSN College of Engineering

Kalavakkam 603110


February 2021

# SSN COLLEGE OF ENGINEERING: CHENNAI 603110

# BONAFIDE CERTIFICATE

Certified that this project report titled **DRIVER ASSISTANCE SYSTEM** is the *bonafide* work of **Aravind P (185001021 - III Year)**, **Nachammai Devi Pooja S (185001096 – III Year)**, **Praveen Kumar V (185001113 - III Year)** and **Prathyush S (185001112 - III Year)**, who carried out the project work under our supervision as an internal fnded project in department of CSE during the Academic year 2019-2020.

**Ms. Angel Deborah**
**Supervisor**
Assistant Professor,
Department of CSE,
SSNCE

**Mr.K.R. Sarath Chandran**
**Supervisor**
Assistant Professor,
Department of CSE,
SSNCE

**Dr. Chitra Babu**
**Head of the Department**
Professor,
Department of CSE,
SSN College of Engineering,
Kalavakkam - 603 110

Place: Chennai Date:

## ACKNOWLEDGEMENTS

I thank GOD, the almighty for giving me strength and knowledge to do this project. I would like to thank and deep sense of gratitude to my guide **Ms. Angel Deborah**, Associate Professor, Department of Computer Science and Engineering, for his valuable advice and suggestions as well as his continued guidance, patience and support that helped me to shape and refine my work.

My sincere thanks to **Dr. CHITRA BABU**, Professor and Head of the Department of Computer Science and Engineering, for her words of advice and encouragement and I would like to thank our project Coordinator **Mr.K.R.Sarath Chandran**, Professor, Department of Computer Science and Engineering for her valuable suggestions throughout this first phase of project.

I express my deep respect to the founder **Dr. SHIV NADAR**, Chairman, SSN Institutions. I also express my appreciation to our **Dr.V.E. ANNAMALAI**, Principal, for all the help he has rendered during this course of study.

I would like to extend my sincere thanks to all the teaching and non-teaching staffs of our department who have contributed directly and indirectly during the course of my project work. Finally, I would like to thank my parents and friends for their patience, cooperation and moral support throughout my life.

**Aravind P** **Nachammai Devi Pooja S** **Praveen Kumar V** **Prathyush S**

## ABSTRACT

With the development and evolution of science and technology, monitoring human activities has become facile, these upcoming new technologies have the potential to revolutionize safety and security in various areas of the society. Surveillance and monitoring being the key factors of security. This paper mainly focuses on developing an integrated driver assistance system using signal processing and embedded tools which is applied in automobiles. Earlier methods were based on physiological and analog data, but today's scenario requires a smarter and digitized work system to ensure integrity and compatibility with multifarious smart devices like cell phones, laptops, etc.

This paper consists of three inter-linked modules which are firstly, driver drowsiness detection, followed by alcohol content detection and accident/crash detection alongside Control to constantly monitor the driver’s physiological condition which will affect the stability of the vehicle. To implement this, a variety of software algorithms and input extraction hardware tools have been employed in a collaborative way. For the industrial implementation of this project a prototype has been developed. To detect the onset of fatigue or loss of vigilance of the driver, within the close vicinity of the driver multiple sensors are embedded on this prototype.

## TABLE OF CONTENTS

## LIST OF ABBREVIATIONS

| ABBREVIATION | EXPANSION |
|---|---|
| IOT | Internet of things |
| ECG | Electrocardiogram |
| EEG | Electroencephalogram |
| EOG | ElectroOculogram |
| LED | Light emitting diode |
| VANET | Vehicular ad-hoc network |
| DBN | Dynamic Bayesian network |
| WCD | Water cluster detector |
| OBD | On-board diagnostics |
| SD | Storage disk |
| USB | Universal storage bus |
| UI | User interface |
| GPS | Global positioning system |
| ADC | Analog to digital Conversion |
| SIM | Subscriber identity module |
| WIFI | Wireless fidelity |
| GPRS | Global Packet Radio Service |
| AT | Attention |
| MIDI | Musical instrument Digital interface |
| GPIO | General Port Input output |
| HDMI | High-definition multimedia interface |
| BLE | Bluetooth low energy |
| UART | Universal Asynchronous Receiver Transmitter |
| BCM | Bit compression multiplexer |

LIST OF FIGURES

## INTRODUCTORY CONCEPTS

Fatigue or Drowsiness can be defined as the impulse to fall asleep. A driver at this state will tend to lose their vigilance over the steering of the vehicle which ultimately leads to road accidents and far more undesirable consequences especially during the afternoon and mid-night hours. A drowsy driver can manifest several symptoms like frequent eye closure and yawning, nodding, shaking head etc. In the United States of America, National Highway Traffic Safety Administration has analyzed that driver fatigue results in 1,550 deaths, 71,000 injuries, and $12.5 billion loss in revenue every year. It is obligatory to develop and design a system that has the competence to both detect and monitor the drunken or drowsy driver and inform the designated users of the current situation. This system needs to be robust and effective under various circumstances such as dim lighting, thermal and vibratory shocks, damp humidity etc.

Composed of the three modules, the underlying principle governing the drowsiness detection phase is the object detection framework concept which is simultaneously applied for both face and eyes at the same time. These two target objects are subjected to localization and tracking. The specially chosen target is the human eye, since eyelid closure measurement deemed to be a competent method in terms of robustness and veracity in the domain of recognizing fatigue. In spite of other methods like head movement detection and yawn, the eyes were chosen.

Going with the second module, the alcohol content detection mechanism relied on the concepts of electrochemistry. Breath analyzers used by the traffic police are one of the best ways to detect drunken drivers, and the same principle is used here as a built-in mechanism within the prototype using gas sensors. The gas sensor which performs the main role in this phase has an in-built electrode which performs either oxidation or reduction on the ethanol gas molecules in its close proximity. As a result of an electrochemical reaction, voltage is generated and is sent as information to the Raspberry Pi board.

The final module being the vehicle crash detection mechanism depended on the piezoelectricity completely. The domain of piezoelectricity is really versatile. Piezoelectric sensors generally worked on the basic principle of law of conservation of energy which states that energy can neither be created nor destroyed but can be transferred from one place to other. Here, in this case, the mechanical energy is being converted into the electrical energy. In the scenario where an automobile undergoes an accident, it’s hit with a huge amount of mechanical energy in the form of jerks and vibrational shocks. This mechanical energy either in the form of pressure, force or strain is converted into DC electrical energy by the piezoelectric sensor in the prototype. It is able to generate the required voltage and passes the information to the Raspberry Pi minicomputer where further instructions await.

Now that all the inputs have been extracted to perform the alertness deficiency analysis, it was mandatory to design a fast and durable output end system which could deliver the information to the designated users without any discrepancies. The Internet of things was chosen as the right end phase system which performs those actions. The advantages with the Internet of things are the effective data communication, automation and control, reliable Information, time-efficient, money saving nature and most importantly the speed. We need to exploit that property so as to design a quick response model for this project. Telecommunication and Cloud computing are the two main phases of the I.O.T end system. The end module is an IOT based system having the facility to inform the designated users about the prevailing situation via Android app through messages and mail.

## LITERATURE SURVEY

In the precursor techniques, driver monitoring systems used physiological data and these were analog in nature just like the [1] [2] ECG (Electrocardiogram), EEG (Electroencephalogram) [4], EOG (ElectroOculogram), Galvanic skin response, Skin temperature, Heart rate variability, blink amplitude and many more. These signals were utilized in a collective way to enhance the accuracy of the monitoring systems. Several ingenious technologies were also used at instances like the wet electrodes. But these were deemed incompetent, the main issue with these systems was that they used a lot of wires and complex hardware connections and also the drivers were filled with sensors around their body making it difficult to drive. Hence, it was mandatory to design a wireless monitoring system which used minimal wires for the inter-linking connections. Thus, it led to idea of [4] non-intrusive computer vision system which is being implemented in this work. Aside from the physiological analog signals, PERCLOS[5] [2] was one metric which was widely utilized in facial recognition and eye tracking.

The driver fatigue detection module basically consists of two phases, one being the face detection phase and the second one being the eye detection phase. The classifier used in this work is a collaboration of the [3] Haar cascade algorithm which is highly associated with the Viola-Jones algorithm and OpenCV [4] [3]. Haar cascade was in fact chosen as it could handle real-time data, low level of latency and could be used to sample live-stream video. Some techniques also involved the usage of LEDs and multiple cameras to perceive the facial expressions. [4] But these methods faced setbacks when the cameras were subjected to variable lightings and running backgrounds.

Earlier days, there were instances that to detect the iris part of the human eyes Hough transform was put into action using bounding circles. Finally, the eye openness estimation process was performed by other techniques like the application of [2] Spectral regression embedding (SR) on the segmented eye image to learn the model of the eye shape. Then this process was followed immediately by fusion where two eye detectors (CV-ED and I2R-ED) were implemented and a pair of detection windows was created by each detector. OpenCV was again used in the last to carry on the estimation process so as to locate and track the human eyes.

The earlier techniques for alcohol content detection were mainly based on the analysis of driver effects like rapid closing of eyes, Over-speed, Lane maintenance, intoxication due to drinks and much more. These were just physical measurements combined with electronic elements to form networking systems in which one such prototype was named VANET (Vehicle ad hoc Networks) (refer APPENDIX A1). These engaged Dedicated Short-Range Communication (DSRC) which allowed vehicles to communicate with each other or with roadside equipment.

Speaking of sensor networks, there was one prototype which performed alcohol content detection using [8] Water-Cluster detecting (WCD) breadth sensors. The extraction part handling the vehicle crash detection mechanism also had many precursors which involved electronic components like sensors and even smart phones. One such much prototype was designed and implemented using [9] OBD-II Devices and Android based smartphones. The OBD (On-board diagnostics) Interface was used to detect vehicular or automobile collision. The application end was the smart phone in this case. The software for this was programmed in the Android platform. With all the inputs being extracted, it was now left to the Raspberry Pi board to carry out the rest of the process that is the I.O.T end system. The Internet of things being an advanced technology holds the key to the future.

## OVERVIEW

The subsequent chapters hold detailed information about each module and analyses the underlying principle behind those respective sub-systems. Starting with the proposed technique which highlights the four phases of the project, followed by the Drowsiness detection mechanism, Alcohol content detection, Vehicular crash detection, I.O.T end system. There is a pictorial analysis of the hardware section as well, which is then followed by the Experimental results. These results contain the intermediate results of procedures involved within the making of the prototype consisting of both theoretical content and JPEG images as well.

Several equations and figures have been utilized along the way in order to facilitate the reader with the step-by-step processes involved in this project. Last but not the least; we have the summary of the entire work which gives the ultimate overview of this project briefing each sub-system with a short note which is then followed by the conclusion and future scope. The conclusion part ends the theoretical content regarding the project and passes it on to the future scope where any future applications can be made or assisted by this project are discussed. The future scope is based on the scientific redesign and remodeling of this project.

## PROPOSED TECHNIQUE:

The system consists of 4 phases. These 4 phases depict the entire prototype as they explain the interrelationship between hardware and software components. The initial phase being the setup phase used for training the classifiers for Drowsiness detection. Then comes the detection phase where input is received from all the three modules and physiological state of the driver is closely monitored. The third phase is the output phase where the result of the detection phase is analyzed using Raspberry pi and the information is used in alert phase. The final phase is the alert phase where the designated user is alerted using I.O.T devices. Here is the detailed information of phases in the project.

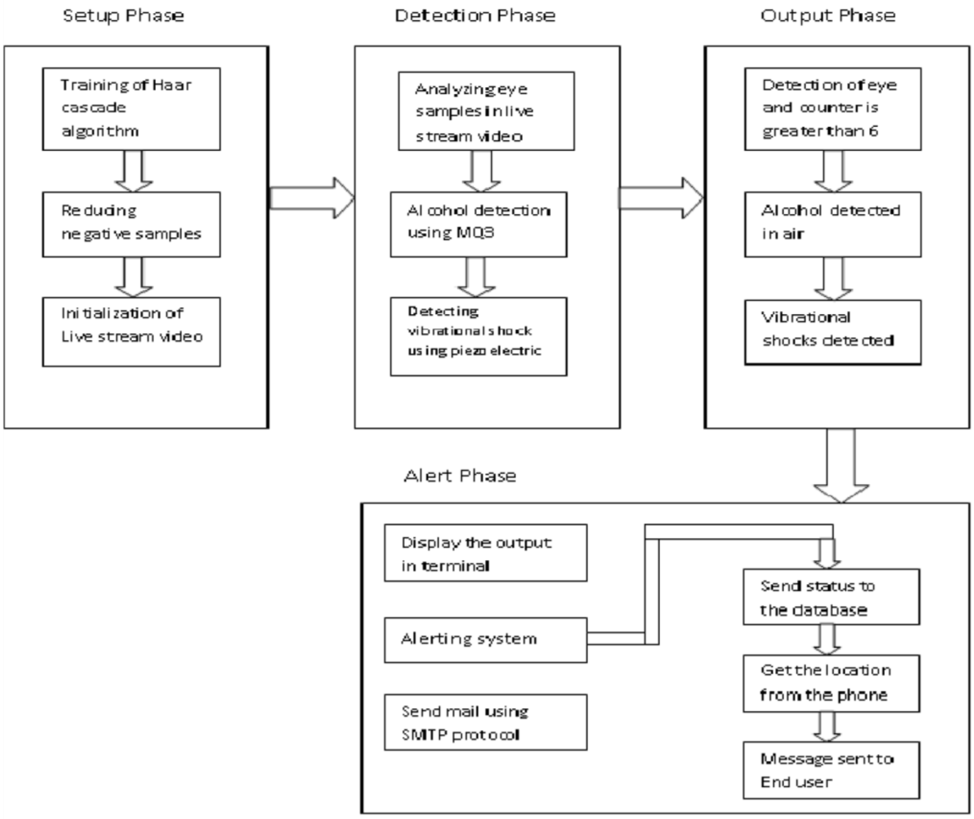


Fig 4.1: Overall Process of the system

## SETUP PHASE:

The first phase of the project is the setup phase where Haar cascade classifier and OpenCV are trained with data sets. Here human faces and classes are created based on facial and eye features. The data set is stored in the Raspberry pi minicomputer .The MQ3 gas sensor and piezoelectric sensor does not require any initial training. From the Data set some target objects were cropped from their images in order to remove the background pixels from them. This will help the model to find targets more efficiently and accurately. The OpenCV has an in-built mode that permits to create more number of positive images by distorting the original positive images and introducing background images. The models are trained and stored as XML files in the minicomputer. These models are be Imported into the project using OpenCV. These imported modules are used to classify live images. With help of these modules the OpenCV can automatically apply bounding boxes and resizing the images. The issues in Haar classifier like over training and under training were taken care so that the classifier does not output false results.

Computer learns to visualize their surroundings through a technique called Computer Vision. Initially the images are captured using USB webcam which is connected to the Raspberry Pi minicomputer in one of its USB ports. This USB webcam has a 2MP resolution and is used to capture the live-stream video.
Algorithms discussed above are applied to this live streaming video to analyze the physiological state of the driver.

## DETECTION PHASE

The second phase is Detection phase and its primary focus is to monitor target objects like face and alcohol content in the air. The facial feature is monitored using Haar cascade algorithm. The bounding boxes are used to localize the eyes so that the eyes are closely monitored. Coming to Alcohol content detection mechanism, MQ3 sensor is used to analyze the ethanol content in air. Adsorption occurs when alcohol content in air comes in contact with sensor. Alcohol molecules are nothing but ethanol particles (C2H5OH). These particles are present in the close proximity of the drunken driver who may either exhale or sneeze to eject these molecules. The gas sensor is placed straight to the driver's face for efficient sensing of Alcohol molecules.

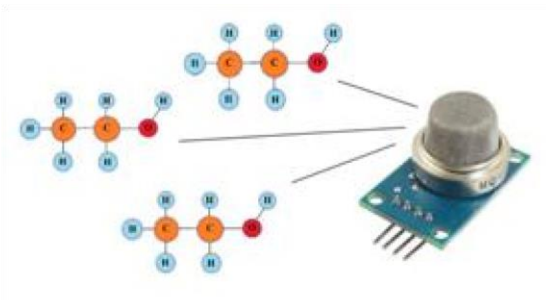

Fig 4.2: interaction between MQ# sensor and ethanol molecules

The Vehicle accident detection mechanism can detects all kind of accidents. The piezoelectric sensor should not confuse vibrations of vehicle when the vehicle hits a speed breaker or a pit in the road with vibrations of accident. The magnitude of the force threshold is set by the user in order to distinguish the vehicle crash force magnitude from the rest. This piezoelectric sensor can be placed on all sides of the car because it is efficient, handy, cost effective and easy to install.

Fig:4.3: Vehicle crash scenario

**OUTPUT PHASE:**

The important phase of the prototype is OUTPUT phase where the facial elements are closely monitored. Buzzers are activated to alert the passengers and driver if the eye is closed for more than 6 seconds. They are also activated if the alcohol content present in the air is high or the vibration shock is greater than threshold value. These data are sent to raspberry pi which is the main component of this prototype. The output for each scenario is stored as algorithms in Raspberry pi. The DC motor stops immediately after the buzzers goes high indicating that the vehicle has stopped.

**ALERT PHASE:**

The final phase is the alerting phase where the end user is alerted using I.O.T components. The Buzzer is an internal caution device whereas these SMS and GPS location tracking come under cloud computing and is external in this case.  SMTP (simple Mail Transfer Protocol) is used to send an email to the end user with the nature of event that occurred. This Protocol is integrated in python code for robust performance. A Database is created in Firebase software to track all activities. To get the location if an accident has occurred, an Android Application is developed. And finally, a SMS is sent to the end user with latitude and longitude of the place where the incident has occurred. But the prototype we created is used by designated user to keep an eye on physiological conditions of the driver.

CHAPTER 3

## Drowsiness Detection Mechanism

Firstly, USB web-cameras are utilized to record the input video covering the user (driver's) face. This video is then loaded into the program in grayscale mode as it is easy to process and takes less computation power than RGB channel. The video is then sampled to obtain the discrete frames where the algorithm is applied. We have used the Haar cascade algorithm to perform the face and eye detection. This is basically a machine learning based approach where a cascade function is trained from a large set of both positive and negative images. Based on the training it is then used to detect the objects in the given images. This will be then used in the drowsiness classification module. For localization of eyes, first we have to detect the face which is carried out by using the above mentioned haar features. Here are some Haar-Features.

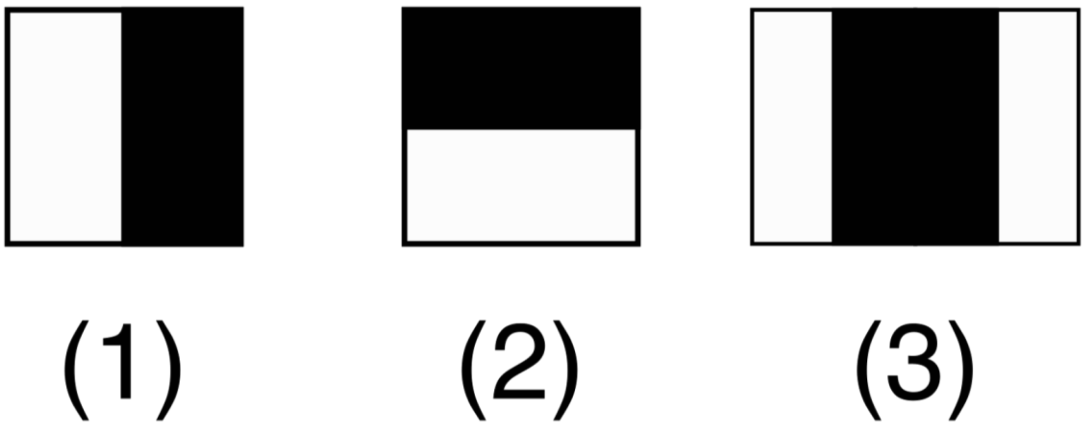


Fig 5.1 The first two are "edge features", used to detect edges. The third is a "line feature". Edge features which can detect edges effectively like the eye brows, lips etc. Whereas the line features which can detect lines with relatively higher efficacy like the nose bridge.

Refer Fig 5.2 for an example of a facial analysis based on line and edge features :-

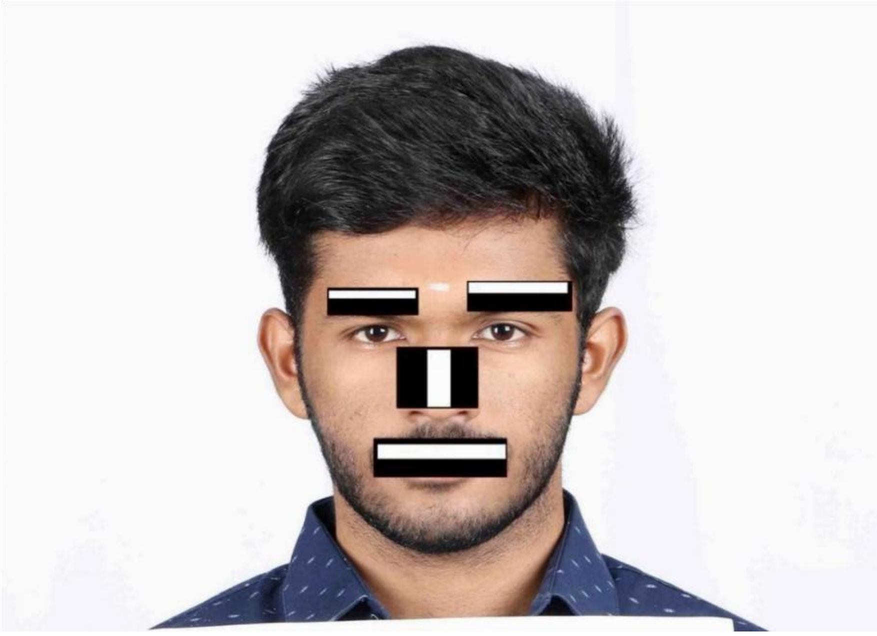

Fig 5.2

The live stream video is sampled at 40 frames per second and the algorithm converts it into discrete grayscale images which are analyzed by the Haar cascade algorithm continuously inside the loop. The features are being applied on those images and the corresponding pixel intensities are calculated. These functions performed by the classifier are trained by the user before the entire process is initiated with a finite trained XML dataset file which is provided by OpenCV.

**$\Delta$ = (Sum of Black pixel intensities) – (Sum of white pixel intensities)**

**$= (1/n)*\Sigma I(x) - (1/n)*\Sigma I(x)$ (1) $I(x)$**

**– Pixel intensities**

**n – Number of black or white pixels**

The intensities of the pixels are separated as black and white segments and are summed up individually. Then they are subtracted against each other and delta is determined to form the integral image. Adaboost training (refer APPENDIX A.4), which is a boosting algorithm is employed along weak learners to boost the efficiency of the neural networks. It selects the best features and trains the classifiers to use them. This algorithm builds a strong classifier as a linear combination of weighted weak classifiers. The weak classifiers are threshold functions based on the features fj.

$H(x) = \mathrm{sgn}(\Sigma \alpha j h j(x))$ (2)

$$h_j(x) = \begin{cases} -S_j & \text{if } f_j < \theta_j \\ S_j & \text{if } f_j > \theta_j \end{cases} \quad (3)$$

**H(x) – Strong classifier**
**hj(x) – Weak classifier**
**αj – Coefficients or weights to boost the performance of the weak classifiers**
**Sj – Polarity (either -1 or 1)**
**θj – Threshold value based on features**

The final step is the cascading of classifiers. Instead of applying all features on a window, the features are grouped into different stages of classifiers and applied one-by-one. If a window fails the first stage, discard it. We don't consider the remaining features on it. If it passes, apply the second stage of features and continue the process. The window which passes all stages is a face region. Similarly, repetitive procedure of these steps may manifest a tracking process in the output window.

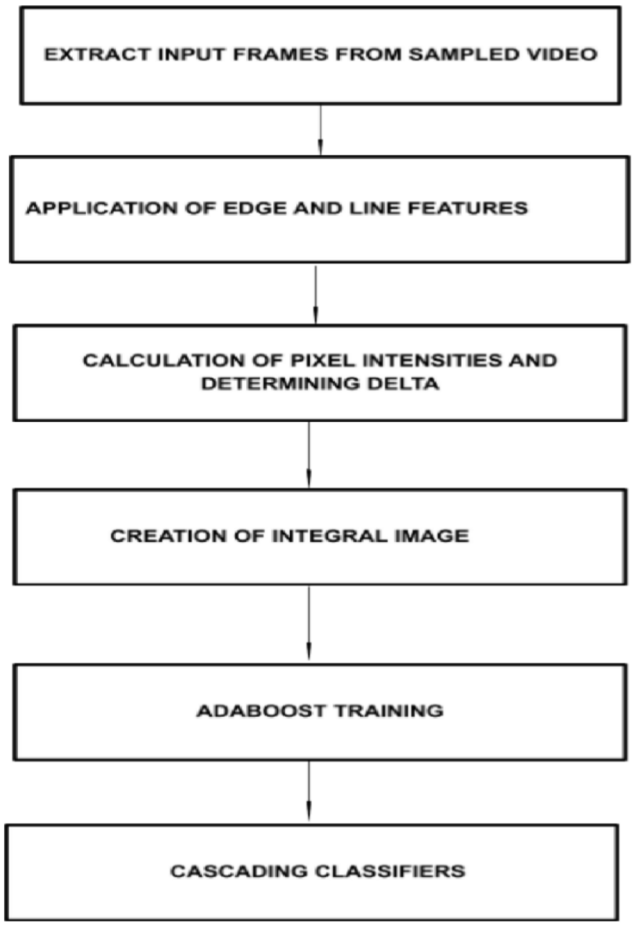


Fig 5.3

The above flowchart describes the step-by-step process discussed in the module. After recognizing the face and eye localization process, the eyes are tracked instantaneously. When the eyes are open, the system keeps on tracking and does nothing. When the eyes are closed, the classifier doesn’t recognize the target and the system immediately initiates the counter where the user needs to set a particular threshold time limit to determine the basic time for eye closure for tiredness. Once the threshold is set and eyes are closed for more than the threshold during the detection phase, a data is sent to the Raspberry Pi board. The data is immediately recognized at the Raspberry Pi3 minicomputer and location available in the phone of the driver to be taken by the Raspberry Pi is sent to the owner of the Vehicle as both SMS and an E-Mail.
The Data is initially being fetched from the Driver’s phone and it is then uploaded to the Firebase for processing it.

## CHAPTER 4

## ALCOHOL CONTENT DETECTION

The Gas sensors are the most ideal decision for identifying liquor content in the dampness around the driver.MQ gas sensors are widely used nowadays where each of MQ gas sensors detects specific gas molecules. In this project, we have implemented MQ3 gas sensors, since it detects ethanol (alcohol) gas molecules. The sensor is generally active at temperatures between -10°C and 50°C MQ3 alcohol sensor works on 5V DC and draws around 800mW. It can detect Alcohol concentrations anywhere from 25 to 500 ppm which is basically implemented in the breath analyzer used by the traffic authorities.

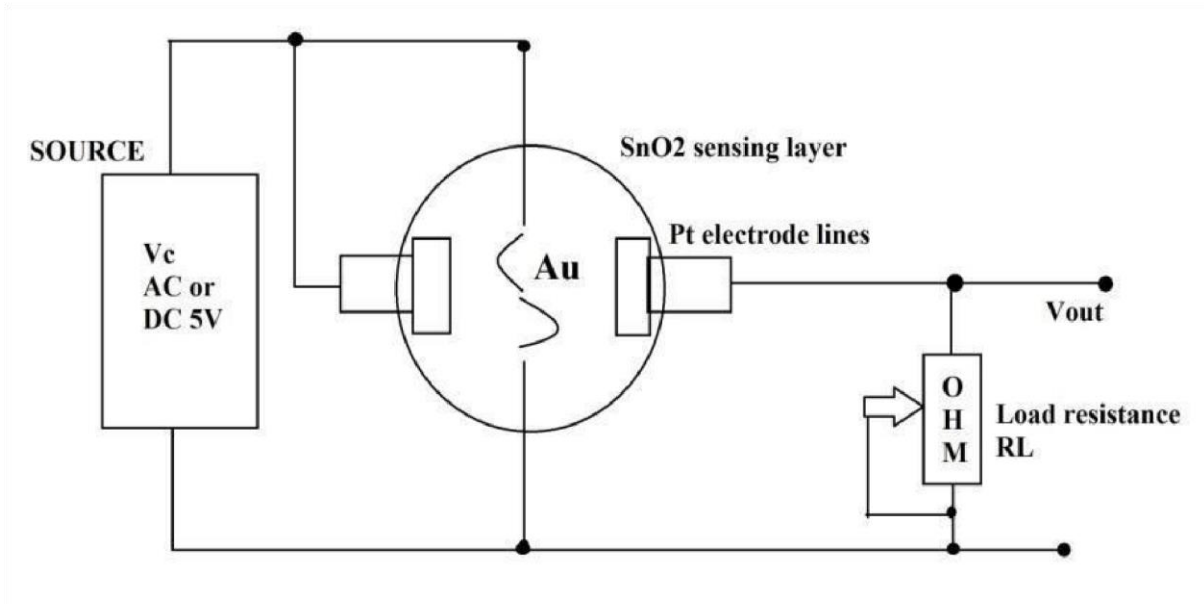


Fig 6.1

The gas molecules diffuses through the porous SnO2 (Tin oxide) membrane to the Au (Gold) electrode where it is either chemically reduced or oxidized. The Tin Dioxide is the most important material being sensitive towards alcohol which has a low conductivity when surrounded by clean air. But, when surrounded by alcohol molecules, its conductivity increases proportionally with the gas molecules concentration. This electrochemical reaction generates a specific amount of current that passes which alters the resistance of the sensing element and thus, a potential difference is generated. This analog voltage generated is converted into digital data using an ADC and is observed at the Raspberry pi which gives the status as ‘Drunken’ is sent to the user via email. The below flowchart describes the flow of alcohol detection mechanism occurring in the MQ3 sensor when it detects alcohol.

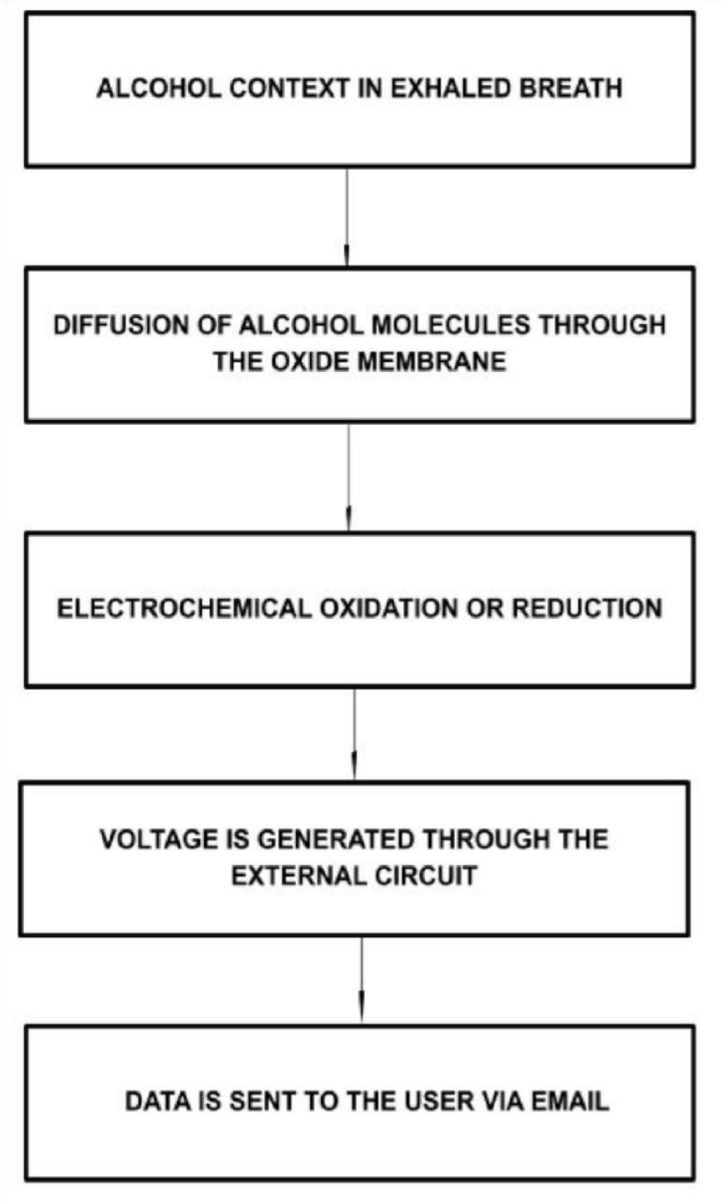


Fig 6.2

# CHAPTER 5

## VEHICLE CRASH DETECTION MODULE

The last input extraction module after the Drowsiness recognition and Alcohol content detection is the Vehicular crash detection mechanism. We have used the piezoelectric sensor also known as vibration sensor to implement this module. Variations in pressure, strain, acceleration, temperature, force, weight and several other parameters cause the piezoelectric effect. The piezoelectric sensor inherently uses piezoelectric effect by converting them into an electrical current. These sensors are so versatile in nature that they are used for process control, quality assurance and other industrial applications.

The vibrations are measured in units of acceleration. The pressure is generally applied transversely, longitudinally or ashore on the piezoelectric sensor. A transverse piezoelectric effect where a force is applied by the sensor. These pressure or strains cause the occurrence of electric dipole moments in the solids due to the force applied on the piezoelectric material like quartz etc. The amount of charge displaced depends on the dimensions of the sensor and the piezoelectric coefficient. The mathematical expression is given by

$$\mathbf{Q_x = d_{xy} * F_y * (b/a)} \qquad \mathbf{(4)}$$

$$\mathbf{I(t) = dQ_x/dt} \qquad \mathbf{(5)}$$

**QX – Amount of charge displaced in the horizontal x-axis**
**$d_{xy}$ – Piezoelectric coefficient**
**$F_y$ – Force applied on neutral y-axis**
**a,b – Dimensions of the sensor**
**I(t) – Current generated during the process**

The piezoelectric or vibration sensor is an electrical combination of a voltage source and a filter network consisting of capacitances and inductances. The voltage produced is directly proportional to the applied mechanical force.

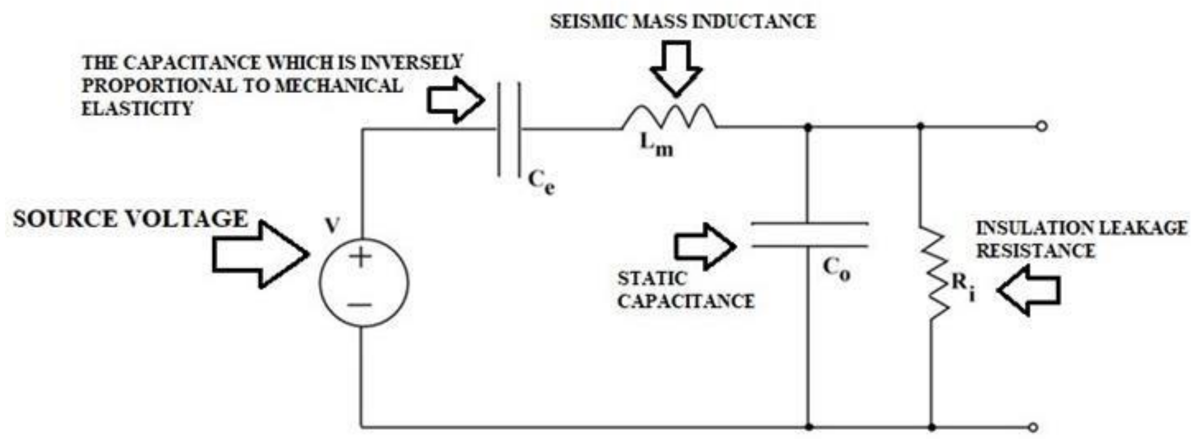


Fig 7.1

The flow diagram of action or sequence in this module is given as

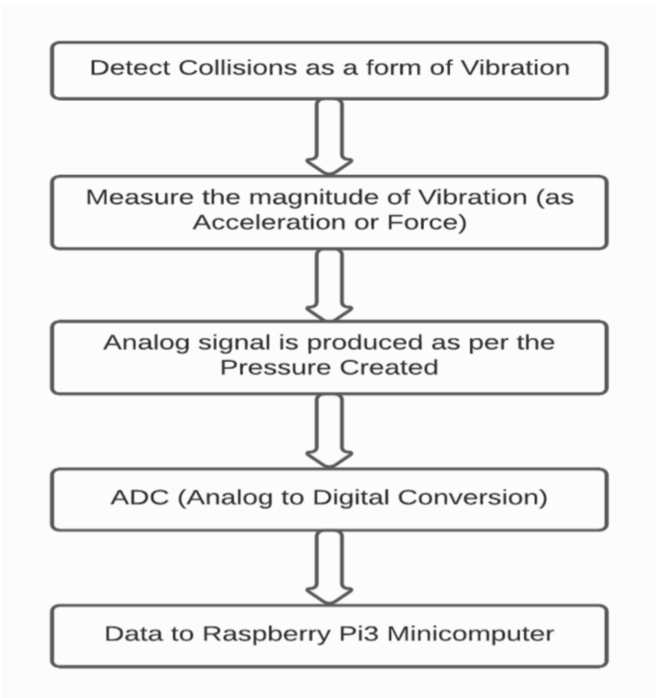


Fig 7.2

## CHAPTER 6

## I.O.T END SYSTEM

The main objective of the Alert or surveillance phase is to caution the designated users when the drivers lose their vigilance over the steering of the automobile. This generally brings in the field of Internet of things (I.O.T) which is a much-used technology nowadays. The Internet of things has become the foundation for many smart devices and appliances from domestic to public sectors. In this project we have made use of the Location available in the phone of the driver to be taken by the Raspberry Pi and then the Location is sent to the Owner of the Vehicle as both SMS and an E-Mail. The Data is initially being fetched from the Driver's phone and it is uploaded to the Firebase for processing it.

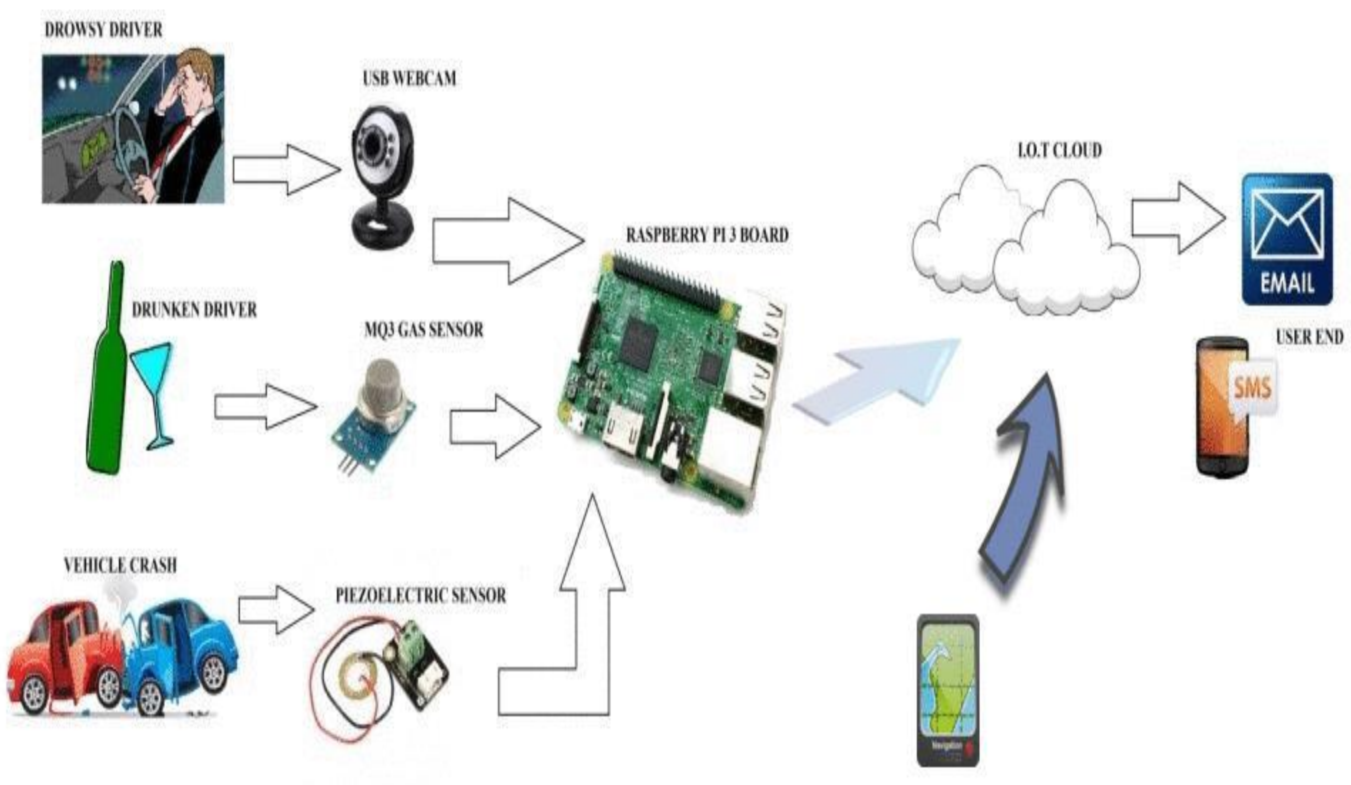


Fig 8.1

The commands are actually programmed by the user in the python platform using AT commands. These commands originate from the Hayes commands which were implemented by the Hayes smart modems. The wireless modems and dial up need AT (attention) commands to interact with the Raspberry Pi minicomputer. These commands include the Hayes subset commands which are also known as the basic commands, along with other extended AT commands which are specific to a GPRS network.

These processes constitute the I.O.T end system module. This is the final section in the prototype where the information from the vehicle is transmitted to the designated users present both inside and outside the automobile. The type of alert system can be chosen by the user as well like whether an internet call has to be made or a SMS is sent or an entry is to be made on the app of the user. The result is projected along with the latitudinal and longitudinal coordinates of the vehicle. Also, the vehicular number is noted down in the app so that the agencies/owner can distinguish between their drivers.

# CHAPTER 7

## HARDWARE SECTION

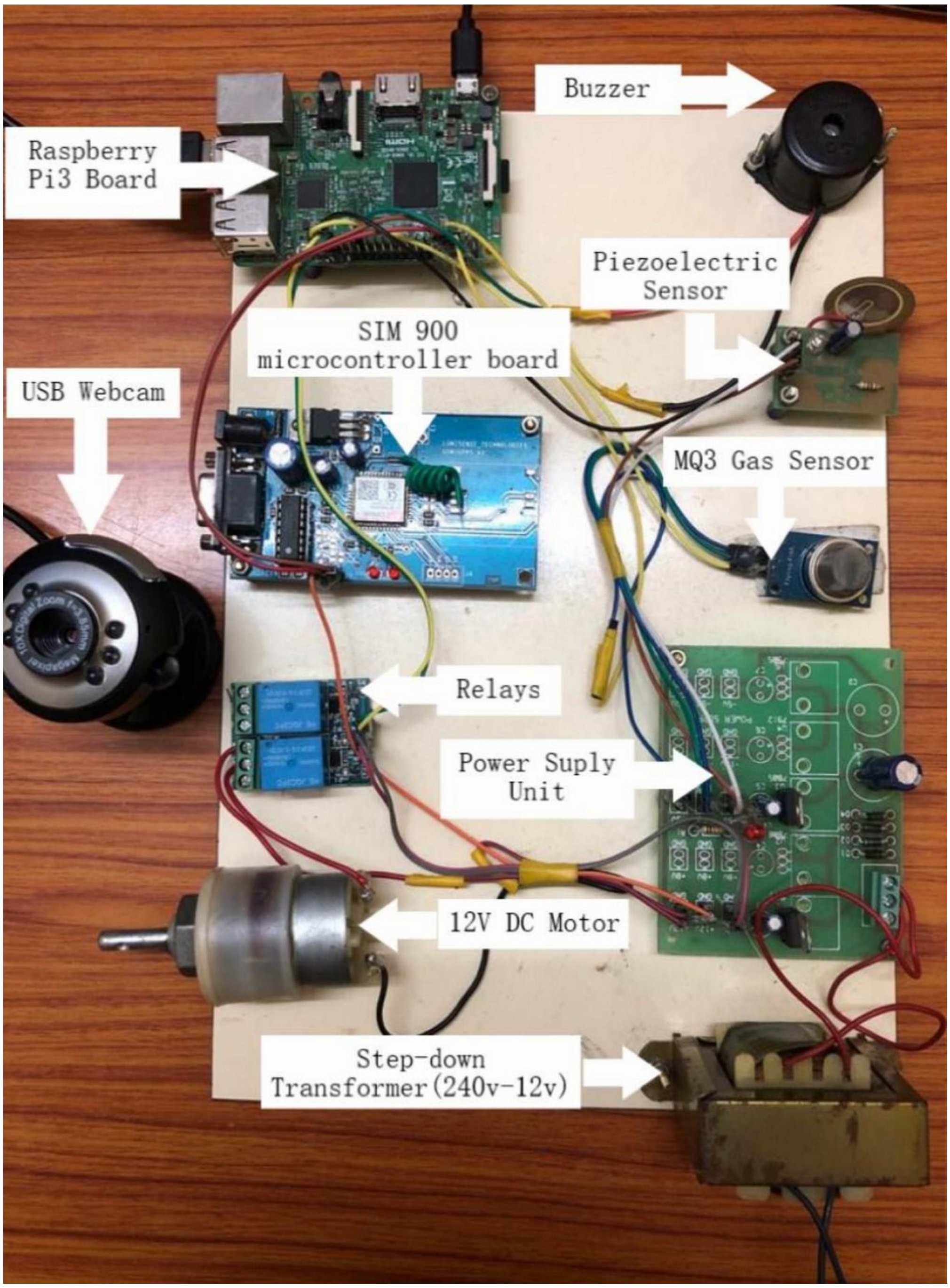


Fig 9.1

## 1) PROCESSING UNIT (RASPBERRY PI3 BOARD)

The Raspberry Pi is a series of minicomputers which were first developed in the United Kingdom for both domestic and industrial purposes. Many smaller components were embedded in it like the ARM cortex processor, RAM slot, SD card slot, USB slot, Graphics processor, audio card, WIFI adapter, Bluetooth module, USB to MIDI convertors and many more. The Raspberry Pi 3 uses a Broadcom BCM2837 SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KiB shared L2 cache. This processing unit is the main unit in the entire prototype as it performs a versatile role in the output phase and carries the data to the alert phase which is the user end. Below are the features of the Raspberry Pi3 model B minicomputer: -

- 1GB RAM (Influences the video capturing module in Drowsiness module)
- Quad Core 1.2GHz Broadcomm BCM287 64bit CPU (same as above)
- BCM 43438 WLAN (Wireless local area network) and BLE (Bluetooth low energy)
- 100 Base Ethernet (important for establishing connectivity)
- 4 USB 2 ports (USB webcam is connected here)
- 40-pin extended GPIO (all wired connections pass through them)
- Full size HDMI (To display the data in the monitor or a projector)
- CSI Camera port (If RPi cam is used)
- DSI display port (If a touchscreen display is used)
- Micro SD card slot (Stores data mainly the software algorithms in this project)
- Micro USB power source ( upto 2.5A)

## 2) ELECTRONIC SENSORS

- MQ3 Gas sensor
- Voltage supply (5V with 2% tolerance)
- Detecting concentration (0.05mg/L – 10mg/L) of alcohol
- Using temperature (-10°C to 50°C)
- Standard Detection temperature (20°C)
- Sensing resistance (1MΏ to 8MΏ) & (0.4mg/L alcohol)
- 200KΏ Load resistance
- Preheat time (>24 hrs)
- $SnO_2$ (Tin oxide) sensing layer
- Au (Gold) electrode
- Pt (Platinum) electrode lines
- Stainless steel gauze for Anti-explosion network

- Copper plated Nickel Clamp ring
- Bakelite resin base
- Piezoelectric sensor
- 500Ω Impedance
- Voltage supply (<30V) – usually 5V
- Operating temperature (-30°C to 70°C)
- Low soldering temperature
- Strain sensitivity (5V/μƐ)
- Quartz piezoelectric crystal
- Dual terminal ports

### 3) USB WEBCAM

- Corded USB type connection
- High speed USB 2.0
- Built-in microphone (with noise suppression)
- Plastic lens and Fixed focus type
- 60° Field of view (FOV)
- 4.0mm focal length
- 1280x960 2MP resolution
- 40fps at 640x480 resolution

**EXPERIMENTAL RESULT:**

Once the python code is executed, the popup appears so that the driver can adjust his seating position to face camera. In drowsiness detection mechanism, the bounding boxes localize the eyes and start to monitor them. For project concern, we have used a laptop to view the internal processes but while implementing industrially, these all modules will be embedded in smart systems of the automobiles.

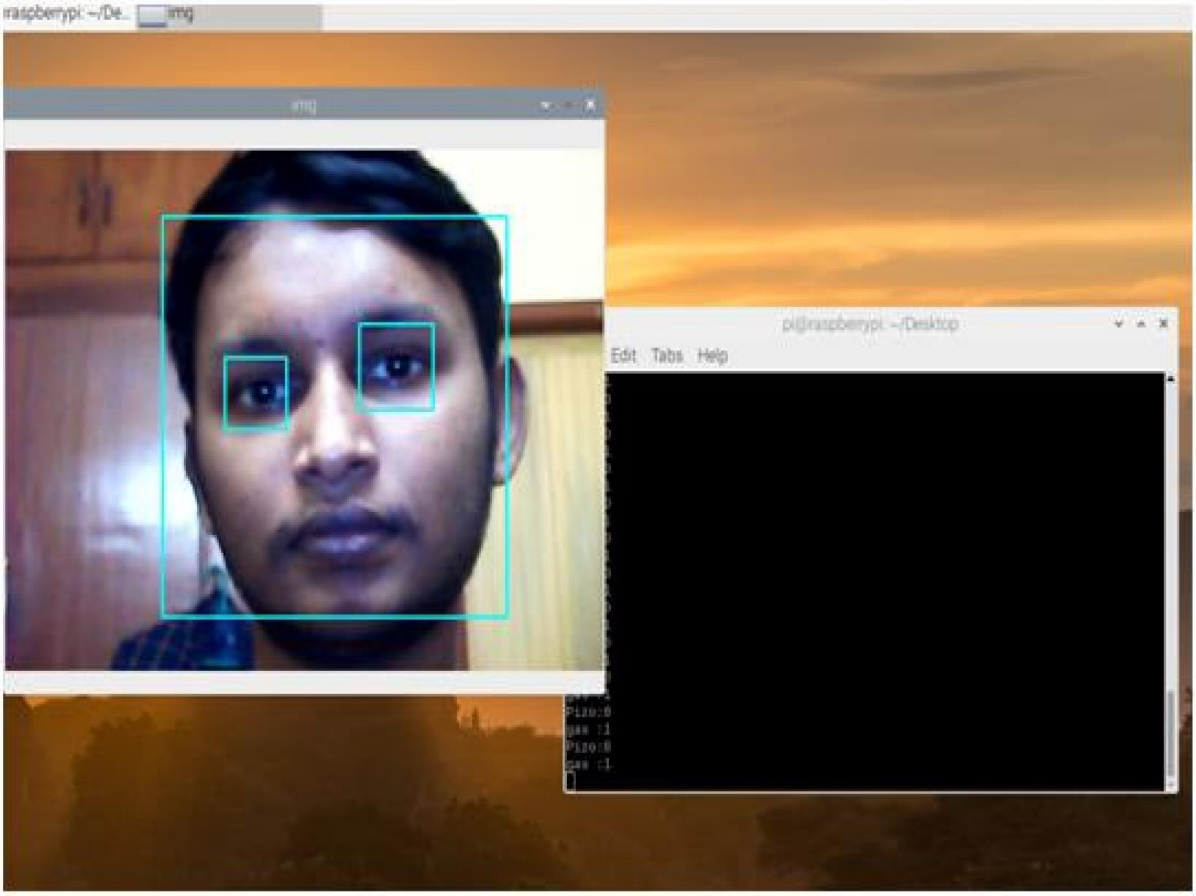


Fig 10.1: initialization of code and localization of eyes

After the eye is detected, the USB camera continuously monitors the facial interactions of the driver. A counter is initialized if the eye is closed. If the count in the counter is more than 6 seconds then prototype detects that the driver is sleepy and transmits the data to the Raspberry Pi board. From there, begins the alert phase where the designated drivers, passengers and users in general are notified of the existing scenario SMS and emails.

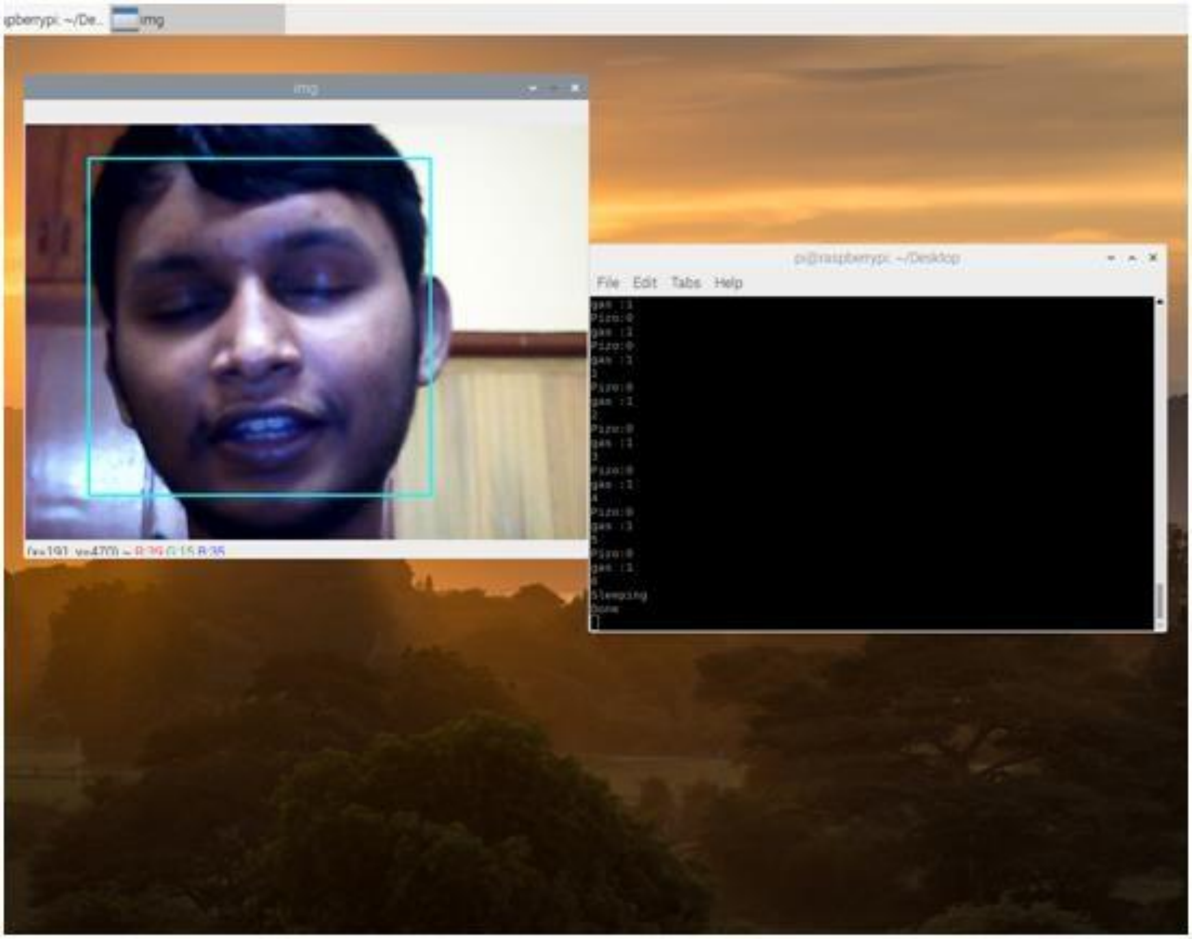


Fig 10.2: closed eye is detected and counter is initiated

Here are some of the outputs of the application where the End user can view the information regarding the driver’s physiological state and location coordinates during the alert phase. A database is created in Firebase which stores the information regarding the location of the vehicle when the accident occurred. The Android application is used to extract the location of the driver which is secured using User Id and Password. The Android application is created in Android Studio and it is installed to the Driver's Mobile.

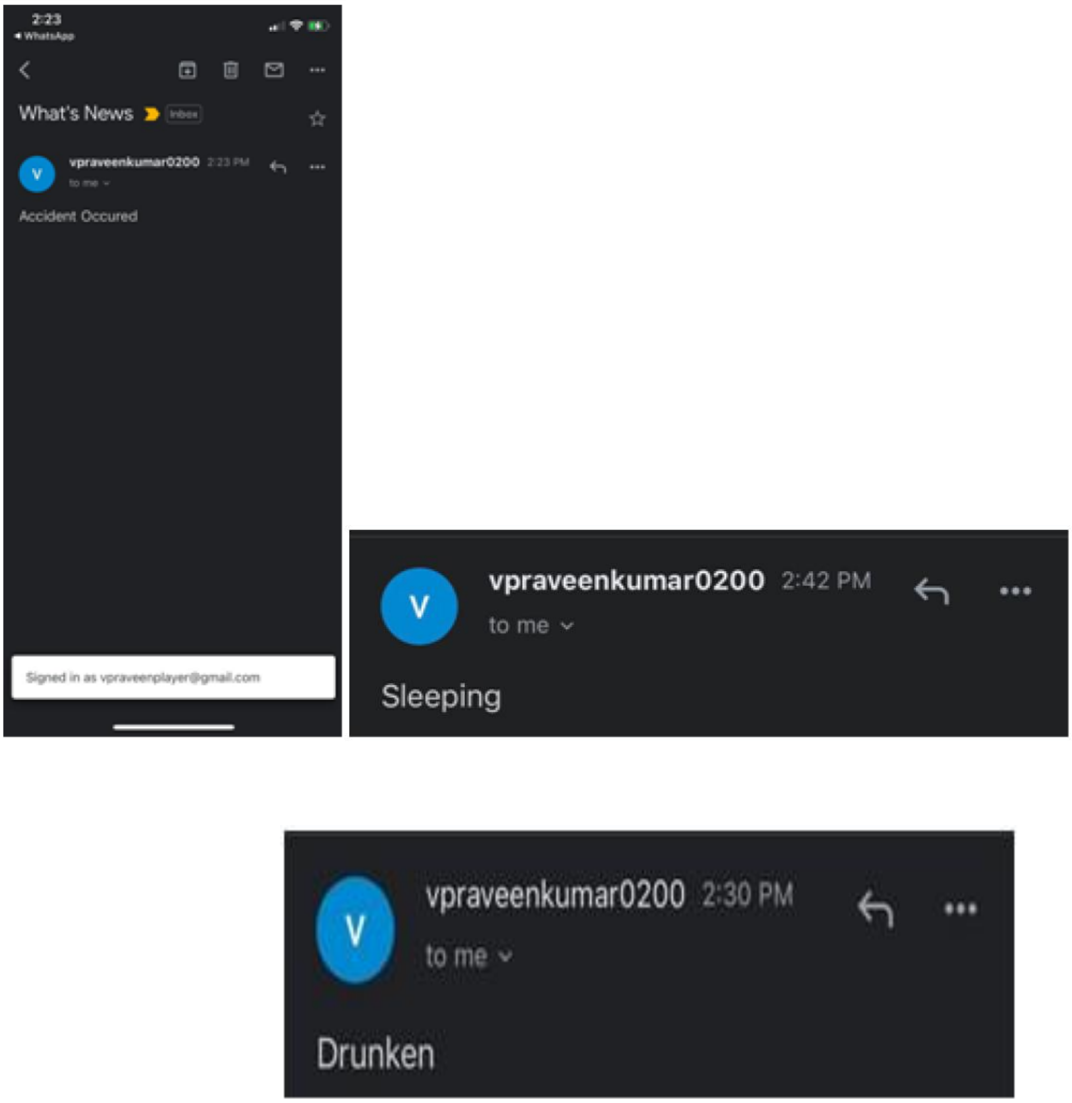


Fig:10.3: alert using email

Here is the picture of SMS received by the Designated User if an accident has occurred.

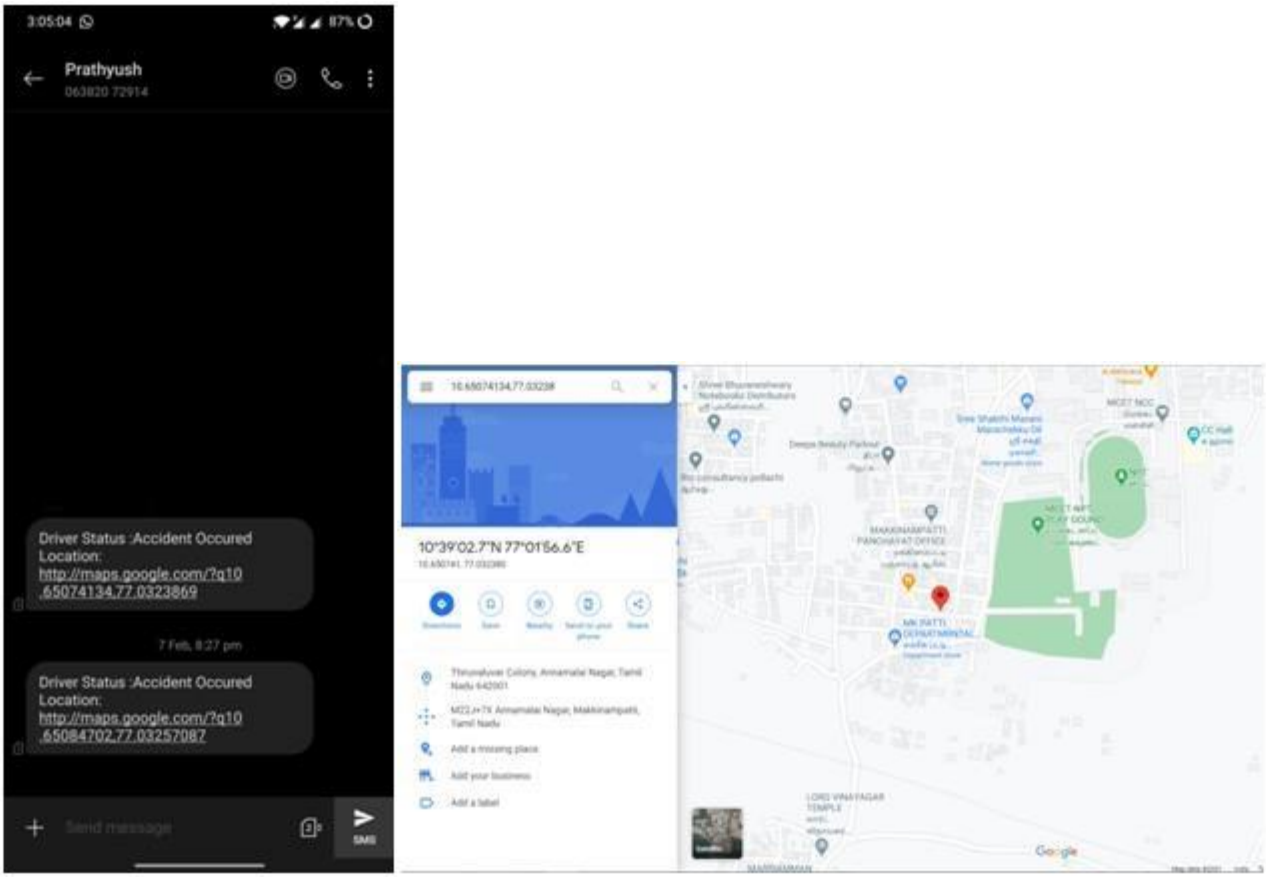


Fig 10.4: alert SMS

Android app which is used to fetch the location of the accident.

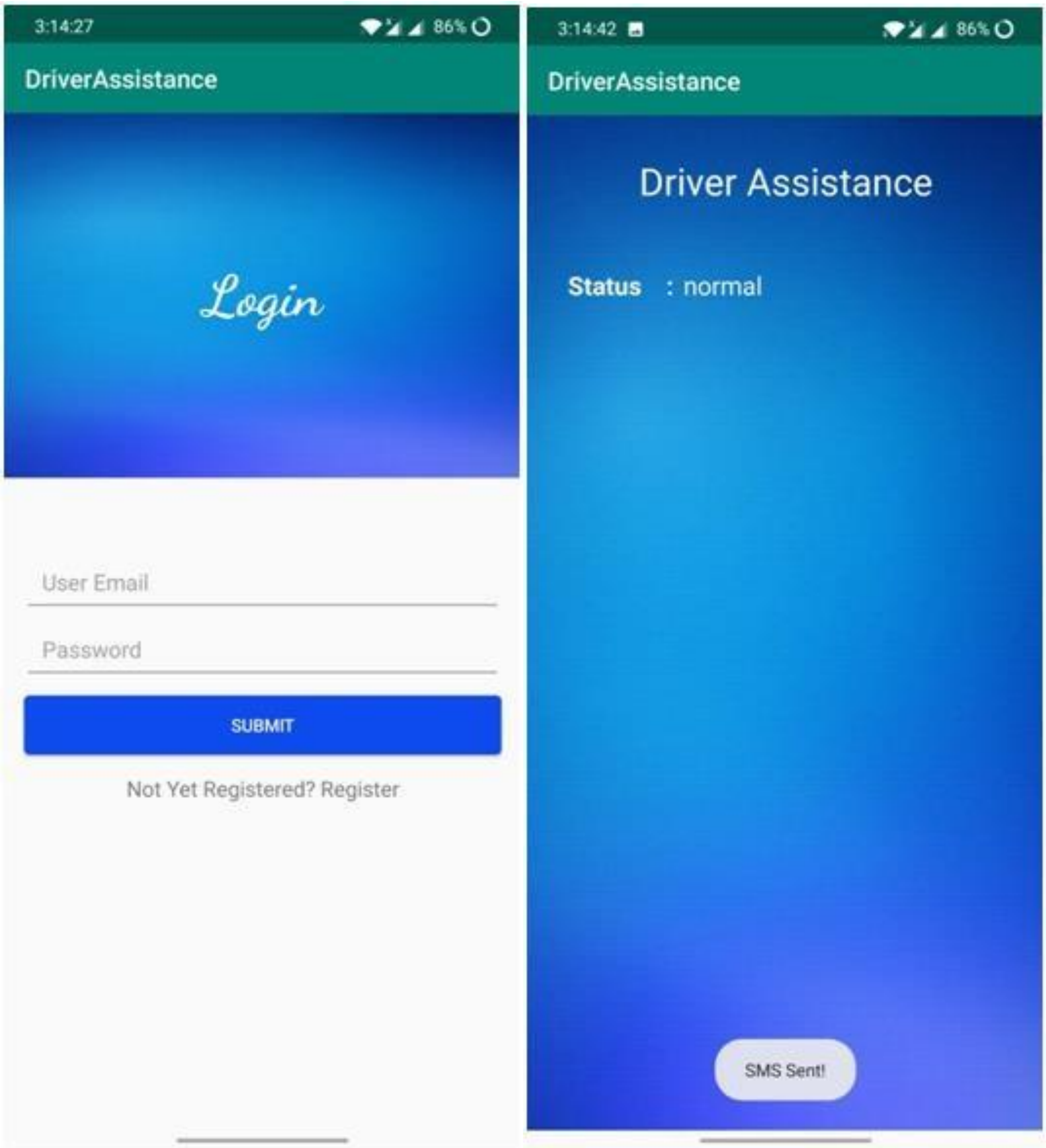


Fig 10.5: Android app

## CONCLUSION:

In this report we have given detailed information about how we have designed and implemented the driver assistance system using several hardware components and software algorithms with compatibility and cost efficiently. The main motive of this work is to ensure the safety and security of driver and passengers travelling in the vehicle. There are lots of researches related to this line of work, but our work validates and extracts input from multiple sensors and are digitally processed and delivered instantaneously to the end user. The Alert delivery schemes have been discussed in the report which make this module a compact and fit for daily use. These were possible only because of the underlying foundation of Internet of things. The utilization of a much-advanced futuristic technology also adds novelty to our project which many researchers missed to use in the past.

## FUTURE SCOPE:

This project will bring a gap between traditional cars and the cars of tomorrow. The cars are going to get automated and reduce the load off the driver. In recent times, the cars are taking on more tasks by themselves and increasing the safety of drivers, passengers and everyone else on the road. It helps that project attain a solid and stable position in the future endeavors to come where they are either directly utilized or used after upgrading. Here is Future application for this project.

## SMART TRANSPORTATION SYSTEM:

India is the second largest country with road network of 65% of land. The automobile industry has faced many revolutionary changes in recent times with invention of new braking systems, electronic control units, advanced gear systems, user-friendly seating and ventilation systems and many more. The concept of Smart Transportation system is to reduce the accidents due to inefficient communication between vehicles and increase the response time of precautionary stage if an accident has occurred. Smart Transportation system major role to play in reducing these human-related errors and increasing safety. It includes features like blind-spot monitors, tire-pressure monitors, adaptive cruise control, lane-tracing assist, road-sign assist, automatic high beams and more are already offered by some automakers as standard features, or as upgrade packages. Beyond safety, Smart Transportation system could unlock other benefits including traffic awareness, decreased insurance premiums, increased fuel efficiency and infrastructure use efficiencies. With fewer accidents on the road, there also will be fewer traffic jams related to those accidents. Many Smart Transportation system features help drivers better monitor their vehicles and the environments around them. In turn, this teaches humans to trust cars more and ultimately rely on vehicle technology to help them make good driving decisions.

The internet of things is transforming the multifarious sectors of our society each and every day. I.O.T is nowadays used to create innovative ideas and designs that have unlocked many networked car solutions. It has revolutionized the automobile industries by establishing long-distance connectivity, wide-range compatibility and accessibility. The instantaneous communication between the prototype and the concerned authorities promises both the passengers and their families a safe journey all along the way.

## REFERENCES


[1] Anuva Chowdhury, Rajan Shankaran, Manolya Kavakli, and Md. Mokammel Haque, “Sensor Applications and Physiological Features in Drivers’ Drowsiness Detection: Review”, *IEEE Sensors Journal, Vol. 18,* No. 8, April 15, 2018.

[2] B. Mandal, L. Li, G. S. Wang and J. Lin, "Towards Detection of Bus Driver Fatigue Based on Robust Visual Analysis of Eye State," in I*EEE Transactions on Intelligent Transportation Systems*,vol. 18, no. 3, pp. 545-557, March 2017.

[3] Yogesh Chellappa, Narendra Nath Joshi, and Vaishnavi Bharadwaj, “Driver Fatigue Detection System”, in *IEEE International Conference on Signal and Image Processing (ICSIP)*, 978-1-5090-2377-6, 2016.

[4] Javed Ahmed, Jian ping li, Saeed ahmed khan, Riaz ahmed shaikh, “Eye Behaviour Based Drowsiness Detection System”, 1*2th International Computer Conference on Wavelet Active Media Technology and Information Processing (ICCWAMTIP),* 978- 1-4673-8266-3115, 2015.

[5] Belal Alshaqaqi, Abdullah Salem Baquhaizel, Mohamed El Amine Ouis, Meriem Boumehed, Abdelaziz Ouamri, Mokhtar Kecge, “Vision Based System for Driver Drowsiness Detection”, *11th International Symposium on Programming and Systems (ISPS)*, 978-1-4799-1153-0, 2013.

[6] S.P. Lakshmi Narayan, E. Kavin Karthik, E. Prabhu, “IoT Based Food Inventory Tracking System” in *Advances in Signal Processing and Intelligent*

*Recognition Systems (SIRS 2018), Communications in Computer and Information Science*, vol. 968. Springer, Singapore, 2019.

[7] S. AruulMozhi Varman, A. R. Baskaran, S. Aravindh and E. Prabhu, "Deep Learning And IoT for Smart Agriculture Using WSN", *IEEE International Conference on Computational Intelligence and Computing Research (ICCIC)*, pp. 1-6, Coimbatore, 2017.

[8] Minoru Sakairi, “Water-Cluster-Detecting Breath Sensor and Applications in Cars for Detecting Drunk or Drowsy Driving”, IEEE Sensors Journal, Vol.12, Issue: 5, May 2012.

[9] J. Zaldivar, C.T. Calafate, C. Cano, P. Manzon, “Providing accident detection in vehicular networks through OBD-II devices and Android-based smartphones”, IEEE 36th Conference on Local Computer Networks, pp.813819, October 2011.

# APPENDIX A

## A.1 PERCLOS

**PERCLOS** means PERcentage of eyelid CLOSure. Here we calculate the proportion of time that the individual’s eyes are closed over a specific period of time. The position of the pupils of the driver is related to gaze score. These parameter estimations starts with face detection, followed by detecting eyes. It has been widely used as a valid measure of driver fatigue. PERCLOS uses a Support Vector Machine (SVM) to classify the eye state. Drowsiness measure at the appropriate moment was SVM. Continuous shaking of the head creates blurred images which would totally compromise the accuracy of eye state detection. Since these events are less frequent and the other measurements can compensate, the emerging loss of information would not make much damage.

### A.2 VANET

It is the abbreviation for Vehicular ad-hoc networks which are fundamentally constructed by MANETs (Mobile ad-hoc networks). It is a fast and spontaneous creation of a wireless network for vehicle to vehicle data communication. VANET plays a key role in Intelligent Transportation systems

(ITS). VANET was fundamentally manifested a five-layer architecture to detect abnormal behaviors. This establishes connectivity between vehicles in the close vicinity and helps them in lane maintenance and collision avoidance. It also establishes vehicle to roadside component data communication to provide safety and navigational services. They support a wide range of applications like generating Cooperative awareness messages (CAMs) whenever a fault is detected, Road Transportation Emergency Services for connectivity with fire brigades, Electronic brake lights for response to sudden opposite vehicle.

### A.3 WDC

WATER-CLUSTER DETECTION breadth sensor is also an alcohol detection system. . It carries out the processes based on the concepts of polarization of charges. The WCD sensor senses the exhaled breath by measuring electric currents of water clusters which are either positively charged or negatively charged and separated by an electric field. The WCD sensor is coupled with the alcohol sensor to form the WCD-alcohol sensor which detects electric currents from alcohol content in the breath. In addition to this, the WCD sensors also have a proximity range of 0.5m which is the approximate distance between the driver and the steering wheel or dashboard.

### A.4 ADABOOST TRAINING

Adaboost which is the shortened term for Adaptive boosting belongs to the domain of machine learning which can be used in collaboration with any other learning algorithm to enlarge the performance. It is a meta-algorithm that is generally applied on weak classifiers to get enhanced to strong classifiers with significant weights. In Haar cascade classification process Adaboost training plays a major role which is nothing but an object detection framework algorithm commonly known as the Viola Jones algorithm. Adaptive boosting is sensitive to outliers (calibration error or variations in data) and noisy data. It is also referred as an ensemble method that produces strong classifiers from a number of weak classifiers. One of the famous applications where Adaptive boosting is employed is the enhancement of performance of machine learning algorithms like decision trees on binary classification problems.

Invented by scientists Robert and Freund. It is an ensemble method that trains and deploys trees in series. It implements boosting, wherein a set of weak classifiers is connected in series such that each weak classifier tries to improve the classification of samples that were misclassified by the previous weak classifier. Such models are added until a training set is predicted or the maximum model limit is reached. When the weak classifiers are cascaded, the predictions are resolved from the weighted average of the weak classifiers. This way decision trees could be grown that would benefit the partitioning of samples with higher weights.