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# A proposed Accident Preventive model for Smart Vehicles

**Rishabh Malik , Naman Mittal**

Computer Science and Engineering Department, NIET College, India.

ABSTRACT: ***Now a days, drowsy driving is becoming biggest challenges leading to the traffic collision. Based on the existing data and statistics, several road accidents and causalities happen due to the drowsy driving which leads to severe injuries. To overcome these challenges, various studies have been done in designing systems that can predict the driver fatigue and alert him beforehand, thus avoiding him to fall asleep behind the wheel and cause an accident. Few existing approaches used psychological measures to give higher accuracy in checking the drowsiness of the driver. However, such approaches are actually intrusive as electrodes are supposed to be incorporated on the head as well as the body. In this paper, a non-intrusive and real-time system has been proposed. This system considers eye closure ratio as input to find driver drowsiness. If this ratio decreases from the standard ratio, the driver is alerted with the help of a notification and also an email alert is communicated to the owner of the vehicle. For our system, a Pi camera is used to catch the photos of the driver's eye and the entire framework is incorporated in a vehicle using Raspberry-Pi.***

**Keywords:** Drowsiness, Raspberry Pi, Haar Cascade classifier, Sensors, Eye Aspect Ratio, Regression Trees

## 1. INTRODUCTION

Among several issues leading to traffic accidents in this today's world, drowsy driving is one of the major challenges that requires high consideration. The road accidents or mis happenings usually occurs when the driver does not get sufficient amount of rest or sleep. Throughout the previous studies it has been found that several attempts were taken to detect the drowsiness of the driver by considering various parameters. We have proposed a method, which is based on the behavioral measurements, in which the eye closure ratio is used as the input upon behavioral measurements involve monitoring the eye blinking pattern, yawning, eye closure, facial movements via an external camera. In this work, the face of the driver was continuously recorded in order to detect eyes movements using a Raspberry Pi camera. In order to effectively capture the face, the Pi camera is mounted on the vehicle dashboard and is kept approximately 20cm away from the driver's face. This Pi camera is joined with the Raspberry Pi using a flexible cable and the Raspberry Pi itself, can be placed anywhere in the vehicle, out the human eyesight. Initially, the detection of facial landmarks was performed using the Haar Cascade classifier.

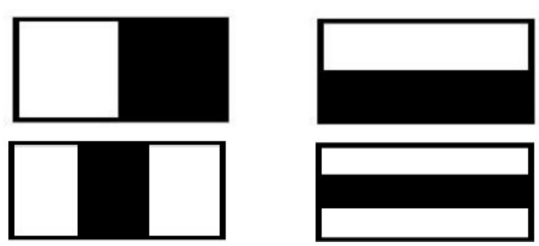

**Fig.1.1.** Example of rectangle Haar-like features



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## 2. PROBLEM STATEMENT

At present time, drowsy driving has become one of the major issues of the traffic collision. Use of the face detection and recognition system in lieu of the traditional methods will provide a fast and effective method of verifying person presence in the car or other vehicles accurately while offering a secure, stable system. The proposed system used the eye closure ratio as input parameter to detect the drowsiness of the driver. If the eye closure ratio deteriorates from the standard ratio, the driver is alerted with the help of a buzzer. The overall objectives is to develop a real time face detection and recognition system to perform the following tasks and we have applied it on car or some other vehicles:

- To check face movements in real time.
- To identify the detected eye blink by the use of EAR (Eye Aspect Ratio) Algorithm.
- To prevent the accident using the buzzer.

The scope of this system is to solve the problems that can arise in daily life:

1. The system can be used to detect faces from stored database.
2. The system can be used in any vehicles to detect driver face.
3. The system can be planned for congested places like airport, railway station that require more alertness of the vehicle owners.
4. The system can also be used in the offices for inspecting the employees to check whether is asleep or not

## 3. LITERATURE REVIEW

In last decades man researchers worked on drowsiness detection and made some progress. However, still research is going on in this field to make the system more reliable. Many existing methods implemented vehicle-based measures which involve mounting sensors on various components of the vehicle like on the steering wheel, accelerator to evaluate the intensity of drowsiness [1-3]. The process of implementing the vehicle-based measures can be further broken down into two categories. The evaluation can be performed based on two approaches, namely Steering Wheel Movement (SWM) and Standard Deviation of Lane Position (SDLP). In order to measure the SWM, an angle sensor is utilized to determine the driver's level of drowsiness based on his steering pattern. On the other hand, SDLP implements an external camera which is used to determine whether the vehicle is drifting out of its lane.

The existing work on face recognition ignored the issue of face stimulus, assuming that predefined measurement was relevant and sufficient. This suggests that coding and decoding of face images may give information of face images emphasizing the significance of features. These features may or may not be related to facial features such as eyes, nose, lips and hairs. We want to extract the relevant information in a face image, encode it efficiently and compare one face encoding with a database of faces encoded similarly [4].

## 4. PROPOSED SYSTEM REQUIREMENT AND METHODOLOGY

Face Detection and Recognition System is used by decision making team whether this person belong to the dataset stored or not. This module takes the captured image as input data and analyses it to find whether the captured face is there in the database or not. This module uses PCA algorithm for finding the data. After analysis this module marks that the candidate is verified and excel sheet is updated accordingly.

Hardware Requirements

- Camera (Atleast 5 MP)
- Raspberry Pi 3/3B+
- GPS Module



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Software Requirements

- Python 3
- OpenCV 3+
- Dlib

This part of the documentation describes in detail the design of Sentimental Analysis with the help of the diagrams such as DFD, sequence diagram, use case diagram etc.

#### 4.1 DATA FLOW DIAGRAM (DFD)

Figure 4.1 represents the data flow diagram for the proposed model in a clear and concise manner.

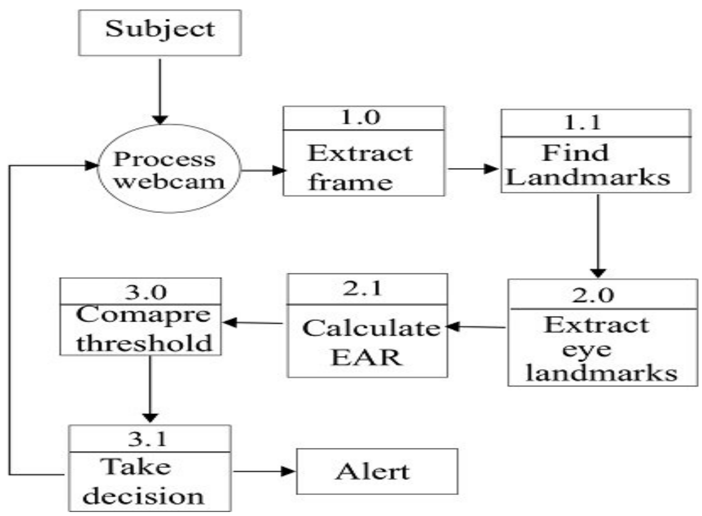


**Fig. 4.1:** Level 1 DFD for drowsiness detection

#### 4.2 Flow Chart

The flowchart figure 4.2 for the entire process simulation is as follows:



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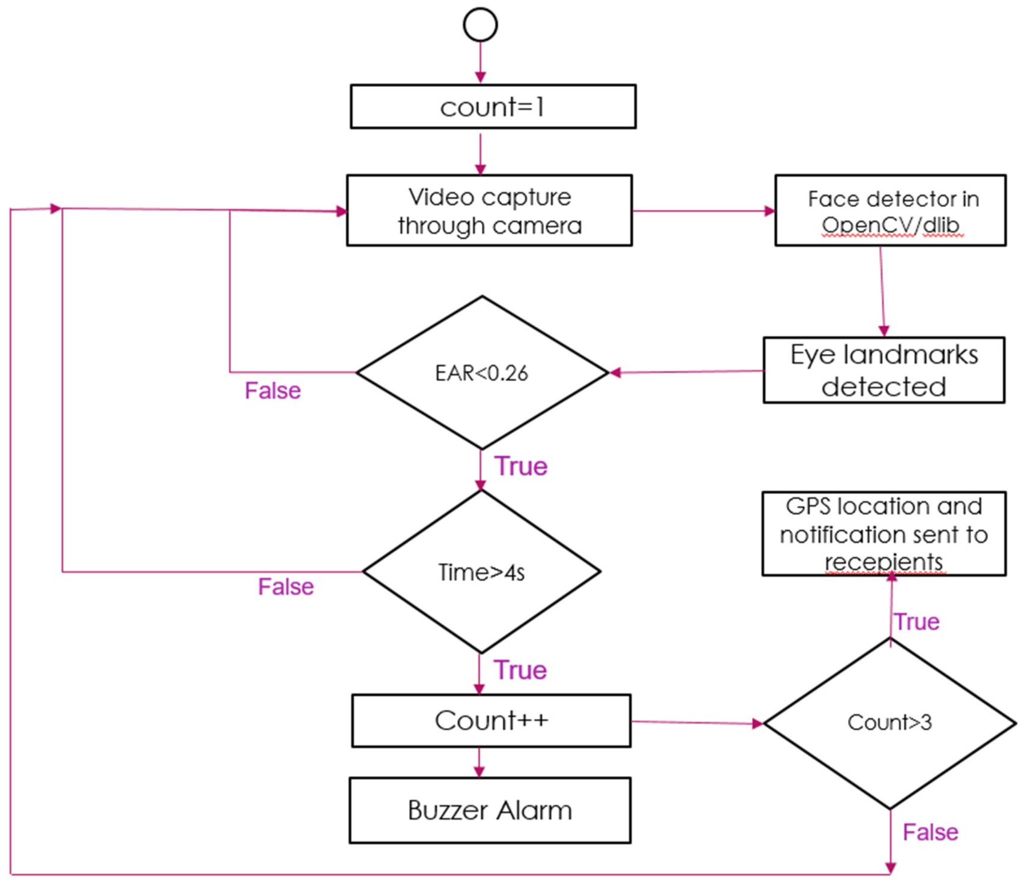


**Fig. 4.2:** Flowchart of the drowsiness detection system

The entire proposed framework has been divided into 4 modules-

i. UI Module
ii. Drowsiness Detection module
iii. Email Alert module
iv. Location Detection module

1. A window appears on running the application, this window is the UI of the project which takes in 3 inputs- driver name, relative/owner name and relative/owner email address.



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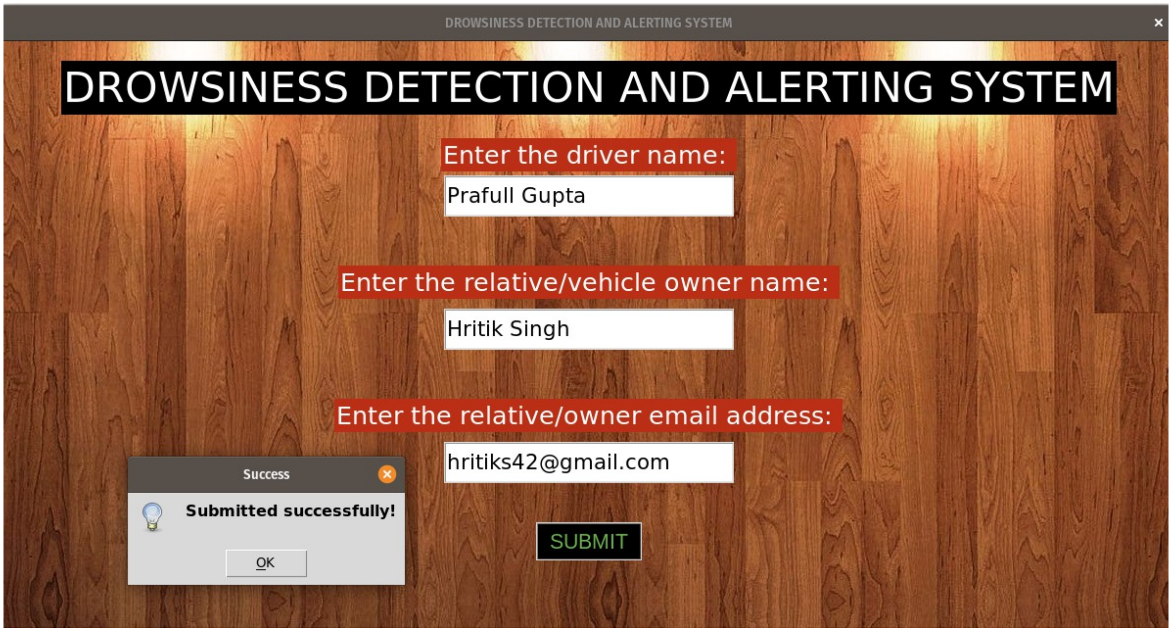


**Fig. 4.3:** Main UI window of the project

2. After filling the details and submitting them the live video window starts that checks for drowsiness and no face detection frame by frame.

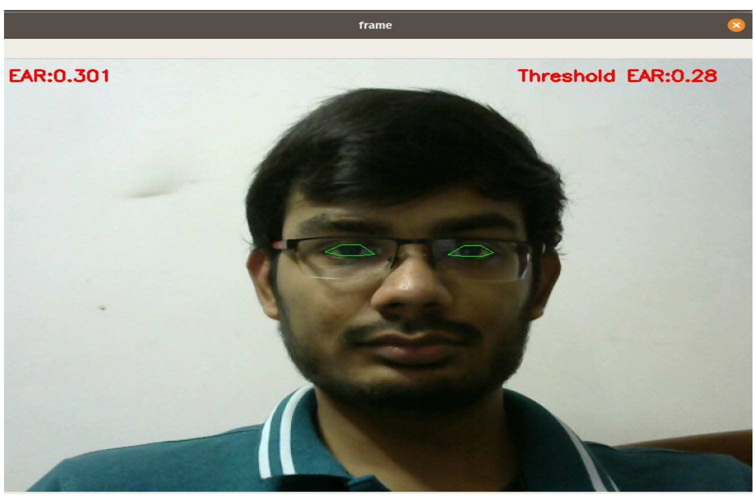


**Fig. 4.4:** Live video capturing window

3. If the face is not detected in the frame then the system shows an error and plays a sound no face detected.



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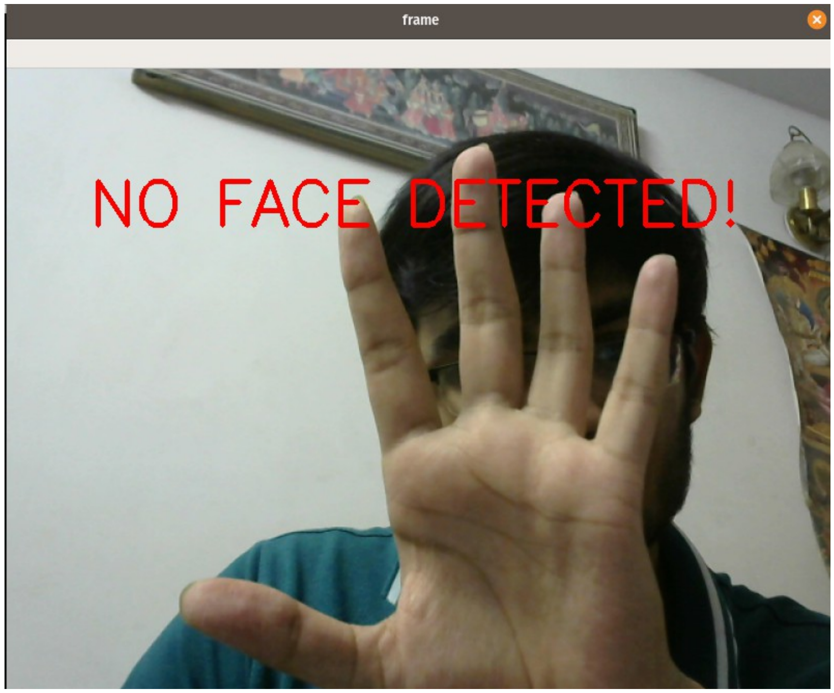


**Fig. 4.5:** No face detected window

4. If the driver is feeling drowsy i.e. if the EAR value is more than 4 seconds then the system shows a drowsiness alert and plays an alert sound.

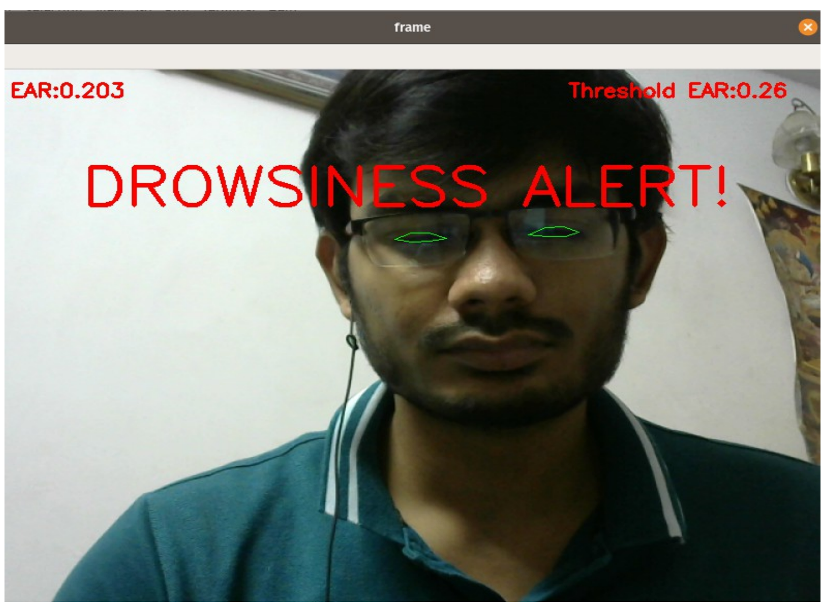


**Fig. 4.6:** Drowsiness alert system

5. Once the drowsiness is detected then an email is also sent to the relative/owner alerting him/her that the driver is feeling drowsy.



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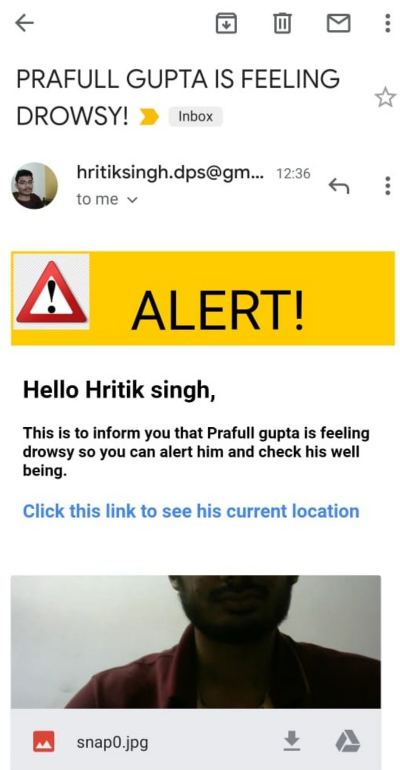


**Fig. 4.7:** Email alert sent to the relative/owner

6. In the email a link to the driver's current location is also send, upon clicking on the link Google maps page will open containing the driver's exact location of the time he was feeling drowsy.

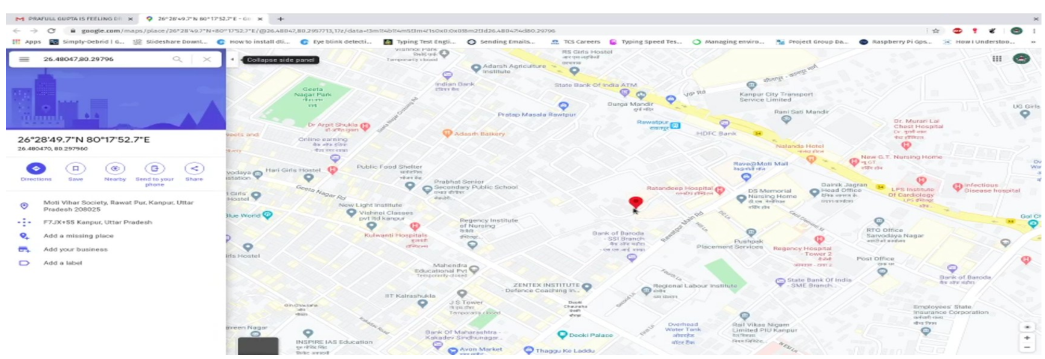


**Fig. 4.8:** Location of the driver in Google maps

### 4.2 Facial Landmark Detection



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The facial landmark is detected using the dlib library's facial landmark detector [Kazemi and Sullivan (2014)]. It is a pre-trained facial landmark detector inside the dlib library. The indexes of the 68 coordinates are shown below:

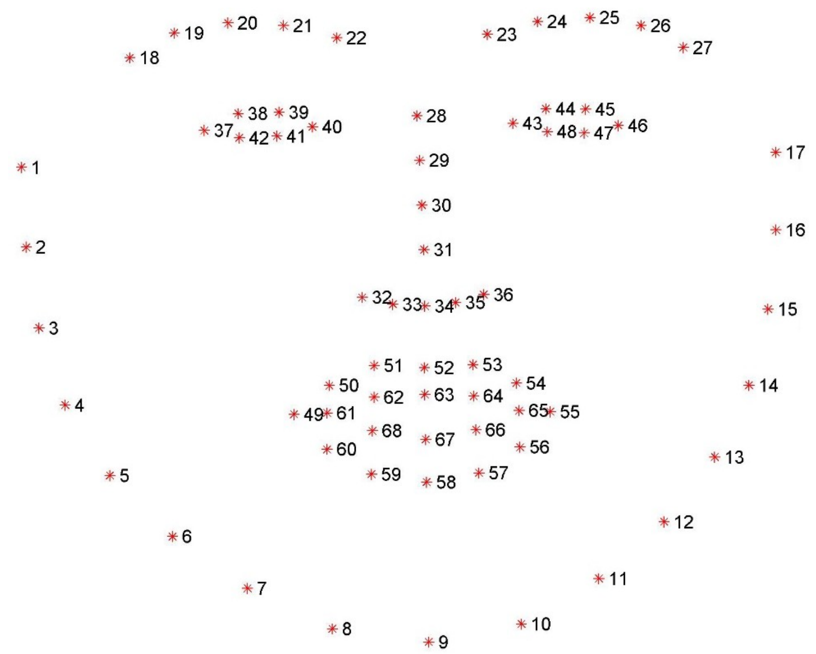


**Fig. 4.9** Visualizing the 68 facial landmark coordinates from the iBUG 300-W dataset

By making use of the facial landmarks, the eye aspect ratio is computed. This ratio is based on two factors that are the distances between facial landmarks of the eyes. This method for eye blink detection is efficient and easy to adopt that considers each eye as represented by 6 *(x, y)*-coordinates

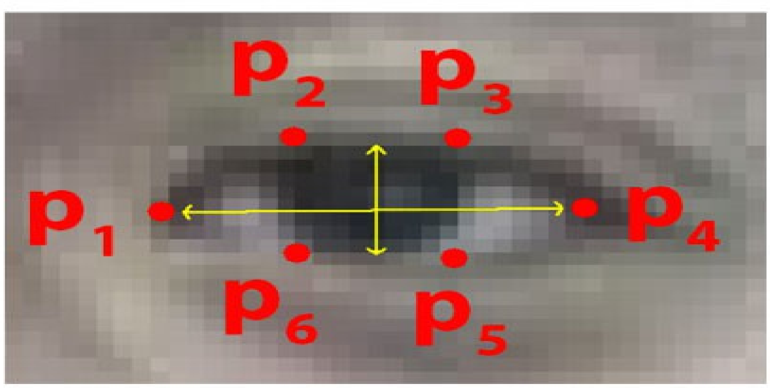


**Fig 4.10:** The 6 facial landmarks associated with the eye.



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The equation *eye aspect ratio* (EAR) [Soukupová and Čech, 2016] is used for real-time eye blink detection using facial attributes and is as follows where *p1, …, p6* are 2D facial landmark locations

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

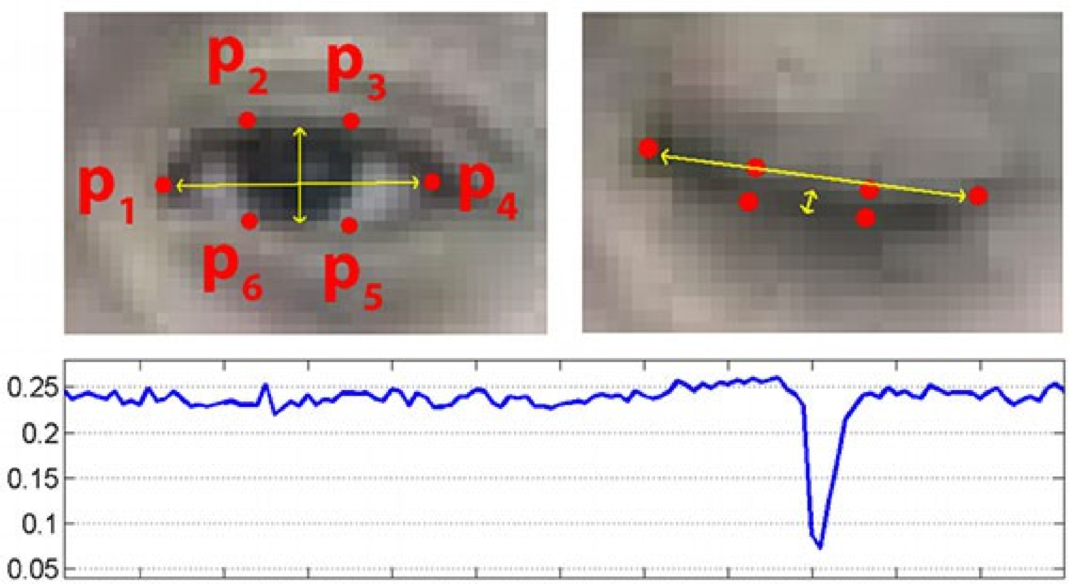


**Fig 4.11** *Top:* An open eye and closed eye visualization of eye *Bottom:* Plot showing the eye aspect ratio per time [Soukupová and Čech].

## 5. CONCLUSION

This paper proposed a trusted and secure drowsiness detection and alerting system for vehicle driver. This newly proposed system will minimize the number of accidents happening daily and help people drive safely. The requirement of this model for specialized hardware is very limited as it uses a Raspberry Pi and a camera to be installed. Future work could also include adding infrared cameras to help increase the accuracy in the dark environment.



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