# Recognizing Driver Somnolence using computer vision

**Anitha K, Nischitha V N, Prakruthi SP, Sindhu D K**

***Abstract:*** ***Every year road accidents are getting increased. Somnolence and Drowsiness of drivers are one of the main reasons for road accidents. So we have to do more research on this area and find out novel technologies. Common exiting methods are vehicle based, behavioral based on physical parameters. And some techniques are effecting by disturbing the drivers. Methods need costly hardware and handling of data. Here, proposed method a driver sleepiness detection technique having low cost and high accuracy is developed. Here we are using image processing technique and Open CV, the drivers face is recording using webcam and face is detecting in every frames. Here aspect ratio of eyes(EAR), ratio of opening mouth (MOR) and length of nose ratio(NLR) are pointing. Then we calculate the facial landmarks using dlib library. Detection of drowsiness is depends on the computation of EAR, MOR and NLR and threshold values. Machine learning algorithm haar-cascades algorithm is used***

***Index terms:Somnolence, webcam, EAR, MOR, NLR, pedestrian walking***

## I. INTRODUCTION

Drowsy drivers are one of the main reasons of vehicle accidents. The main sitting target of such accidents are the drivers who drive transport vehicles for long route, nonstop extend period of time and drivers who drive during dark for long trips. Sleepy drivers are the nightmare to travellers in each nation[1-2]. Consistently, countless wounds and death are happening because of these issues. So, drowsiness detection and its sign is a dynamic zone of research because of its enormous practical relevance. The fundamental system has three modules; image acquisition framework, preparing framework and cautioning framework. Here, in image acquisition framework capturing of driver's face in the form of video and it is passing to the next module, preparing framework where the detection of driver drowsiness is taking place, once the somnolence is detected , caution or warning is sending to the next system. Then alarm or warning is sent to the driver.

**Revised Manuscript Received on December 22, 2018**.

**Anitha K**, Assistant Professor, Department of Computer Science, RajaRajeswari College of Engineering,Bengaluru

**Nischitha V N,** UG scholar, Department of Computer Science and Engineering, RajaRajeswari College of Engineering, Bengaluru

**Prakruthi SP**, G scholar, Department of Computer Science and Engineering, RajaRajeswari College of Engineering, Bengaluru

**Sindhu D K** UG scholar, Department of Computer Science and Engineering, RajaRajeswari College of Engineering, Bengaluru

## II. RELATED WORK

Sleepiness detection has numerous implications including decreasing streets traffic accidents. Utilizing image processing techniques is among the new and dependable strategies in drowsy face. The present examine was done to research drowsiness and giving pictures of drivers' face, utilizing augmented reality driving test system. So identifying dimension of drowsiness as indicated by the flag, data identified with 25 drivers was recorded with imaging rate of 10 fps. Besides, 3000 frames were broke down for every driver. The casings were examined by changing in dim scale space and dependent on the cascade and Viola and Jones strategies and the pictures attributes were extricated utilizing binary and histogram techniques. Road accidents occur due to many reasons. There are few causes for road accidents which are listed below: few among them are because of the driver, climatic conditions, due to pedestrians, bad road conditions and many more [3]. In vehicle based method, unintentional and intentional movements are to be detected in order to detect somnolence of the driver. Computerized automotive techniques can be used to overcome those safety problems [4]. Based on the skin color characteristics, face of the driver can be identified from the image captured in vision based driver somnolence detection system [5]. Challenging task in detection of humans in an image is because of their variable appearance and wide range of poses. Pedestrian detection using images need some robust feature to differentiate human forms correctly [6].

Many problems may encounter during detection of face of the driver like low light, distance between driver and camera, atmospheric blur, these need to be taken care which can be detected by giving many number of dataset or training set to the system[7]. We focus on detecting the face of the driver using web camera by extracting the color features of the human [8]. There is variety of models that helps to detect the face of the driver for considering the facial features [9]. In the early 2000s the image processing techniques were used to detect the face of the driver by framing the frames [10]. In order to get rid of the facial hair on the face and the get a better and a clear image infrared light is used in the camera to detect the face image clearly [11].



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The mpl neural organize was connected for breaking down data.70% of data identified with every driver were embedded to the system of which 15% for test and 15% for approval. In the last stage the precision of 93% of the yields were assessed. The insightful identification and use of different criteria in long haul time outline are of the upsides of the present investigation, contrasting with different explores. This is useful in early discovery of driver drowsiness and makes them cautious.

## III. PROBLEM STATEMENT

Normally, the driver drowsiness is identifying by using three techniques; 1.Based on vehicle, 2. Based on visual characteristics 3.Based on Physiological parameter. In vehicle based strategy, various measurements like guiding wheel development, quickening agent or brake design, speed of vehicle, sidelong quickening, deviations from path position and so on are observed. Discovery of some irregular variation of qualities can define as sleepiness. This estimation is not disturbing like hardware attached. For visual behavior technique, physical character of person like squinting of eye, shutting of eye, yawning, pose of neck and so forth are examined to identify the sleepiness .This is additionally not disturbing estimation like straightforward webcam utilized to recognize this highlights. In physical technique the physical parameters like Electrocardiogram (ECG), Electooculogram (EOG), Electroencephalogram (EEG), heartbeat, beat and other parameters observed, these measurements, sleepiness or exhaustion rate is recognized [12]. This estimation of the hardware connected on the person who is driving will divert. According to the hardware utilized for the framework, the size and cost of the application will increase. In any case, consideration of more parameters/highlights will build the precision of the framework to a specific degree. These components help us to build up a minimal effort, driver's drowsiness real time detection framework having satisfactory precision. Subsequently, here in this proposed system camera framework to identifying a person's exhaustion from visual picture just utilizing machine leaning and image processing for this framework minimal effort and additionally versatile.

## IV. PROPOSED MODEL

The data flow diagram of our proposed system driver somnolence monitoring system has been portrayed in Figure 1. We've framed this system using the machine learning techniques using python programming language. Initially, the face is captured by utilizing camera and it will be situated direct of the person who is driving to catch the face picture. Capturing of video and the separated frames to acquire two-Dimensional pictures. Detection of Face using haar cascades algorithm. Subsequent to identifying the face, using facial landmarks of eyes, nose, and mouth are set apart to pictures. From the facial landmark, EAR, MOR and NLR evaluated and utilizing these highlights and ML technique. The choice as acquired for sleepiness of the person who is driving. In the event that sleepiness is recognized, a caution will be sent to the driver to wake up. The subtitles of each square are talked about underneath. The details are discussed below.

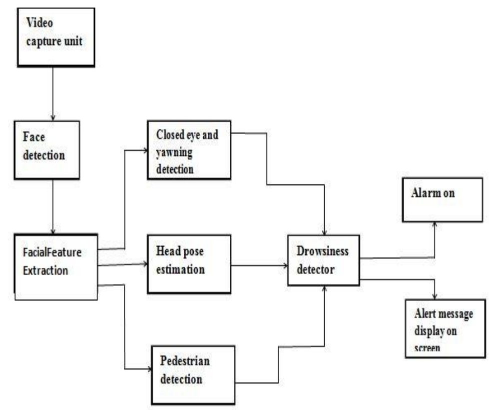


**Fig 1: Data flow diagram of the modules**

The proposed system includes 3 modules, namely:

### A. Image acquisition:

Image acquisition is a process of capturing and detecting of image from the source. This module includes video capture unit and face detection unit. In the Video capture unit the webcam is placed on the dash board of the car to capture the face of the driver in the vehicle and the driver's face is been recorded. And this recorded video is converted into frames. After converting into frames preprocessing is processed, where the image is converted into grey scale. In the face Detection unit the frames from video capture unit is sent into face detection unit. Here the image quality is increased by applying two process. Firstly, the noise and dust in the image are removed and the pixel values are increased for a clear image. Secondly, converting the image into grey scale.

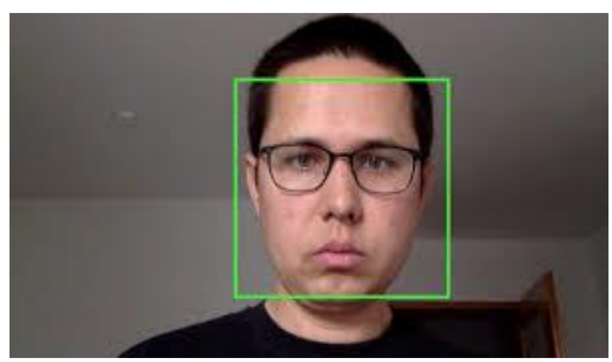

**Fig 2: Frame that detects the face**

This unit mainly focuses on detecting the driver's face. The face is detected using Haar-cascade algorithm. Haar-cascade algorithm is a machine learning algorithm, which is used to


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detect the object from videos/images. The green rectangular box as seen in the fig indicates the detected part. Hence, in the above fig the face is been detected.

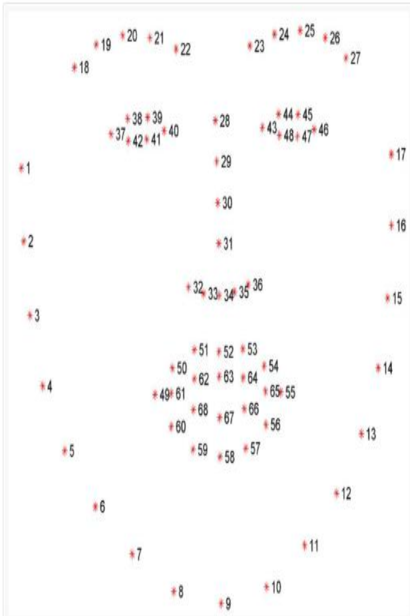


**Fig 3: Facial landmark positions**

In the facial landmark unit, once the face is detected, using dlib library functions facial landmarks are created. To identify the somnolence of the vehicle driver the landmark is created for eyes, mouth and nose. Points are used to indicate the facial landmark.

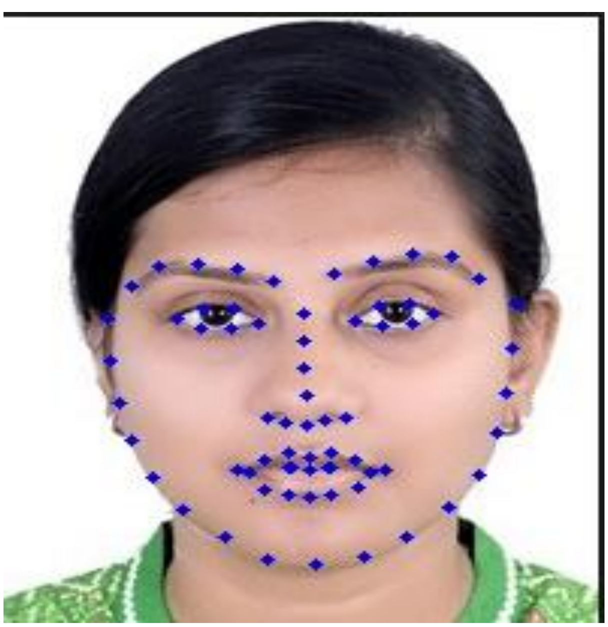

**Fig 4: Facial landmark positions on the face**

### B. Preparing framework

After identifying the landmarks of face, these are steps of preparing framework. The aspect ratios are calculated based on the Euclidian distance. Euclidian distance is used to calculate the distance between two points, by taking the ratio of its width and height with the corner points. Euclidian distance formula is d = math.sqrt(sum([(a - b) ** 2 for a, b in zip(x, y)])) where d is the distance.

**1) Eye aspect ratio (EAR):** With the help of EAR aspect eyes closed is detected during somnolence. It is calculated by using the Euclidian method for eye corner points and the ratio of height and width of the eyes.

A threshold value 0.35 is given for EAR. When the eyes are closed the value of EAR will be zero, if the EAR value meets and gets beyond the threshold value then it is said that the eyes are closed and somnolence alert message is displayed for the driver with the alarm.

**2)Mouth opening ratio (MOR):** With the help of MOR aspect yawning is detected during somnolence. It is calculated by using the Euclidian method for mouth corner points and the ratio of height and width of the mouth.

A certain threshold value given for MOR. When the mouth is open during yawning the value of MOR will increase dynamically, if the MOR value meets and gets beyond the threshold value then it gives a somnolence alert message displayed for the driver with the alarm.

**3)Head Bending**: head bend is also the result of somnolence of the driver. Our system also detects the head bend of the driver due to somnolence. Here head bend is calculated by the nose length ration function. The bend of the head is usually caused upward and downward that is in y-axis of the line. The alarm and alert message is given when the NLR is beyond the given threshold value for upward and downward direction both.

**4)Pedestrian Detection:** Another webcam is used in order to detect the pedestrian around the vehicle, after detecting the pedestrian it will cause an alert message or alarm such that the driver will get alert. Histogram of oriented gradients is used to detect or discover the passerby. Initially, the video is recorded and this recorded video is converted into frames that are the image is resized. Further, the image is converted into grey scale. And in the detection unit the body of the pedestrian will be detected and landmark is created. Thus gives an alert message or alarm for the driver that the pedestrian are nearby the vehicles.

### C. Cautioning Framework

This module gives the caution in the form of message and alarm to the driver. We have deployed this cautioning module to eye aspect ratio, mouth aspect ratio, head bend and for pedestrian detection.

## V. EXPERIMENTAL RESULTS

The results and discussion section briefs about the final discussion of the system along with its functionality and the


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usage of system/applications. The section demonstrates the snapshots of the implementation when executed on a system. The Fig 5. Shows the Home Page of our proposed system. It is the main page of the somnolence detector where the detection can be done by the eye aspect ratio and the mouth aspect ratio, head bend ratio and the pedestrian walking detector.

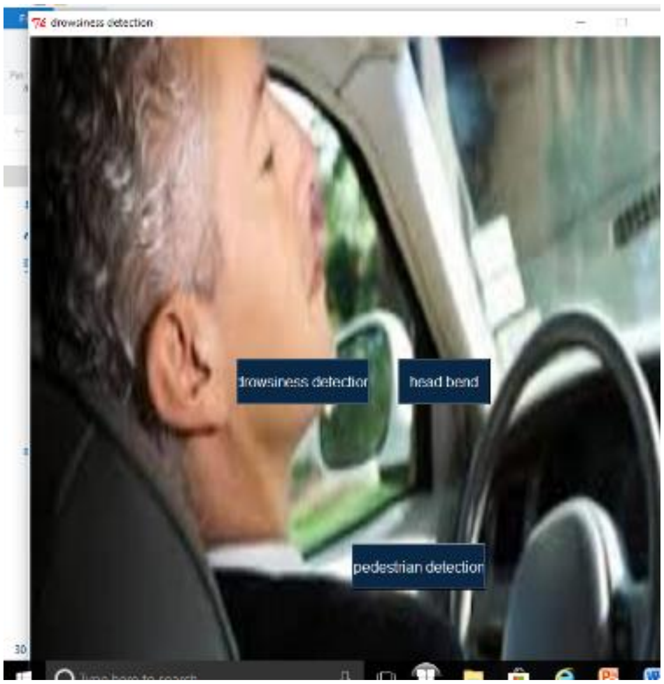


**Fig 5: Home page**

The Fig 6. Shows the somnolence alert message and an alarm after detecting the closed eye. Here, by using a webcam the face of the driver is recorded first using the video capture unit and the video/images are converted into frames. Once the frames are formed the face is detected and the facial landmark positions are marked on each frame. Then eye aspect ratio is calculated on the position of the eyes. If the eye aspect ratio is beyond the given threshold value then this setup detects the somnolence of the driver. And the cautioning framework alerts message and an alarm to the driver for the closed eye.


**Fig 6: Somnolence alert message with an alarm for closed eyes**

The Fig 7. Shows the somnolence alert message and an alarm after detecting the mouth yawning. Here, by using a webcam the face of the driver is recorded first using the video capture unit and the video/images are converted into frames. Once the frames are formed the face is detected and the facial landmark positions are marked on each frame. Then mouth aspect ratio is calculated on the position of the mouth. If the mouth aspect ratio is beyond the given threshold value then this setup detects the somnolence of the driver. And the cautioning framework alerts message and an alarm to the driver for the yawning.


**Fig 7: Somnolence alert message with an alarm for yawning**


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The Fig 8. Shows the somnolence alert message and an alarm after detecting the drowsy head bend. Here, , by using a webcam the face of the driver is recorded first using the video capture unit and the video/images are converted into frames. Once the frames are formed the face is detected and the facial landmark positions are marked on each frame. Then nose length ratio is calculated on the position of the nose. If the nose length ratio is beyond the given threshold value then this setup detects the somnolence of the driver. And the cautioning framework alerts message and an alarm to the driver for the head bend.

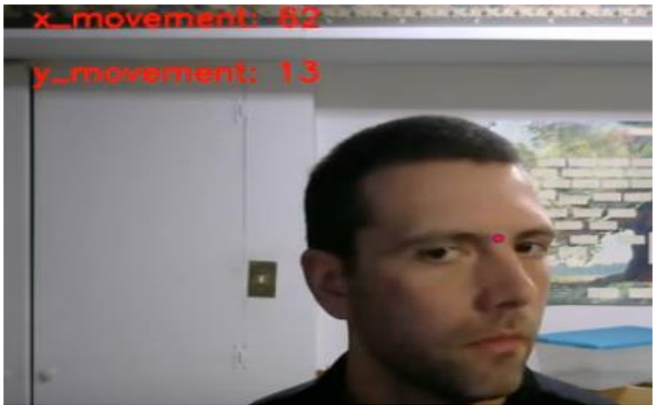


**Fig 8: Somnolence alert message with an alarm for head bend**

The Fig 9. Shows the alert message with an alarm for pedestrian walking around. Here, by using a webcam the pedestrians are recorded first using the video capture unit and the video/images are converted into frames. Once the frames are formed the human body is detected on each frame. If the length ratio is beyond the given threshold value then this setup detects the pedestrian is near. And the cautioning framework alerts message and an alarm to the driver for the pedestrian walking.

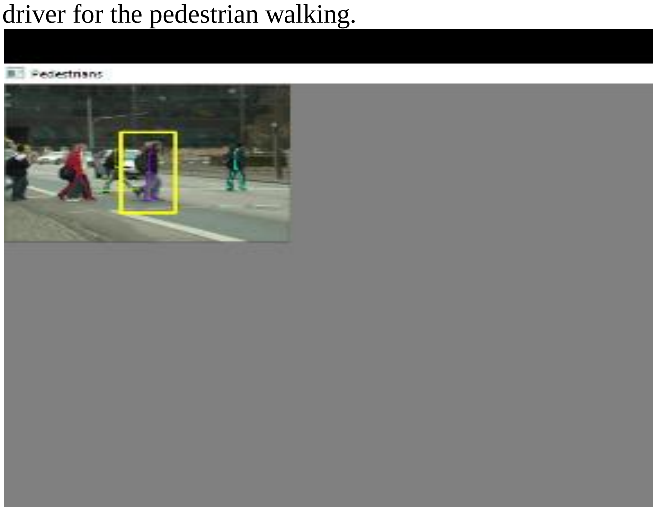


**Fig 9: Somnolence alert message with an alarm for pedestrian walking**

## VI. CONCLUSION

The driver somnolence is detected by the implemented system. Here we have developed our system based on recognizing the visual characteristics for detecting using the machine learning techniques using the face detection algorithm called Haar-Cascade algorithm. If the aspect ratios are beyond the given threshold values an alert message with an alarm is given to the driver. Using one more web camera the pedestrians walking around beyond the given threshold distance the system detects the pedestrian with an alarm sound. This system helps in reducing the accidents happening on road due to somnolence.

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