IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
IJARSCT
Impact Factor: 6.252
Volume 2, Issue 5, May 2022

Real Time Driver Drowsiness Detection

Harshal Patil, Varsha Khandekar, Prashant Rajput, Deepak Somani, Harshal Chippa
Students, Department of Information Technology
Smt Kashibai Navale College of Engineering, Pune, Maharashtra, India

Abstract: *In recent years, driver fatigue has been one of the leading causes of road accidents around the world. One direct way to measure driver fatigue is to measure the driver's condition, i.e., drowsiness. Therefore, it is important to recognize the drowsiness of the driver to save his life. The aim of this project is to develop a prototype of a driver drowsiness detection system. This system is a real-time system that continuously records the driver's image and, according to the algorithm, measures the condition of the eye and warns the driver if necessary. Although there are many different methods of measuring driver fatigue, this approach is completely unobtrusive, does not affect the driver and provides the exact condition of the driver's eye. Distance between facial features. If the eye closure exceeds a certain level, the driver is recognized as sleepy. Several OpenCv libraries and the Dlib library are used to implement this system. The developed system is implemented by means of a camera, i.e. WebCam.*

Keywords: OpenCv, Dlib, Eye Aspect Ratio, Euclidean Distance.

I. Introduction

The driver's alertness deteriorates due to lack of sleep, prolonged and continuous driving, or other illnesses such as brain disease, etc. Various surveys of traffic accidents show that about 30 percent of accidents are caused by driver fatigue. normal period for man, then excessive fatigue occurs and also leads to fatigue, which leads the driver to drowsiness or loss of consciousness. Drowsiness is a complex phenomenon that suggests that the driver's warnings and awareness are decreasing, although there is no direct measure to detect drowsiness, but several indirect methods can be used for this purpose.

Various types of methods for measuring driver drowsiness are mentioned, including vehicle-based measurements, physiological measurements. With these methods, an intelligence system can be developed that warns the driver in the event of drowsiness and avoids accidents.

The above approaches to sensing drowsiness primarily make prior assumptions about measurements based on the vehicle and environment measurements. The automotive industry has also tried to develop various systems for predicting driver drowsiness, but few commercial products are available today. Conduct such as closing eyes and yawning. Measurements based on vehicle and environmental factors only contribute 4% and 5% to traffic accidents. It is for this reason we have proposed a method to detect drowsiness through video or webcam, analyze the recorded video images and create a system that can analyze every frame of the video.

II. RELATED WORKS

Some efforts have been reported in the literature on the development of the not-intrusive monitoring drowsiness systems based on the vision. In [1], a method that detect the face using Haar feature-based cascade classifiers is proposed. In [2], a method to detect the drowsiness by using Eye state detection with Eye blinking strategy is presented. In [3], Authors reviewed and discussed about driver drowsiness and different methods to detect drowsiness. In [4], Authors have proposed a new driving drowsiness detection algorithm with consideration of individual differences usingn a deep cascaded convolutional neural network model named DCCNN and EAR. In [5], a novel drowsiness detection algorithm using a camera near the dashboard which uses an AdaBoost classifier based on the Modified Census Transform features and regressing Local Binary Features are used for face landmark detection. In [6], Authors presented a survey of approaches to driver drowsiness detection using machine learning techniques and discussed the range of features and measures used for classification. In [7], a low cost, real time driver drowsiness monitoring system based on visual behavior and machine learning is proposed by Authors. In [8], Authors introduced a machine learning approach for visual object detection which is capable of processing images extremely rapidly and achieving high detection rates. In [9], a continuous driver tiredness observing framework has been proposed by authors which is dependent on visual conduct and AI. In [10], an adaptive thresholding technique has been developed to detect driver drowsiness in real time. The developed system works accurately with the generated synthetic data. In [11], a real time eye blink monitoring system is proposed to identify the driver is drowsy or not. In [12], a new algorithm is proposed to determine open or closed state for an eye, based on the difference between iris or pupil color and white area of the eye in open state. In the proposed method, the vertical projection is used to determine the eye state. In [13], authors proposed a new driver monitoring method considering both driver drowsiness and driver distraction factors.

III. PROPOSED SYSTEM

The drowsiness detection while driving tends to major accidents; to avoid this issue the following model is designed. There are several steps to decide about the driver's fatigue. First, face region should be extracted from the captured image. Second, eye area is found in the face. Third, mouth should be detected in the face area. These two tasks collaborate with each other to improve the face detection results. Then yawn and eye closure detection tasks are applied to the extracted mouth and eye. Initially, the video is recorded using a webcam. The camera will be placed at in front of the driver to capture the front face image. From video, images are extracted to obtain 2D images. After detecting the face, facial landmarks such as the position of the eyes, nose and mouth are marked on the images. From the facial landmarks, the EAR and MOR is quantified and using these characteristics and the machine learning approach, a decision on drowsiness of the driver is taken. If drowsiness is detected, an alarm will be sent to the driver to warn him/her. Subsequently the face is tracked in the next captured frames and the procedure is repeated. Fig. 1 shows the overall architecture of the proposed system.

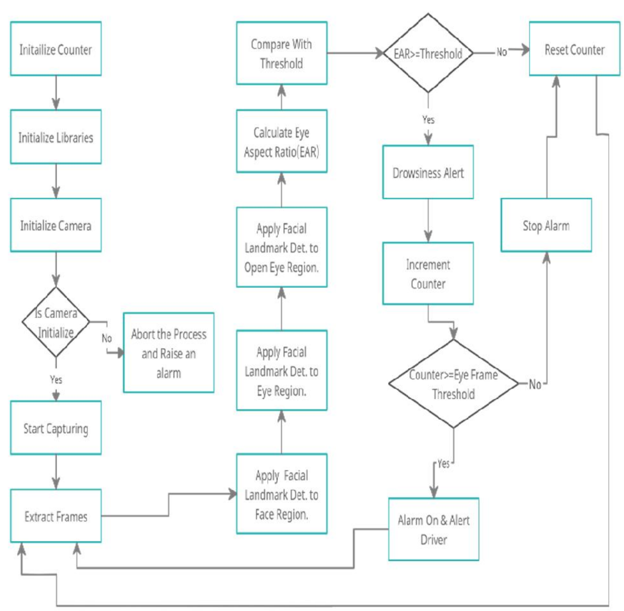

Fig.1. Process Flow of the Proposed System

3.1 Face Detection

For the face Detection we will use Haar feature-based cascade classifiers which is an effective object detection method proposed by Paul Viola and Michael Jones in [8]. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, Haar features are used. A cascaded Adaboost classifier with the Haar-like features is exploited to find out the face region. First, the compensated image is segmented into a number of rectangular areas at any position and scale within the original image. Because of the different facial features, the Haar like feature is efficient for real-time face recognition.

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

Impact Factor: 6.252

Volume 2, Issue 5, May 2022

3.2 Eye's and Mouth Detection

In the system we will use facial landmark prediction for eye detection Facial landmarks are used to localize and represent salient regions of the face. Facial landmarks have been successfully applied to face alignment, head posture estimation, switching faces, blink detection, and much more. In the context of facial landmarks, we aim to use shape prediction methods to identify important facial structures on the face. Detecting facial landmarks is therefore a two step process:

- Localize the face in the image.
- Detect the key facial structures on the face ROI.

The pre-trained facial landmark detector inside the dlib library is used to estimate the location of 68 (x, y)-coordinates that map to facial structures on the face. The indexes of the 68 coordinates can be visualized on the Fig. 2

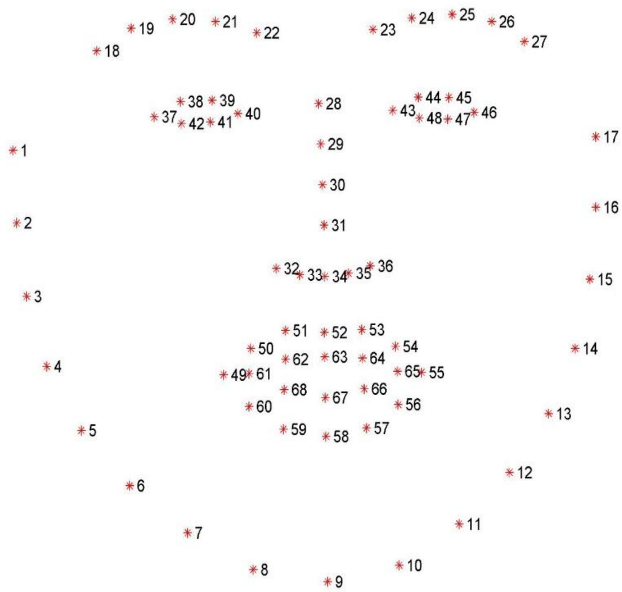

Fig.2. Facial Landmark Co-ordinates

We can detect and access both the eye region by the following facial landmark index show below.

- The right eye using indexes [37, 42].
- The left eye using indexes [43, 48].

Also, we can detect and access the mouth region by the following facial landmark index shown below.

- The mouth using indexes [49, 60].

3.3 Recognition of Eye's and Mouth State

A simple but efficient algorithm is used to detect blinking eyes and yawning using a newer facial landmark detector. A single scalar quantity reflecting an eye opening level and the driver is yawning or not is derived from the landmarks. Finally, blinks are detected with a per-frame sequence of the eye aperture estimates by an SVM classifier trained with examples of blink and non-blink patterns. The driver is yawning or not is also detected using the same algorithm.

Eye Aspect Ratio Calculation

The reference points of the eye are recognized for each video image. The eye aspect ratio (EAR) between height and width of the eye is computed.

$$EAR = \frac{\| 44 - 48 \| + \| 45 - 47 \|}{2\| 43 - 46 \|}$$

Here, above equation shows the formula for EAR calculation. The EAR is mostly constant when an eye is open and is getting close to zero while closing an eye. Since eye blinking is performed by both eyes synchronously, the EAR of both eyes is averaged.

Mouth Opening Ratio Calculation:

Mouth opening ratio is a parameter to detect yawning during drowsiness. Similar to EAR, it is calculated as,

$$MOR = \frac{\| 51 - 59 \| + \| 52 - 58 \| + \| 53 - 57 \|}{3 \| 49 - 55 \|}$$

Here, above equation shows the formula for MOR calculation. As defined, it increases rapidly when mouth opens due to yawning and remains at that high value for a while due to yawn (indicating that the mouth is open) and again decreases rapidly towards zero.

3.4 Eye and Mouth State Determination:

Finally, the decision for the eye state and mouth state is made based on EAR and MOR calculated in the previous step. If the distance is zero or near zero, the state of the eye is classified as "closed"; otherwise the state of the eye is identified as "open". And if the distance is greater than four or near to four then it is classified as driver is yawning.

3.5 Drowsiness Detection

The last step of the algorithm is to determine the person's condition based on a pre-set condition for drowsiness. The average duration of a person's blink is 100-400 milliseconds (i.e., 0.1-0.4 seconds). Therefore, when a person is sleepy, closing their eyes should be outside of this range. We're going to set a time frame of 5-10 seconds. If the eyes remain closed for five or more seconds, drowsiness is detected and a warning bang is triggered. Similar to this, drowsiness is detected using yawning if a person is sleepy, he will start yawning. So we're going to set a time frame of 5-8 seconds. If the mouth opened for 7 or more seconds, drowsiness is detected and a warning bang is triggered.

IV. RESULTS AND DISCUSSION

The proposed system has been developed and tested with the generated data. The webcam is connected with the laptop for further processing and classification of the video streaming. Below the different drowsy conditions are displayed.

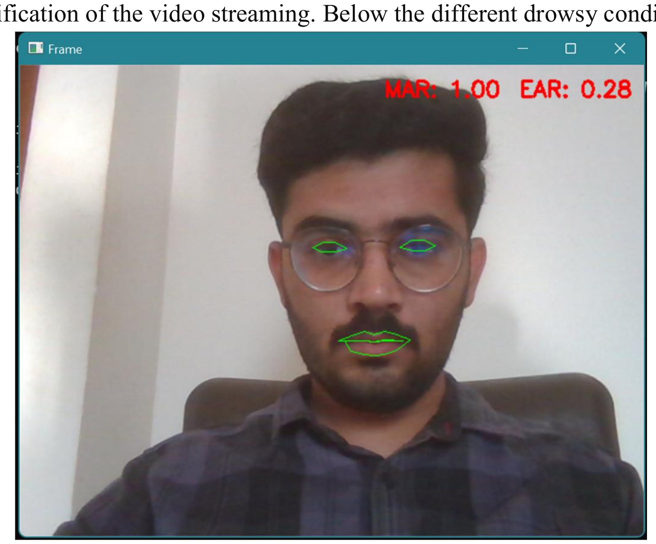

Fig.3. Normal – Glasses

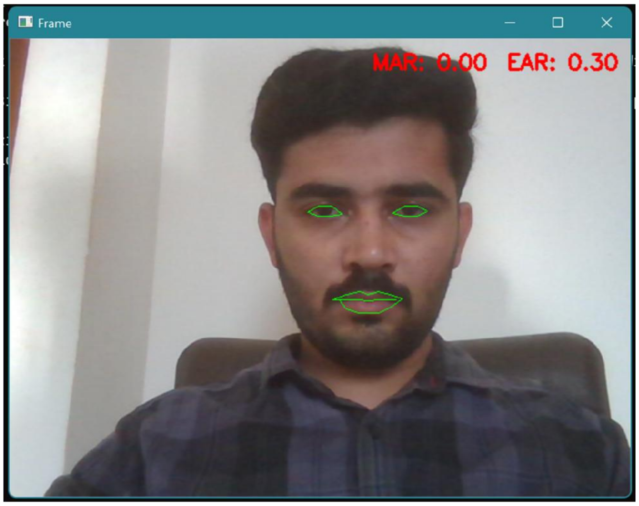

Fig.4. Normal – Without Glasses

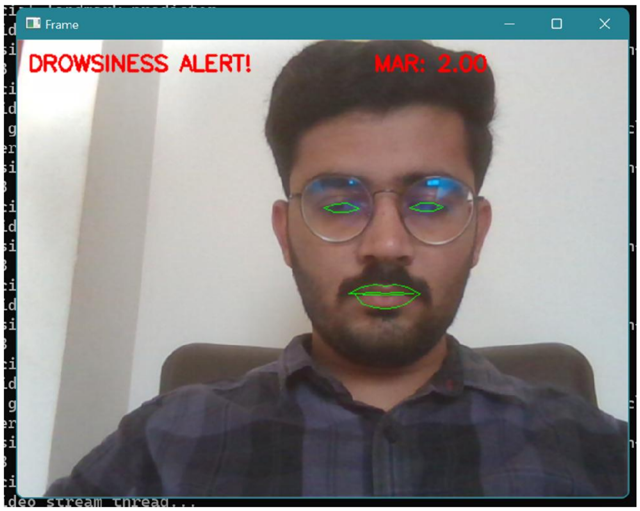

Fig.5. Closed Eye's – With Glasses

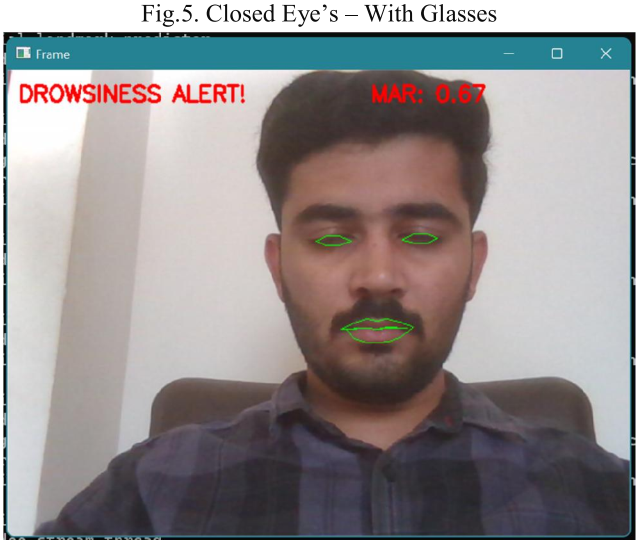

Fig.6. Closed Eye's – Without Glass

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

Volume 2, Issue 5, May 2022

Impact Factor: 6.252

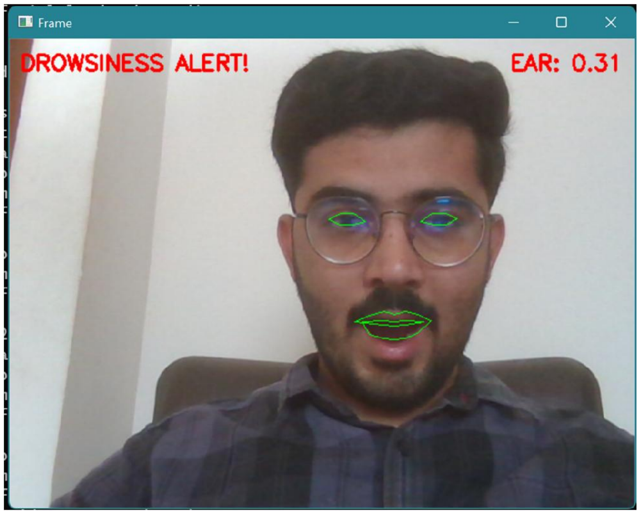

Fig.7. Yawning

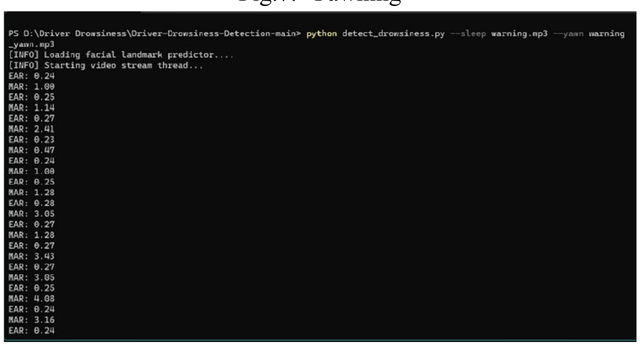

Fig.8. EAR and MAR values

V. CONCLUSION

A real-time eye blink detection and yawn detection algorithm is presented. We quantitatively incontestible that Haar feature-based cascade classifier is precise enough to dependably estimate the positive pictures of face, tier of eye and mouth openness, whereas they're sturdy to low image quality (low image resolution in a very massive extent) and in-the wild.

Future Scope

The software system developed can be implemented on dashboard of a car using a hardware platform like raspberry pi, etc. We plan to further work on the project by adding a database to add and record the driver's information for any future need. Also to avoid multiple face problems we can also blur the background of driver.

Limitations

Use of spectacles:

When the driver wears glasses, it is difficult to recognize the condition of the eye because it is highly dependent on light, so the reflection from the glasses can give the result of a closed eye such as an open eye. Therefore, for this purpose, the eyes must be close to the camera to avoid light.

Multiple face problem:

If multiple faces appear in the window, the camera may detect a larger number of faces. It is possible that undesirable results may be displayed due to the different conditions of different faces. Hence, we need to make sure that only the driver's face is in the window range of the camera. In addition, the recognition speed is reduced due to the multi-sided operation.

REFERENCES

[1] Manu B.N, "Facial Features Monitoring for Real Time Drowsiness Detection", 12th International Conference on Innovations in Information Technology (IIT), 2016 [Pg. 78-81]

[2] Amna Rahman, "Real Time Drowsiness Detection using Eye Blink Monitoring", Department of Software Engineering Fatima Jinnah Women University 2015 National Software Engineering Conference (NSEC 2015)

[3] Kusuma Kumari B.M, Prof. Ramakanth Kumar .P, "A Survey on Drowsy Driver Detection System", International Conference On Big Data Analytics and Computational Intelligence (ICBDACI), 2017

[4] Feng You , Xiolong Li , Yunbo Gong, Haiwei Wang, Hongyi Li, "A Real-time Driving Drowsiness Detection Algorithm With Individual Differences Consideration", IEEE ACCESS, 2019

[5] Jang Woon Baek, Byung-Gil Han, Kwang-Ju Kim, Yun-Su Chung, Soo-In Lee, "Real-time Drowsiness Detection Algorithm for Driver State Monitoring Systems", International Conference on Ubiquitous and Future Networks, 2018

[6] Mkhuseli Ngxande, Jules-Raymond Tapamo, Michael Burke, "Driver drowsiness detection using Behavioral measures and machine learning techniques", Pattern Recognition Association of South Africa and Robotics and Mechatronics International Conference (PRASA-RobMech) Bloemfontein, South Africa, 2017

[7] Ashish Kumar, Rusha Patra, "Driver Drowsiness Monitoring System using Visual Behaviour and Machine Learning", IEEE Symposium on Computer Applications & Industrial Electronics (ISCAIE), 2018

[8] Paul Viola, Michael Jones, "Rapid Object Detection using a Boosted Cascade of Simple Features", Accepted Conference on Computer Vision and Pattern Recognition, 2001

[9] Dr.K.Venkata Nagendra , Dr.Maligela Ussenaiah , Mr.G.Rajesh, "Driver Drowsiness Monitoring System using Visual Behaviour Using SVM", The International journal of analytical and experimental modal analysis Volume XII, Issue IV, April/2020

[10] R. Kumaran, M. Karthick, R. Deepak Kumar, B. Rahul Final, "Driver Drowsiness Monitoring System using Visual Behaviour and Machine Learning", International Journal of Engineering Research & Technology (IJERT), 2020

[11] R. Ahmad, J. N. Borole, "Drowsy Driver Identification Using Eye Blink Detection", IJISET - International Journal of Computer Science and Information Technologies, vol. 6, no. 1, pp. 270-274, Jan. 2015.

[12] M. Dehnavi, N. Attarzadeh, M. Eshghi, "Real time eye state recognition", IEEE Iranian Conference on Electrical Engineering (ICEE), May 2011.

[13] Jaeik Jo Sung Joo Lee, Ho Gi Jung, Ryoung Park, Jaihie Kim "Vision-based method for detecting driver drowsiness and distraction in driver monitoring system", Optical Engineering Vol 50(12) December 2011.