Driver Drowsiness Detection System

Prof. Rupali[1] Pashte
SLRTCE, IT, Mumbai, India

Ms. Rinky Singh[2]
SLRTCE, IT, Mumbai, India

Ms. Nandini[3] Upadhyay
SLRTCE, IT, Mumbai, India

Mr. Sundaram[4] Dubey
SLRTCE, IT Mumbai, India

---***---

Abstract— Today, Driver drowsiness is the major cause for most of the accidents in every country. Detecting the eye of the driver for tiredness is the easiest way for measuring the drowsiness of driver. For the face detection, the system uses the certain algorithm to detect face position and face size, and the face geometrical position is used for reducing the searching range of eyes. Next, the proposed eye detection algorithm for the eye location is to judge whether the driver wears glasses or not. Finally, the system detects driver's eye state in the eye region on the face. The existing systems in the literature, are providing slightly less accurate results and some of them are costly then our system. Due to low clarity in images and videos results may vary with respect to the camera positions. In order to solve the above-mentioned problem, a driver drowsiness detection system is proposed in this paper, where we calculate the eye region vertically and horizontally with help of a formula. Specifically, the proposed frame work, continuously analyzes the eye region of the driver and alerts the driver by activating the alarm when he/she is drowsy. As soon as the driver starts the system an alert notification is sent to the owner of the vehicle thus ensuring the security factor. When the eyes are detected closed for too long time, an alarm is buzzed to warn the driver. The undertaking output of the proposed system, which is implemented on Open CV, python libraries and with a single camera view, highlights the good performance of the system in terms of accurate drowsiness detection results and thereby reduces chances of road accidents.

Keywords- DDDS (Driver Drowsiness Detection System); Face detection; Eye detection; Image processing; EAR (Eye Aspect Ratio)

1. INTRODUCTION

The number of vehicles in developing countries has been gradually increased over the past few decades. Official investigation reports of traffic accidents allude that dangerous driving practice, such as drunk and drowsy driving, account for a high scope of accidents. For the fatigue/drowsiness detection issue, the driver's status can be evaluated through the eye blinking ratio. It is often pointed out that night shifts make drivers particularly vulnerable to road accidents. Driver fatigue is the most common causes for serious road accidents around the world and is a serious hazard and superior topic of concern. Driver drowsiness is identified as a contributing cause in most of the road accidents. Since drowsiness can majorly slow down the reaction time and subsequentl reduces driver's awareness and judgment capabilities. The development of a system which will monitor the driver's eye status and is capable of producing warning to the driver upon detecting signs of drowsiness can prevent road accidents and thus could save lives. In this paper, by recognizing the accurate eye position and the effective eye detection methodology (EAR) is proposed to enhance the accuracy of fatigue detections. Security is also a major factor in this paper where alert message is sent to the owner whenever someone starts the system. Experimental results show that the proposed method is able to detect region of interest which is the eye and subsequently generates effective output in real driving environment. This paper uses proposed system which gives more accurate results with additional benefit of low cost.

2. RELATED WORK

In 2018, Cyun-Yi Lin, Paul Chang, Alan Wang, and Chih-Peng Fan proposed the system that includes four parts, which are the face detection, the eye-glasses bridge detection, the eye detection, and the eye closure detection. In 2018, Rui Huang, Yan Wang, Lei Guo used a novel fatigue detection approach based on eye state analysis is proposed. Specifically, first build a fatigue detection convolution network (FDCN) based on common convolution neural network (CNN). Then we incorporate projection cores into FDCN to construct P-FDCN for enhancement.

In 2016, Yafei Wang, Tongtong Zhao, Xueyan Ding, Jiming Bian, Xianping Fu ,an appearance-based head pose-free eye gaze prediction method is proposed, for driver gaze zone estimation under free head movement. In 2017, Gulbadan Sikander, Shahzad Anwar, Yasser Abd Djawad proposed a novel method for the detection of facial features in images. The method proposed first uses the Viola-Jones methods to identify possible regions of interest subsequently use calculations based on the symmetric property of the human face to detect the true facial features.

In 2016, K T Chui, K F Tsang, H R Chi, B W K Ling and C Kit Wu, An Accurate ECG-Based Transportation Safety Drowsiness Detection Scheme.

3. PROPOSEDFRAMEWORK

The entire proposed system is to detect driver eyes to observe the fatigue and alert the driver with the alarm and vibration if drowsiness is detected. This driver drowsiness detection system is capable of deciding whether the eyes are open, closed or drowsy. If the driver eyes are closed for too long, alert signal is issued. This is done by organizing a web camera in front of the driver and regularly capturing its real-time video using Open CV. Drowsiness can be easily determined from few symptoms that are noticeable in drowsy drivers face. Similarly, the analysis of the eye status, the drowsiness detection system will be able to tell whether the driver is drowsy or not. At first when the driver enters the car, the system will detect the face and an alert notification is sent to the owner. This ensures the security factor of both the car and the system. Now the camera is in on state, video clips are continuously captured from the drivers face and sends notification to the car owner.
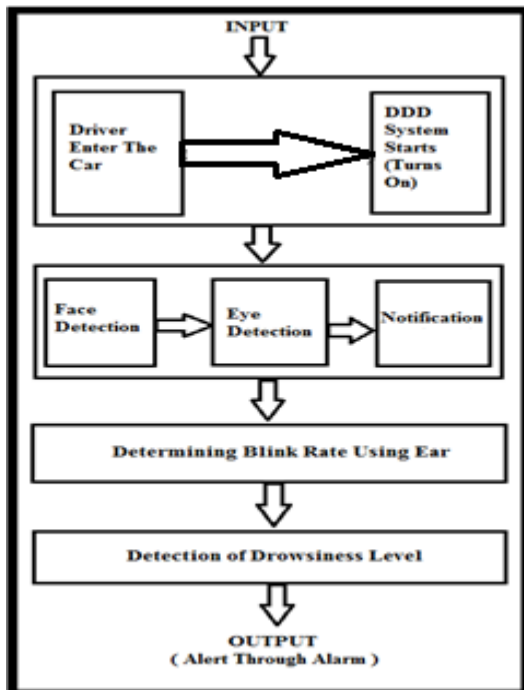

Fig .1.Block Diagram of Proposed DDDS.

To detect the eye blink, present state of eye is needed which is either closed or open. If the state of eyes changes from closed to open or open to close, it indicates that eyes are blinking. If the state of the eyes is in closed state for a certain amount of time and the EAR value is below the critical value then the person is detected as drowsy and the system predicts the state of the driver eye. If drowsiness of a driver is detected a buzzer alarm sound and the vibration is raised, until the driver is alert.

The web camera is used to detect the eye of driver, the data collected will be processed according to the python program. After data processing, if the driver is drowsy then he/she will be alerted with vibrator which is placed under the seat belt of the driver and there will be a loud alarm which will make the driver alert and make driver concentrate on driving again.

4. EXPERIMENTALSETUP

A.WORKING OF THE SYSTEM

The system will detect the face of the user as soon as the system starts and an alert message will be sent to the owner of the vehicle. This makes sure that there are no chances of robbery of vehicle and that no one else is using the car. Once the face is detected then eye region will be the main focus of the system and process of drowsiness detection starts. The process will function according to the code used in Open CV, the camera will work as a sensor which is used to take the live video of the driver. The system will detect the driver drowsiness and the buzzer will act as a actuator for this setup and will only act if it founds the low EAR (eye aspect ratio) in through the sensor.
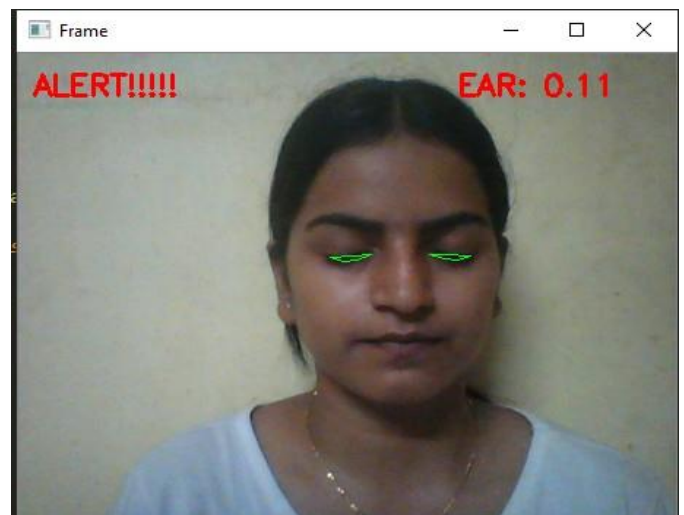

Fig .2.Frame of DDD system.

B. THE EYE ASPECT RATIO (EAR)

The Eye Aspect Ratio is a constant value when the eye is open, rapidly falls to 0 when the eye is closed so the figures below shows a person's Eye Aspect Ratio over time. The person's eye blinks are obvious. A program that determine if a person's eyes are closed if the Eye Aspect Ratio falls below a certain threshold.

It's give different points to the eye and by that it detects the ration by using the EAR formula and make the decision about the driver's drowsiness. The formula of the EAR is EAR =

$$||(p2 - p6) - ||(p3 - p5)/(2||p1 - p4||)$$

As we can see in the figure, the eye in the first image is open and other is closed which decreases the ratio by

the calculation. Now its work as if the ratio is less for a long duration or is closed for the greater time than the usual one than the buzzer will notify the driver about his condition.
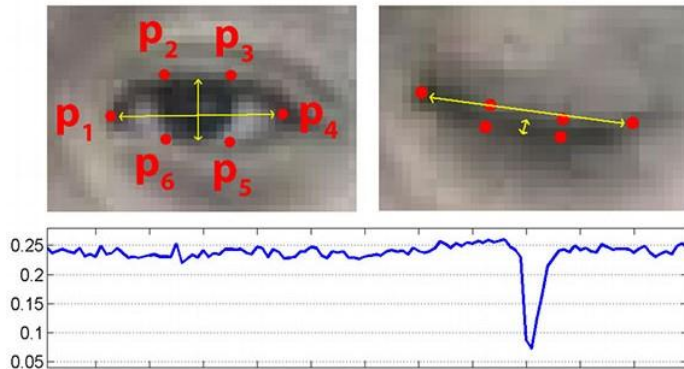

Fig .3..The Eye Aspect Ratio Diagram

C. DETAILED STEPS OF DDD SYSTEM

Now we see the steps to find the Drowsiness in the driver. Here we have some images that is of an experiment and below the images we see the part that is done in this step.

STEP 1:

The main goal is recognizing the face of the driver using shape predictor. Once the face is identified, the notification will be send to the car owner and our work starts on the concerned region of interest. The eye detector detect eyes by describing the contrast taking measurement of the distance between eye area and the ear area it will recognize area as eye in the face.

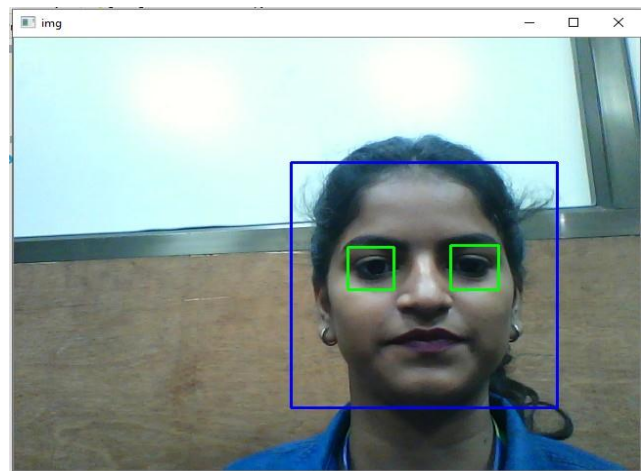Fig .4..Message notifications sent

STEP 2:

Fig .5.The detection of the face in experiment

In this step we facial landmark localization to extract the eye from the faceFacial landmarks are used to align facial images to face, so that the location of facial landmarks in all images after alignment is approximately the same. By this way the region of interest will be found in the video stream.
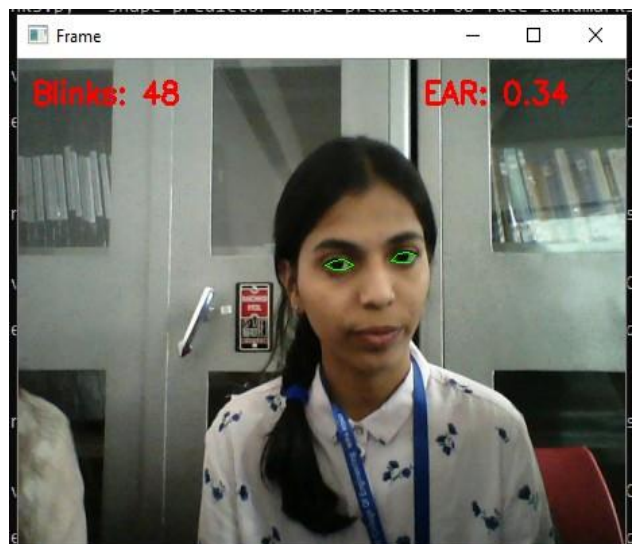
STEP 3:

Fig 6..The detection of eye and calculating the EAR when eye is open

Here the eye is detected so now we can compute the eye aspect ratio on the driver to determine if the eyes are closed. The eye aspect ratio is instead a much easier solution that involves a very simple formula based on the ratio of distances between landmarks of the eye. This method for eye blink detection is really helpful as it is quiet speed and efficient, and also very easy to use.
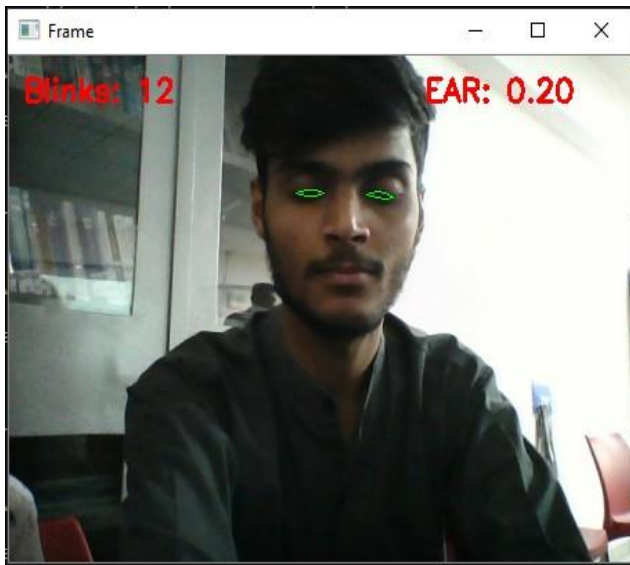
STEP 4:

Fig .7.The detection of eye and calculating the EAR when eye is closed

Now this face has the low eye aspect ratio which indicates the eye is closed. If this ratio will be keep on the low value then the alarm will go on and the driver will be notified about it. Generally, when blink rate reduces below 10 blinks per minute, is considered as abnormal eye conditions. Based on these factors, when eye is closed for too long the drowsy is detected as shown in Fig.7

5. CONCLUSION

This paper introduces a drowsiness detection system based on face detection using open CV, followed by detection of the eyes, and also evaluates the eye aspect ratio followed by drowsiness detection at real time. In the proposed system the details about the eye status is obtained through image processing. In future, the detection of yawning of the driver can be also be implemented using same frame work for detecting further details about the drowsiness of driver.

6. REFERENCES

[1] Machine Learning and Gradient Statistics Based Real-Time Driver Drowsiness Detection Cyun-Yi Lin, Paul Chang, Alan Wang, and Chih- Peng Fan, Department of Electrical Engineering, National Chung Hsing University, Taiwan, R.O.C. #CHIMEI motor-electronics Co., Ltd., Taiwan, R.O.C.

[2] P-FDCN B ased Eye State Analysis for Fatigue Detection, Rui Huang, Yan Wang, Lei Guo School of Automation Science and Electrical Engineering Beihang University Beijing, China.

[3] Head Pose-free Eye Gaze Prediction for Driver Attention Study, Yafei Wang, Tongtong Zhao, Xueyan Ding, Jiming Bian, Xianping Fu School of Physics and Optoelectronic Engineering, Dalian University of Technology, Dalian 116024, China Information Science and Technology College, Dalian Maritime University, Dalian 116026, China.

[4] Facial Feature Detection: A Facial Symmetry Approach, Gulbadan Sikander Institute of Mechatronics Engineering University of Engineering and Technology, Peshawar, Pakistan.

[5] K T Chui, K F Tsang, H R Chi , B W K Ling , and C Kit Wu, An Accurate ECG-Based Transportation Safety Drowsiness Detection Scheme, in IEEE Transactions on industrial informatics, vol. 12, no. 4, page no 1438-1443, 2016.