Driver's Drowsiness Detection and Alarming System

Prof.Anand Mohanrao Magar, Dhanashri Rajput, Aryan.V.Dharmadhikari, Roshani.D.Dhembare, Tanish.N.Dhangar, Ayush.S.Dhangar, Manish.S.Dhane

Department of Engineering Sciences and Humanities (DESH) Vishwakarma Institute of Technology, Pune, 411037, Maharashtra, India

Abstract-The majority of reported accidents in our nation are the result of drowsy or distracted driving on the part of the driver. If the drivers had been woken up at the appropriate time, the accidents brought on by sleep-deprived drivers would have been avoided. The accidents and fatalities could have been avoided by creating a device that can identify when the eyes are closed. We have developed a hardware and software solution that might be used to track a driver's eye locations and alert him if his eyes are closed for longer than three seconds.

Keywords: Sleep Deprived Driving, Python, Arduino, image processing, OpenCV, EAR (Eye Aspect Ratio)

1.INTRODUCTION

According to a survey in "2021" around 50 percent of road accidents were caused due to sleep-deprived drivers. Due to a lack of adequate sleep, the efficiency of a driver decreases by increasing the risk of accidents. A system that could have alarmed the driver would have reduced these accidents by a large number. Due to a lack of advocate amount of sleep, the reaction time of a driver decreases affecting his ability to make sharp turns or emergency breaks. Researches also suggest that sleep-deprived driving is as good as drink-driving. Using Python and its libraries, OpenCV for programming we can make a system that will detect the eye ratio of the frame of the image taken. In any case, if there is a change in the eye ratio in the frame the buzzer will start beeping and alarm the driver. The main idea behind creating this project is to prevent the number of accidents caused due to sleep-deprived driving.

2. LITERATURE REVIEW

To lower the number of accidents, a lot of research is conducted in the area of driving safety. The study of the suggested system cited the following material.

[1] The First System Here, the researcher developed a device that monitors the driver's face as the car starts. This essentially allows us to track and record the driver's eye blinking in real-time. They used a speed control system to monitor the car's speed and alert the driver if it starts to slow down by using an already-installed camera in front of the driver. The two components are a prediction of Eye Blink Rate and Night Vision Camera Operation. This study conclusively shows the growth of tiredness detection and accident prevention. The speedometer slows down to a random speed when it receives input from the control system.

[2] The second method seeks to extract facial traits from photographs collected by passively observing drivers and identifying signs of attention. This system must include real-time analysis to warn motorists and stop accidents caused by distracted driving. While deciding how to handle distractions, the pupil is a factor that is taken into account. Distraction is recognized by PERCLOS. Using the given algorithm, it is possible to determine the pupil's actual and ideal position. The evaluation of gaze is based on the discrepancy between the distance from the eye corner to the actual pupil position and the desired pupil position. The frontal face images were taken into consideration when developing the algorithm. The efficiency of gaze detection was between 75 and 80%.

[3] The third system focuses on creating a system that can identify driver weariness more precisely and accurately. Image processing is the foundation of the suggested system. Image-based solutions are more secure and simple to use than vehicle-based and physiological signal-based techniques. Drowsiness was identified using this method based on two circumstances. The first test is measuring the length of the blink, and the second is counting the blinks. viola

jones and the KLT algorithm were combined to detect and track the face. If the object is stationary, the Viola-Jones algorithm will be able to detect it. Any change in posture while driving will negatively damage the ability to detect faces. In order to track the features of the detected face, the KLT feature tracker is employed. The suggested methodology offers a fresh way to assess the driver's health and warn them before they sleep out. This concept will provide a safe ride and help to reduce the number of accidents.

[4] This fourth system relies on keeping a watch on the driver's eyes to detect signs of sleepiness. For the real-time application of the model, an input video was gathered by mounting a camera on the dashboard of the vehicle. It can accept the driver's face, hands, upper body, and occlusions such as non-tinted glasses. The real-time implementation of the model uses the pre-trained 68 facial landmark detector from the library. A camera that can fit the driver's face can be mounted on the car's dashboard to collect the input footage. The face detector based on the Histogram of Oriented Gradients (HOG) was considered. To track the driver's blinking activity and identify yawning in the frames of the continuous video stream, respectively, the suggested method is Eye Aspect Ratio (EAR). The real-time testing was conducted under a variety of lighting circumstances, yielding poorer results for real-time detection even though the model currently performs very well under excellent to perfect lighting conditions, such as those exhibited in the dataset films. Moreover, real-time testing can be done under a variety of illumination conditions.

[5] The Fifth System will concentrate on the driver's actions; if any issue is detected in accordance with the aforementioned systems, it will beep the sound that serves as the primary alarm after three seconds of close-eye detection. to provide the driver a signal.

3. METHODOLOGY

A. Tools

* OpenCV -

All image and video analysis types, including facial identification and detection, are performed using OpenCV. OpenCV is a collection of Python bindings created to address issues with computer vision.

*Dlib –

To find and pinpoint facial landmarks, utilize the pre-trained facial landmark detector included in the Dlib package.

*Imutils

Imutils is a collection of image processing and computer vision utilities that make working with OpenCV more convenient. These functions include basic image processing operations like resizing. It will determine the image's height and width.

*Scipy -

In order to calculate the eye-aspect ratio, the SciPy module computes the Euclidean distance between points on the face that are used as landmarks.

*Pygame–

It consists of a sound library used to load alarm sound files in WAV format.[4]

B. Algorithm

When the eyes are open, the eye-to-relative ratio (EAR) is typically stable and close to 0.25. If the Eye Aspect Ratio is less than 0.25, the person is said to be drowsy.

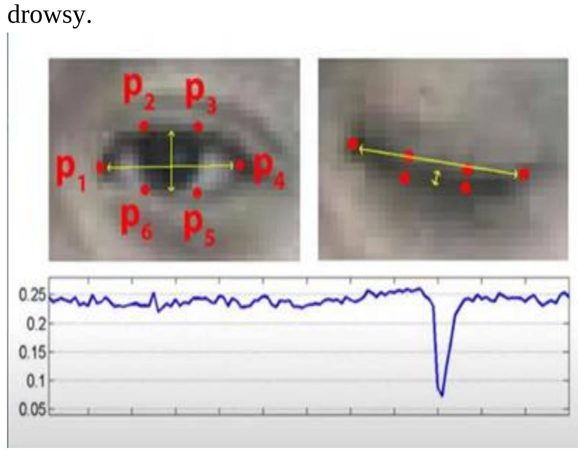

Fig1.The ratio of eyes, the graph of variation of the EAR

P1 and P4 are referred to as long or horizontal points.

P2, P3, P5, and P6 are referred to be shorter or vertical points.

The EAR stands for Eye Aspect Ratio.

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

This is to define the coordinates of the eyes and the threshold value of EAR.

The graph shows the variation in the value of EAR. When the eyes are open the fluctuation is less but as the eyes are closed the graph falls drastically.

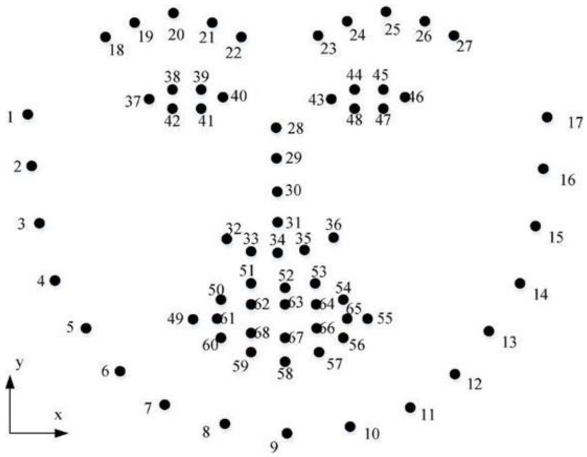

Fig2.Facial landmarks

C. Flowchart

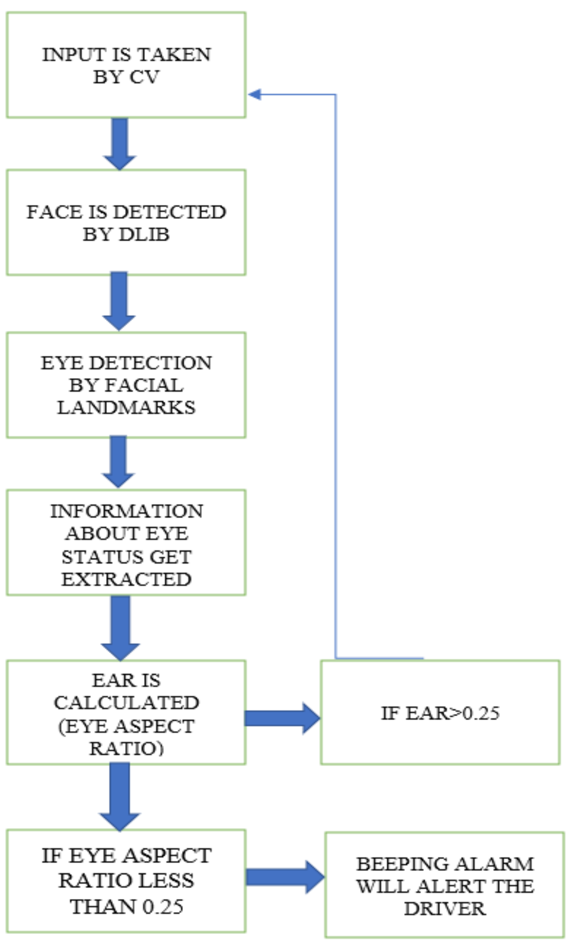

Fig3.Flowchartontheworking

4. RESULT AND DISCUSSIONS

The accuracy of the program can be calculated as follows:

$$\text{Eye Detection Accuracy} = \frac{\text{total number of times eyes detected}}{(\text{total no. of eyes detected} + \text{total no of times eyes not detected})}$$

$$\text{Drowsiness Detection Accuraccy} = \frac{\text{total no. of times alarm sounds}}{(\text{total no. of times alarm sounds} + \text{total no of times alarm didn't sound})}$$

We used the laptop's built-in webcam for my project. When drowsiness is detected, the in-built speaker is used to give sound output to the driver to awaken them. The framework was tested on many people in diverse lighting environments (daytime and evening time)

5. LIMITATIONS

[1] Orientation of face When the face is tilted to a specific degree the system can't detect the face. And the problem with multiple faces detection.

[2] Dependence on appropriate ambient light: Occasionally, the system is unable to detect the eyes due to bad lighting circumstances. So, it produces an incorrect outcome that needs to be controlled.

[3] An ideal distance is necessary: - Just when the distance between the face and the camera isn't at an ideal range, then certain complications arise. The framework is unsuited to detect the face from the image when the face is abnormally close to the webcam (less than 23.5 cm).

6. FUTURE SCOPE

By adding an infrared camera to the current design, the system may be made to identify the eye even in dim light. This type of system may be added to security systems in the future.

7.CONCLUSION

This dlib approach makes use of the pre-trained 68 facial landmark detector from the library. A face detector based on the Histogram of Oriented Gradients (HOG) was used. The proposed method to track driver drowsiness used the Eye Aspect Ratio (EAR), a quantitative metric.

Eye Detection Accuracy and Drowsiness Accuracy average real-time test accuracies obtained using dlib were found to be 80.17% and 78.50%, respectively.
The real-time detection results are less accurate because the model only presently performs effectively in well-lit environments.

ACKNOWLEDGEMENT

We would like to express our gratitude to our guide Prof. Chandrashekhar Mahajan Sir for helping us to work on this project.

REFERENCES

[1] Driver Drowsiness Detection System Using Eye Blink and Yawn Detection" by P. R. Panchal, P. H. Zope, and S. S. Sonawane. International Journal of Advanced Research in Computer Science and Electronics Engineering, vol. 2, no. 9, pp. 433-437, 2013.
[2] "Real-Time Driver Drowsiness Detection System Based on Facial Features" by H. Huang, Y. Chen, and H. Wu. International Journal of Innovative Computing, Information, and Control, vol. 10, no. 6, pp. 2391-2402, 2014.
[3] "Driver Drowsiness Detection System Based on Real-Time Eye Tracking and Lane Departure Warning" by W. Chen, H. Zhu, and X. Lin. Journal of Computational Science, vol. 12, pp. 41-49, 2016.
[4] "A System for Driver Drowsiness Detection Based on Eye Tracking and Head Pose Estimation" by F. Alhammad, A. Almazyad, and M. Almazyad. International Journal of Advanced Computer Science and Applications, vol. 10, no. 3, pp. 317-324, 2019.
[5] "Driver Drowsiness Detection System Based on Fuzzy Logic and Eye Tracking" by T. Nakamura, K. Kondo, and K. Ishida. Journal of Robotics and Mechatronics, vol. 26, no. 3, pp. 431-439, 2014.
[6] "A Vision-Based Driver Drowsiness Detection System Using a 3D Model of the Face" by H. Wang, X. Cheng, and H. Liu. IEEE Transactions on Intelligent Transportation Systems, vol. 19, no. 4, pp. 1125-1134, 2018.
[7] "A Real-Time Driver Drowsiness Detection System Based on a Deep Learning Approach" by X. Zhang, Y. Wu, and Z. Guo. Sensors, vol. 19, no. 4, pp. 822-838, 2019.
[8] "Driver Drowsiness Detection System Based on a Combination of Physiological Signals and Driving Behavior" by J. J. Caballero, A. M. Jiménez, and M. P. García-Sánchez. Sensors, vol. 20, no. 22, pp. 6425-6442, 2020.
[9] "A Hybrid Model for Driver Drowsiness Detection Using Physiological Signals and Driving Performance" by S. Wu, Q. He, and X. Li. Journal of Advanced Transportation, vol. 2021, pp. 1-14, 2021.
[10] "A Novel Driver Drowsiness Detection System Based on EEG Signals and Machine Learning" by S. Lv, Y. Xu, and J. Yu. Journal of Intelligent Transportation Systems, vol. 25, no. 3, pp. 225-235, 2021.
[11] "Real-time Driver Drowsiness Detection System based on Hybrid CNN-LSTM Model" by L. Zhang, Y. Xue, and H. Zhang. IEEE Access, vol. 7, pp. 102311-102322, 2019.
[12] "Driver Drowsiness Detection System Based on Physiological Signals and Driving Behavior" by M. Chen, M. Yin, and Y. Jiang. IEEE Transactions on Intelligent Transportation Systems, vol. 21, no. 1, pp. 366-375, 2020.
[13]"A Wearable Sensor-based System for Driver Drowsiness Detection" by C. Zhou, J. Sun, and Z. Zhang. IEEE Transactions on Intelligent Transportation Systems, vol. 20, no. 9, pp. 3226-3236, 2019.
[14] "Real-Time Driver Drowsiness Detection System Based on Multi-Channel Feature Fusion" by H. Liu, M. He, and J. Yang. Sensors, vol. 21, no. 6, pp. 1941-1955, 2021.
[15] "A Comprehensive Survey on Driver Drowsiness Detection Systems" by M. Saberi, M. Azimi, and H. Kazemi. IEEE Transactions on Intelligent Transportation Systems, vol. 22, no. 2, pp. 1099-1124, 2021.
[16] "Driver Drowsiness Detection System Based on EEG and Machine Learning Techniques" by A. Almazyad, F. Alhammad, and M. Almazyad. IEEE Access, vol. 7, pp. 32168-32177, 2019.
[17] "A Novel Real-Time Driver Drowsiness Detection System based on Electrooculography and Convolutional Neural Network" by M. Eltawil and H. El-Sappagh. IEEE Access, vol. 7, pp. 151497-151510, 2019.
[18] "A Non-Invasive Driver Drowsiness Detection System based on EEG Signals and Deep Learning" by

Y. Wang, J. Li, and J. Li. Sensors, vol. 21, no. 8, pp. 2716-2730, 2021.
[19] "Driver Drowsiness Detection System Using Multi-Modal Signals and Deep Learning" by W. Zhang, X. Wang, and M. Li. IEEE Transactions on Intelligent Transportation Systems, vol. 21, no. 7, pp. 2922-2932, 2020.
[20] "Driver Drowsiness Detection System Based on Multi-modal Deep Learning and Adaptive Weighted Fusion" by Y. Xu, Y. Wei, and Q. Wu. IEEE Transactions on Intelligent Transportation Systems, vol. 22, no. 9, pp. 5251-5262, 2021.