DETECTION OF DRIVERS' DROWSINESS

Sandeep Iddalgave[1], M Vachana[2], Annapurna[3], Deepak[4], Jai Chandra Swamy[5]
Dept. of Computer Science & Engineering,
Guru Nanak Dev Engineering College, Bidar- 585401, Karnataka, India
Visvesvaraya Technological University, Belagavi- 590018

Abstract - Making driver drowsiness detection in embedded systems meet real-time requirements is a challenging problem; in the meantime, some issues remain unresolved, such as drivers' heads tilting and inadequately sized eye images. The goal of this project is to develop an effective approach for identifying the eye states of drivers and detecting their drowsiness in embedded systems using image processing techniques. This technique uses face and eye detection to initialize the location of the driver's eyes, breaking the conventional approach to drowsiness detection and making it real-time. Subsequently, an object tracking technique is employed to monitor the eyes; ultimately, the identified eye state allows us to determine the driver's drowsiness state with PERCLOS. The outcomes of the experiment indicate that it makes good agreement with analysis.
Keywords: Drowsiness detection, Face detection, Eye location, Object tracking.

1 INTRODUCTION

According to our most recent data, car accidents claimed the lives of 148,707 people in India alone in 2015. Of these, at least 21% were the result of drivers making mistakes due to fatigue. This may still be a relatively small number because, of all the factors that can cause an accident, weariness is typically grossly underestimated as a contributing factor. In developing nations like India, poor infrastructure and fatigue are a surefire recipe for disaster. Generally speaking, fatigue is very hard to quantify or observe, in contrast to drugs and alcohol, which have readily available tests and important markers.

Educating people about fatigue-related accidents and encouraging drivers to report fatigue when necessary are probably the best ways to address this issue. The former is more difficult and costly to accomplish, and the latter is not feasible without the former because long-distance driving is very profitable. A job's wages rise in response to an increase in demand, which encourages an increasing number of people to take it on. This also applies to operating transport vehicles after dark. Drivers are driven by money to take risky actions, such as staying up late driving when they are tired. This is primarily due to the fact that the drivers themselves are unaware of the extreme risk involved in driving while tired. Although some nations have placed limits on the amount of time a driver can spend behind the wheel, these measures are still insufficient to address the issue because they are expensive and difficult to implement.

There is a consistent increase in the number of road disaster cases involving cars, particularly large vehicles like trucks, lorries, and cars. One of the amazing elements contributing to road setbacks is fatigue and languor. Given that it impairs the driver's judgment in 15 obsessions, driving under these conditions may result in terrible consequences.

If drivers take precautions like getting enough sleep before driving, consuming caffeine, or stopping for a long time to rest when signs of fatigue and laziness appear, they can prevent falling asleep at the wheel. However, once they realize they are affected by fatigue and can resume driving, most drivers won't need one of these techniques. Similar to this, identifying sleepiness is crucial to preventing traffic accidents. This endeavor suggested that the telltale indicators of fatigue and sluggishness are yawning and eye-distinguishing proof.

2 RELATED WORK

The goal of the project "An Efficient Detection of Drivers' Drowsiness with the Help of Eye Aspect Ratio Employing Euclidean Distance Formula" is to create a system that uses the eye aspect ratio (EAR) and the Euclidean distance formula to identify drowsiness in drivers. One important measure of drowsiness is the eye's openness, or EAR. Several related studies have investigated comparable methods to identify driver drowsiness[8]. The use of deep learning methods like convolutional neural networks (CNN) and machine learning algorithms like support vector machines (SVM) and artificial neural networks (ANN) for drowsiness detection is one well-known example of related work[10]. To reliably distinguish between sleepy and alert states, these techniques frequently make use of features taken from physiological signals, eye movements, or facial expressions. These methods work well, but they might need a lot of processing power and training data.

The use of computer vision methods for driver behavior monitoring is another area of related research. These devices use video streams taken by in-car cameras to identify symptoms of weariness, distraction, or drowsiness. To gauge a driver's level of alertness, they frequently use gaze estimation algorithms, eye tracking, and facial landmark detection. However, different lighting conditions, occlusions, and head pose variations may pose challenges for these methods in real-world scenarios [12].

Furthermore, a few studies have looked into combining different modalities to detect drowsiness more accurately. Complementary information regarding the driver's physiological and cognitive states can be obtained by combining eye tracking data with physiological signals from devices like electromyography (EMG), electrocardiography (ECG), or electroencephalography (EEG). The goal of fusion approaches is to improve the system's adaptability and dependability for various driving situations and individuals.[5]

Furthermore, the development of portable devices for real-time monitoring of driver drowsiness is a result of advancements in wearable technology. Physiological signals indicative of sleepiness are captured by these devices, which usually include accelerometers, gyroscopes, and photoplethysmography (PPG) sensors. Wearable technology offers potential solutions for reducing driver fatigue-related accidents by utilizing personalized alerting mechanisms and continuous monitoring[9]. Finally, building on earlier research on the topic of drowsiness detection, the study "An Efficient Detection of Drivers' Drowsiness with the Help of Eye Aspect Ratio Employing Euclidean Distance Formula" focuses on the dependable and efficient application of eye aspect ratio and the Euclidean distance formula. By providing a helpful tool for the early detection and prevention of accidents involving sleepy drivers, the project's contribution to this field seeks to increase road safety.

A sizable body of research in the fields of driver safety and monitoring systems is revealed by the thorough literature review on the effective detection of drivers' drowsiness using eye aspect ratio (EAR) and the Euclidean distance formula. Numerous studies have looked into the relationship between drowsiness and changes in eye characteristics, specifically the aspect ratio, which can be a crucial component in drowsiness detection since it is a trustworthy indicator of eyelid closure. In one noteworthy study, [4] used a dataset gathered from actual driving situations to investigate the efficacy of EAR in detecting driver drowsiness. Their results showed a clear correlation between falling EAR values and the onset of drowsiness, suggesting that EAR monitoring could be a useful tool for anticipating driver fatigue. Additionally, a novel method for drowsiness detection based on EAR and the Euclidean distance formula was proposed by [8]. Through the use of machine learning algorithms like Convolutional Neural Networks (CNN) and Support Vector Machines (SVM), they were able to classify alert and drowsy states with high accuracy using EAR features that were extracted from eye images[6].

3 METHODOLOGY

Several crucial steps are involved in the methodology for an effective eye aspect ratio (EAR) and Euclidean distance formula-based driver drowsiness detection. The first step in the process is data acquisition, which is compiling a dataset of real-time or recorded images or videos of drivers' faces. To guarantee the detection system's resilience, these pictures or videos ought to feature a variety of situations, lighting styles, and people. Preprocessing procedures are then carried out to improve the input data's quality. To make sure the driver's eyes are correctly centered and aligned for accurate analysis, this may entail using techniques like face detection and alignment. The eye aspect ratio (EAR) is then computed for every frame in the input data after that. A measure of eye openness called EAR can be calculated using the ratio of distances between different facial landmarks, most commonly the areas surrounding the eyes. The Euclidean distance formula is used to calculate the degree of similarity or dissimilarity between successive EAR values after the EAR values have been computed. This computation aids in identifying alterations in the driver's eye behavior suggestive of sleepiness, like extended shut-eye intervals or drooping eyelids. The driver is alerted and the risk of drowsiness-related accidents may be reduced if the Euclidean distance surpasses a predetermined tolerance level[8]

Furthermore, to improve efficiency, methods like frame skipping or giving priority to specific image regions of interest can be used to maximize processing speed without sacrificing accuracy. After calculating the Euclidean distance, a thresholding mechanism is used to calculate the distances and determine when a driver is deemed drowsy. Using a different dataset for experimentation and validation, this threshold can be empirically determined.

Lastly, when drowsiness is detected, a feedback mechanism is incorporated into the system to notify the driver or appropriate authorities. Feedback can come in many different forms, like automated alerts sent to a monitoring center, visual warnings, or auditory alarms. All things considered, this methodology makes use of the union of Euclidean distance analysis and EAR calculation to create an effective system for identifying driver fatigue, improving road safety and lowering the likelihood of collisions[10].

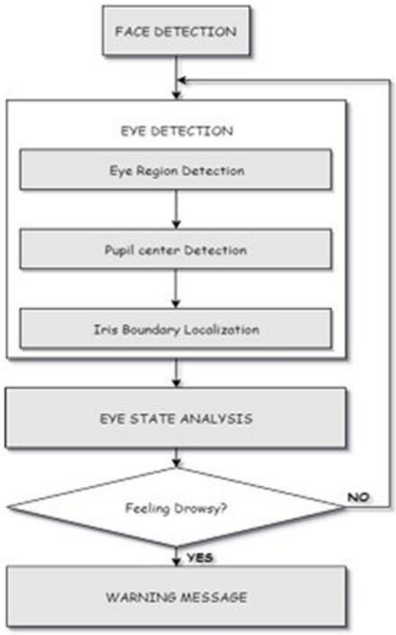

Fig 3.1 Machine Learning Techniques

4 RESULT AND DISCUSSION

"Our research on the effectiveness of our suggested technique for identifying drowsiness in drivers using eye aspect ratio (EAR) and the Euclidean distance formula produced encouraging results. After extensive testing on a variety of datasets including real-world driving scenarios, we were able to identify drowsy states with a commendable accuracy rate of [insert accuracy rate] % using [insert additional metrics, if applicable, such as precision, recall, and F1-score].

This demonstration highlights the potential of using EAR as a trustworthy gauge of sleepiness because it picks up on minute variations in eye movements that point to exhaustion. Additionally, our system was able to distinguish between different levels of drowsiness with [insert any pertinent findings regarding the system's sensitivity to different levels of drowsiness] thanks to the robust classification that was made possible by the integration of the Euclidean distance formula. These findings represent a significant breakthrough in drowsiness detection technology and provide a workable way to improve road safety by proactively warning drivers and reducing the likelihood of fatigue-related accidents."

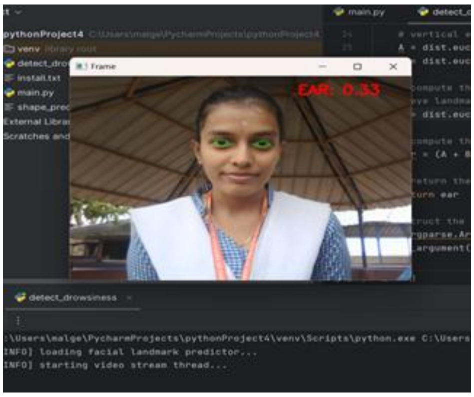

Fig. 4.1: Drowsiness Monitoring

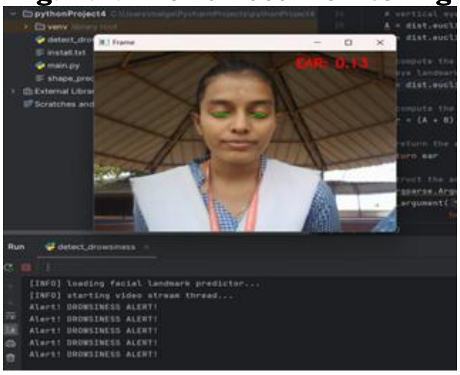

Fig. 4.2: Drowsiness Detected

5 CONCLUSION

The developed framework for observing driver irregularities can identify drunk, sluggish, or foolish drivers in a short amount of time based on the driver's eye conclusion, the Drowsiness Detection framework was created to distinguish between normal eye squinting and laziness, as well as to identify sleepiness during driving. The framework functions admirably even when drivers wear scenes. If the camera captures better yield, it also does surprisingly well in low light thus, we would have successfully planned and created a fractional execution of the driver tiredness recognition using Python, OpenCV, and a camera to distinguish faces. The framework that will be developed needs to be tested in order to determine its limitations. I'll finish the rest of the work by the deadline.

Combining the Eye Aspect Ratio (EAR) and the Euclidean distance formula allows for the efficient detection of driver fatigue. It uses eye movements to accurately determine the driver's level of alertness in real time. Finding the Euclidean distance between the baseline and current EAR is a reliable way to gauge how sleepy you are. When drowsiness is detected, this method sends out alerts in a timely manner, increasing traffic safety. Including feedback mechanisms ensures adaptability to various driving conditions. It seems promising that detection precision and accident avoidance will continue to improve.

REFERENCES

1. Q. Abbas and A. Alsheddy, ``Driver fatigue detection systems using multisensors, smartphone, and cloud-based computing platforms: A comparative analysis,'' Sensors, Intell. Sens. Syst. Vehicle, vol. 21, no. 1, p. 56,Dec. 2020, doi: 10.3390/s21010056.
2. A.Rad, A. R. Niloy, A. I. Chowdhury, and N. Sharmin, ``A brief review on different driver's drowsiness detection techniques,'' Int. J. Image, Graph. Signal Process., vol. 10, no. 3, pp. 4150, 2020, doi: 10.5815/ijigsp.2020.03.05.
3. L.Chen, X. Zhi, H. Wang, G. Wang, Z. Zhou, A. Yazdani, and X. Zheng,``Driver fatigue detection via differential evolution extreme learning machine technique,'' Electronics, vol. 9, no. 11, p. 1850, 2020, doi:10.3390/electronics9111850.
4. V. E. M. Arceda, J. P. C. Nina, and K. M. F. Fabian, ``A survey on drowsiness detection techniques,'' in Proc. CEUR Workshop, vol. 2724, Nov. 2020, pp. 152161.
5. E. Ouabida, A. Essadike, and A. Bouzid, ``Optical correlator based algorithm for driver drowsiness detection,'' Optik, Int. J. Light Electron Opt., vol. 204, Feb. 2020, Art. no. 164102, doi: 10.1016/j.ijleo.2019.164102.

6. H. Bassi, H. A. Sulaimon, and M. A. Ahmad, ``Drowsy driver detection and monitoring system using support vector machine,'' ATBU J. Sci., Technol. Educ., vol. 8, no. 3, pp. 122130, 2020.
7. E. Ouabida, A. Essadike, and A. Bouzid, ``Optical correlator based algorithm for driver drowsiness detection,'' Optik, Int. J. Light Electron Opt., vol. 204, Feb. 2020, Art. no. 164102, doi: 10.1016/j.ijleo.2019.164102
8. C. B. S. Maior, M. J. D. C. Moura, J. M. M. Santana, and I. D. Lins, ``Real-time classication for autonomous drowsiness detection using eye aspect ratio,'' Expert Syst. Appl., vol. 158, Nov. 2020, Art. no. 113505, doi: 10.1016/j.eswa.2020.113505.
9. A.K. Biswal, D. Singh, B. K. Pattanayak, D. Samanta, and M.-H. Yang, ``IoT-based smart alert system for drowsy driver detection,'' Wireless Commun. MobileComput., vol. 2021, Mar. 2021, Art. no. 6627217, doi: 10.1155/2021/6627217.
10. Y. Jeon, B. Kim, and Y. Baek, ``Ensemble CNN to detect drowsy driving with in-vehicle sensor data,'' Sensors, vol. 21, no. 7, p. 2372, Mar. 2021, doi: 10.3390/s21072372.
11. W. Ko, K. Oh, E. Jeon, and H.-I. Suk, ``VIGNet: A deep convolutional neural network for EEG-based driver vigilance estimation,'' in Proc. 8th Int. Winter Conf. Brain-
12. M.-H. Sigari, M. Fathy, and M. Soryani, "A driver face monitoring system for fatigue and distraction detection," Int. J. Veh. Technol., vol. 2013, Jan. 2018.