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Computer Vision-based Driver Safety Monitoring System

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***Abstract* —** *Nowadays, effective transportation is crucial for the growth of all imaginable enterprises, but it has also increased risk due to accidents and disasters. Statistics show that fatigued driving contributes to 2.4% of accidents. Consequently, a technique was developed to lessen accidents brought on by tired drivers. The device is cleverly built to warn the driver if they are detected to be asleep. The system was developed using 68 facial landmark detection algorithms in order to precisely measure the eye ratio and assess whether or not the driver was experiencing dizzy. If this is the case, the warning is played so the driver may get up and take the appropriate action.*
Keywords *—Drowsiness Detection , Eye Aspect Ratio*

I. Introduction

SINCE a few decades ago, as vehicle technology has advanced, the frequency of traffic incidents has increased. It is believed that the driver's sleepiness is a crucial component. According to official statistics, 2202 individuals perished in road accidents in the state between January and May of 2021, and 2357 or more people died merely in the first five months of this year. The Central Road Research Institute (CRRI) found that 40% of traffic accidents are caused by weary drivers who fall asleep at the wheel on the 300-km Agra-Lucknow Expressway. Humans are prone to the condition of sleepiness. It has, nevertheless, evolved into one of the biggest risks on the road as a result of modern lifestyle and car technology. Over the past few decades, drowsy driving has been the subject of numerous studies. There are three key factors that contribute to driver weariness. The first is not getting enough sleep in an effort to fit everything in one day; the second is chronic boredom during lengthy excursions, especially if they include travelling at a steady speed on featureless highways. Despite much study in this field, sleepiness cannot yet be quantified in any particular way.[1-4]

All of this has prompted the creation of a system that will alarm when a person shows signs of becoming sleepy. The driver will undoubtedly be aware of this and take the necessary precautions, to prevent the car from being driven by a potentially dangerous driver.

Driver sleepiness detection techniques come in a variety of forms, usually falling into three categories. The first group is the vehicle-based approach [5], where various measurements including steering wheel movement are used. The vehicle speed, lateral acceleration, break pattern, accelerator, and other factors are continually monitored. The physiologically based methods fall under the second group [6] and include electrocardiograms[7,17,21],electroencephalograms[8,18,21] , Electromyography [19,21]and electrooculograms[9,20.21].

Monitoring the physical state and facial expressions is another method for determining whether the drivers are fatigued, but Wireless sensor networks can't analyze and transmit this data with enough accuracy and a decent recall. Therefore, creating a reliable sleepiness detection system is crucial.[10]

The demonstration of a real-time driver monitoring system for visual attention. Eye blinking is thought to be a crucial factor in assessing driver weariness and sleepiness and appropriately sounding the warning based on real-time data gathering and processing.[11]

Driver drowsiness detection is a technology that aims to detect when a driver is falling asleep at the wheel and alert them to take a break or pull over. Drowsy driving is a major safety hazard, as it can lead to accidents and fatalities on the road. There are several approaches to detecting driver drowsiness, observing the driver's body language, facial emotions, and eye movements. Some systems also use machine learning algorithms to analyze data from sensors and cameras to recognize sleepiness symptoms. The reduction of accidents is the main objective of a driver fatigue detecting system. caused by drowsy driving and improve road safety.

II. Literature Review

The author has described an efficient method to generate an algorithm that determines the landmarks in the face region and finds the face in the image. AdaBoost classifiers based on Modified Census Transform features and regressing Local Binary Features for face landmark identification are used to recognise faces. The value of the eye aspect ratio determines the condition of the eyes(calculated by landmarks in the eye region.) and drowsiness is determined by The percentage of time the eyes are closed is known as PERCLOS (percentage eye closure). [12]

The camera is used to split the facial aspects into lower and upper halves and subsequently detect the blinking and yawning rate and thus conclude if the driver is sleepy or no. The accuracy of this detection is approximated to about 99 to 100% according to the test cases run says the author.[13]

Tiredness detection method that makes use of a dashboard camera. The suggested method finds the face in the picture and makes an estimate of the nearby landmarks. The suggested technique makes use of an AdaBoost classifier based on Modified Census Transform characteristics to find the face. Additionally, the technique employs regressing Local Binary Features to recognize facial landmarks. The state of the eyes is determined by eye aspect ratio, which is easily assessed utilizing the landmarks in the eye region (closed or open) was very well demonstrated in the paper written down by Jang Woon Baek and his co-authors.[14]

The reliability of electroencephalography was quite good writes the author, M.Oviyaa. Only when the driver is ready to fall asleep and occasionally extremely late are the conventional car and the vision-based sensor for tiredness absolutely necessary to prevent traffic fatalities. This essay was specifically written to increase rider safety.

The suggested device uses EEG sensors built into the driver's helmet to identify signs of driving drowsiness. A brain-wave sensor picks up the driver's biological signal from the driver's brain. This system uses a helmet's crucial role as a miniaturized sensor and warning platform to give real-time sleepiness and tiredness monitoring for bikers. It also uses MMI, or mind-machine interface, to handle issues like drowsiness and fatigue.[15]

III. METHODOLOGY/EXPERIMENTAL

The suggested work implements pre-existing features for facial landmark identification to determine the level of sleepiness and exhaustion. The 68-facial landmark is a predetermined landmark that aids in shape prediction to clearly distinguish the various parts of the face, including, but not limited to, the areas around the eyes, lips, and eyebrows.[11] The facial landmarks can be used to identify patterns and changes in the driver's facial movements that may indicate drowsiness or fatigue. To detect drowsiness using this approach, the system would first be recognizing the driver's face in the real-time video that is necessary from a camera mounted in the vehicle. Once the face is identified, the system can use the facial landmark detector to identify the positions of the 68 facial landmarks.

The system can then analyze the positions and movements of the facial landmarks over time to detect changes that may indicate drowsiness or fatigue. For example, the system may look for changes in the position of the eyes (such as drooping eyelids) or changes in the facial muscles (such as a slack jaw). The system may also employ machine learning techniques to examine the information from the facial landmarks and discover patterns that are related to tired driving in order to increase the accuracy of sleepiness detection.

This approach can be effective at detecting drowsy driving, but it is important to note that it is just one of many potential approaches and may not be suitable for all applications. Other methods for detecting driver drowsiness include monitoring eye movements, body movements, and driving patterns.

The methodology steps are as follows:

1. Capture real-time video from a camera mounted in the vehicle.
2. Use a facial landmark detector to identify the positions of the 68 facial landmarks in the video.
3. Analyze the positions and movements of the facial landmarks over time to detect changes that may indicate drowsiness or fatigue.
4. Use machine learning algorithms to analyze the data from the facial landmarks and learn to recognize patterns that are associated with drowsy driving.
5. The motorist may receive a warning to pull over or take a break if the system notices indicators of sleepy driving.

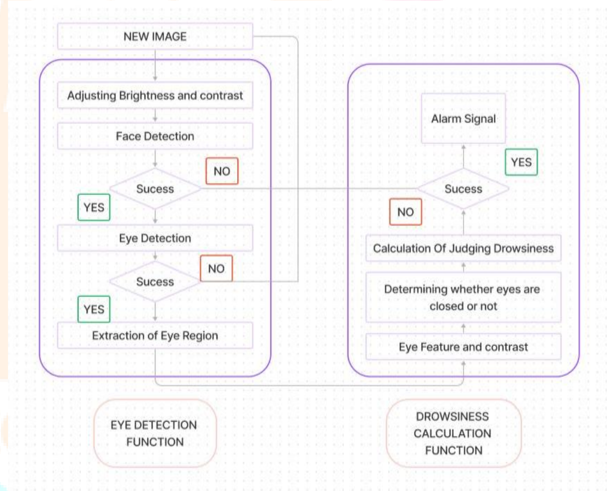

Figure 1 Flowchart

IV. RESULTS AND DISCUSSIONS

When the driver is found to be sleepy, the system is intended to raise an alarm indicator in addition to the display. A key factor in reaching the judgment is the blink rate and the length of time , whenever the eyes are shown to be closed.

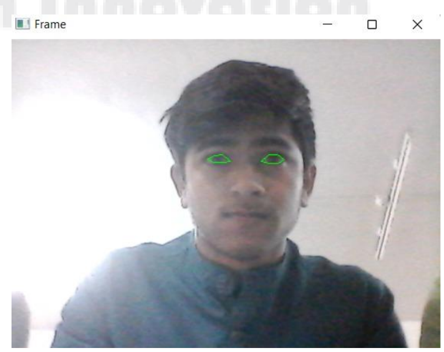

Figure 2 Open Eyes detected

The face region is detected and the eyes are extracted to perform analysis. If the eyes are found to be open no action is taken.

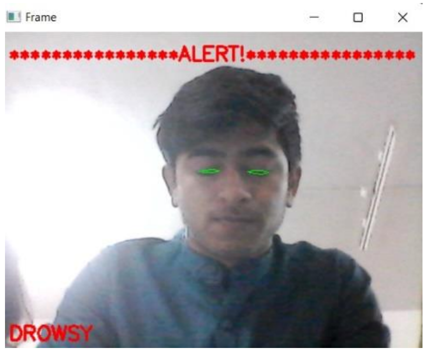

Figure 3 Drowsiness Detected

The eyes, in this case, are detected to be closed and thus an alarm is raised to alert the driver and thus, prevent an upcoming mishap.

V. Future Scope

The future scope of a Computer Vision-based Driver Safety Monitoring System designed to detect driver drowsiness using 68 facial landmarks could include improving the accuracy of the drowsiness detection, incorporating additional sensors and data sources, developing new methods for alerting the driver, integrating the system with other vehicle systems, and expanding the application of the system to other modes of transportation. Other potential areas of focus could include fine-tuning the machine learning algorithms, exploring new approaches to analyzing facial landmarks, and addressing ethical and privacy concerns. The specific direction of the project will depend on the goals and priorities of the development team and the needs of the users.

VI. Conclusion

The presentation of a Driver Visual Attention Monitoring System in Real Time. Based on real-time data collection and analysis, eye blinking is considered to be a critical aspect in determining driver fatigue and drowsiness and correctly sounding the warning

The system is designed to raise an alarm sign along with the alert display when the driver is observed to be dizzy. The Blink rate and the time for which the eyes are detected to be closed are major parameters for driving to the conclusion.

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