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Driver Drowsiness Detection System using Machine Learning

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Abstract: *In today's world, tiredness is one of the leading factors in traffic accidents, many of which result in fatalities. According to statistics, drowsy driving causes the majority of traffic accidents, which often result in fatalities and serious injuries. Because of this, numerous experiments have been conducted on creating software that can identify driver drowsiness and warn them before a serious mistake is made. Some of the more popular techniques create their own systems using techniques from the automotive industry. But other elements like the design of the road, the type of vehicle, and the ability to drive using the driver's wheel heavily influenced these conventional criteria. In order to monitor a driver's drowsiness, certain techniques use psychological methods, which frequently yield the most precise and reliable results. These methods are expensive, though, because electrodes must be applied to the head and torso. To generate results, the model is provided with a sizable database of closed and open eyes. Every time the driver is observed to be sleepy, Buzz alerts the driver. In our model, we employ a typical forward-facing smartphone camera and use the data we have collected to provide results for our website.*
Key Word: *Drowsiness;OpenCV;MobileNet architecture; Convolutional Neural Network(CNN); HAAR cascade classifier; Webcam*

I. INTRODUCTION

Drowsy driving is a common factor in fatal car accidents. Most drivers are aware of the risks associated with texting while driving and driving while intoxicated, but many people underestimate the risks associated with drowsy driving. According to the National Safety Council, drowsy driving causes around 100,000 collisions, 71,000 injuries, and 1,550 fatalities each year (NSC). Drowsiness was also discovered to be a contributing factor in up to 9.5 percent of all crashes and 10.8 percent of crashes involving airbag deployment, injuries, or major property damage, according to a study from the AAA Foundation for Traffic Safety. Drivers need to be aware of the risks because driving while fatigued is extremely risky. Detecting driver drowsiness and warning the driver are both crucial.

To sum up, there are several challenges that are needed to be resolved:
1. The ability to recognize a driver's drowsiness while they are driving and sound an alarm or warning at the appropriate moment is a key difficulty because any delay will increase the likelihood of an accident or failure.
2. A portable webcam's low-quality video capturing capabilities can occasionally prevent it from detecting drowsiness, which compromises the model's accuracy.
3. As a result, there is a need for more, and there is also a demand for more affordable, adaptable equipment, such as a webcam, that can take better pictures.
4. The likelihood of an accident or failure will increase if the webcam feed occasionally shows a loss in frames or self-pressing, which means that the output frame is given to the model with a delay of a few seconds and a portion of the alarm sound or warning delay.

II. LITERATURE SURVEY

Several methods have been suggested in an effort to improve drowsiness detection's accuracy and speed. The previous drowsiness detection techniques and strategies are summarized in this section. A smartphone (either an Android or an iPhone smartphone) serves as the proposed mechanism in [1]'s driver sleepiness detection system. A smartphone's front camera records photos of the driver, which are subsequently sent to the device's CPU for image processing. The main objective in [2] is to develop a drowsiness detection system for drivers based on the measurement of yawning using eye and mouth detection.

In order to prevent car accidents, it aims to ensure the accurate detection of yawning expression in the presence of changing lighting conditions and facial occlusions. The work displayed in [3] is based on the Transfer Learning tenets. To separate the images, it used the MobileNet architecture. The architecture used by CNN for mobile vision and image segmentation is modelled after MobileNet. [4] uses image processing to identify faces and eyes. For face detection, a cascade classifier based on HAAR is used. The eyes are continuously tracked using an algorithm designed to track moving objects. The PERCLOS algorithm was used to determine whether the driver was sleepy. The system will use a camera to track the driver's eyes. When the driver is showing signs of fatigue, output in the form of sound and seat belt vibration is provided. There will be no automatic deactivation of the warning. The final idea is to create drowsiness detection wearable hardware, like smart watches. The driver's face is captured on camera in [5] and converted into numerous image frames. The image frame is used as input, and facial features like the eyes and mouth are extracted from the input image through pre-processing for face detection. The system uses the LBPH technique to detect features like the mouth and eyes. The LBPH technique is used to extract the features of the mouth and eyes. Using the HAAR detection method, the features of the eye (blink) and mouth (yawn) are identified. Check the blink rate of each eye to see if it is open or closed. If the blink rate is higher than the normal threshold, the warning beep system is alerted, and a red signal is displayed. If not, the steps continue to be executed, and a green signal is displayed. Multilayer Perceptron Classifier16, also known as MLP, was used in [6] for data processing. MLP is a simple neural network made up of entangled nodes (neurons) that represent the output from the input class. The artificial neuron takes one or more inputs that resemble dendrites, adds them based on connection weights, and then generates a class of outputs.

III.METHODOLOGY

1. **System Configuration:** The suggested driver sleepiness detection system is built up for real-world driving in Figure 1. A webcam can be installed on a vehicle's dashboard. The webcam is pointed at the driver's face, and it is held horizontally.

2. **Algorithm Framework:**The foundation of the model is transfer learning theory. Transfer learning is a machine learning method in which a model designed for a task in the past is also used as the starting point for a second activity model. They produce very accurate results on related problems. In order to divide up photos, we used MobileNet architecture. The architecture used by CNN for mobile vision and image segmentation is modelled around MobileNet.

3. **HAAR Training:**The OpenCV library provides functions for face and feature (eyes, mouth, sunglasses, etc) detection. Classifiers can be trained using some of these functions. The method of training the classifiers to recognize faces is known as HAAR training. Here, a cascade function is trained using both positive and negative images. Each feature consists of a single value that is created by subtracting the sum of the pixels under various regions of the images. For each characteristic, a different set of pixels are used for extraction. All the extracted features will not be useful for the required process.

4. **Face Detection:**By analysing video stream visuals, this system can determine whether a user is sleepy. Multiple CNNs-kernelized correlation filters, a more advanced in-video face-tracking technique, is used for face detection. The eyes and lips were among the important areas in the driver's face that were located using 68 key points. To determine the driver's level of drowsiness, the system measured the ratio of closed-eye frames to total frames, the duration of continuous eye closure, the frequency of blinking. As a last step, the DDD system warns the driver.

5. **Eye Detection:** The proposed method makes use of HAAR Cascades to identify objects in real time, including the driver's face and eyes. The OpenCV library is used by the model. Then, in order to keep track of the number of frames for both open and closed eyes as well as the alarm status, we set the frame counter "COUNTER" to 0 and the Boolean "ALARM ON" to OFF. If the recognized eyes are closed for five consecutive frames, we raise the alarm,else the counter is restarted at 0.
6. **Drowsiness Detection:**In the suggested technique, HAAR Cascades are used to recognize things in real time, such as the driver's face and eyes. Face identification is performed using multiple CNNs-kernelized correlation filters, a more sophisticated in-video face-trackingmethod. The system calculates the length ofcontinuous eye closure, the frequency of blinking, and the ratio of closed-eye frames to total frames. TheDDD system finally alerts the driver. In the Setting tab, users may adjust settings including alert sound and volume.

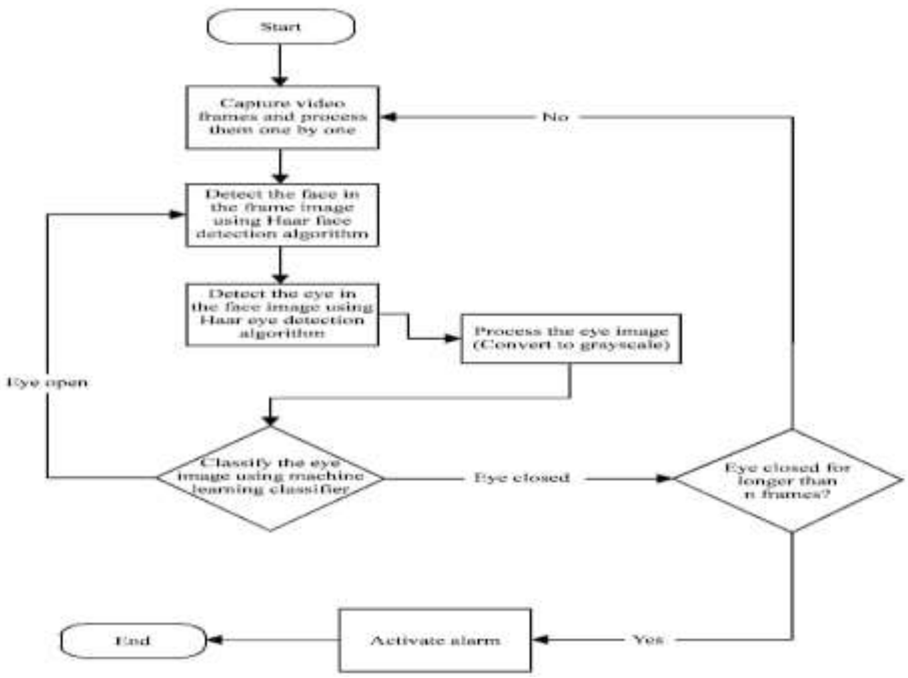

Figure 1:Flowchart showing entire process of Drowsiness Detection System.

IV.CONCLUSION

Driver Drowsiness Detection was created to help a driver stay awake while driving in order to reduce car accidents caused by drowsiness. The topic of this research was drowsy drivers and their potential to cause vehicle accidents. The driver drowsiness detection system calculates the driver's tiredness level from the driver using a combination of webcam, HAAR cascade classifier, drowsiness detection is used to calculate whether or not a driver is drowsy. It retrieves photos from the camera at the same time, which is enough to determine a driver's features in real-time. The system uses open-source software known as OpenCV image processing libraries to process the captured pictures. The combination of a webcam and an OpenCV transforms the total system into a low-cost drowsiness detection system.

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