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DRIVER DROWSINESS DETECTION SYSTEM

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Abstract: One of the main causes of traffic accidents is driver fatigue and drowsiness. Globally, they are increasing the number of fatalities and injuries each year. The route is heavily travelled both during the day and at night. Long-distance travellers, bus and truck drivers, and taxi drivers all experience sleep deprivation. As a result, it is extremely risky to drive while tired. When the system uses a camera to take photographs of the driver, it looks to see if the driver's eyelids are closed for five frames in a row. When the system uses a camera to take photographs of the driver, it looks to see if the driver's eyelids are closed for five frames in a row, the system deduces that the driver is dozing off and sounds an alarm. The technology operates under tolerable lighting settings and can also recognise when the eyes are missing.

Keywords: **Arduino-nano, Deep Learning, Webcam, OpenCV, Eye Aspect Ratio**

1. Introduction

In our nation, the number of cars is growing tremendously. The biggest issue with the growing usage of automobiles is the increase in traffic accidents. Without a question, road accidents are a global threat in our nation. India has one of the highest rates of vehicle accidents worldwide. The National Crime Records Bureau (NCRB) states that around 135,000 traffic accident-related deaths occur each year in India. The World Health Organization (WHO) listed driver mistakes and carelessness as the primary causes of road accidents in its Global Status Report on Road Safety. The main factors in the accident scenario are the driver's inattention, drunkenness, and tiredness.

Currently, transportation infrastructure is crucial to human activity. Any of us can become sleepy while driving, whether it's from getting too little sleep the night before, a physical condition change, or lengthy travel. The feeling of sleep lowers the driver's level of alertness, creating hazardous situations and raising the likelihood of an accident. One of the major contributing factors to accidents on the road is driver weariness and drowsiness. Globally, they increase the number of fatalities and injuries every year. In this situation, it is crucial to leverage new technologies to plan and create systems that can track drivers and gauge their degree of attention throughout the entire driving process.

A system for monitoring driver anomalies must be integrated into the vehicle in order to reduce the effects of such behaviours. In order to create advanced safety systems for automobiles, real-time identification of these behaviours is a key difficulty. In order to create advanced safety systems for automobiles, real-time identification of these behaviours is a key difficulty. Additionally, it offers an overview of a variety of driver- and vehicle-based strategies. A technique for detecting sleepiness has been created that relies on the shape predictor algorithm and eye blink rate. Its foundation is the idea of picture processing.

2. Literature Survey

One common definition of driver abnormality is: "Driver abnormality represents diminished attention to activities that are critical for safe driving in the absence of a competing activity." Driver anomaly monitoring and detection systems have been the subject of several studies utilizing a variety of techniques. The following categories can be used to categories potential detection methods for sleepy drivers: physiological features, driver operation, vehicle response, and driver response. The approaches based on human physiological phenomena are the ones that, in terms of accuracy, are the most reliable. This method can be applied in a variety of ways, including by monitoring eye openness or closure, heart rate, and brain waves (EEG).

1. Malla et al. create a system that is light-insensitive. To find objects, they employed the Haar algorithm, which was implemented by [3] in the OpenCV [4] library. Anthropometric parameters are used to determine the eye regions from the facial region. The amount of ocular closure is then determined by detecting the eyelid.
2. Vitabile et al. use an infrared camera to create a system to identify signs of driver drowsiness. A tracking system for the driver's eyes has been devised by taking use of the phenomenon of bright pupils. The device sends the driver an alarm message when it detects tiredness.

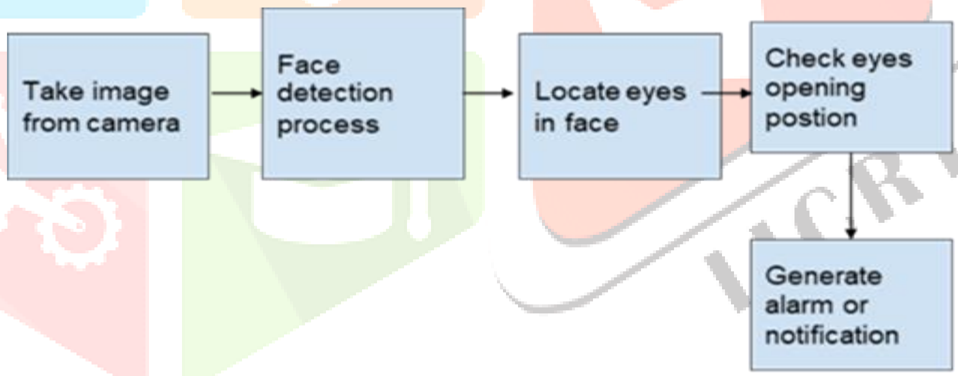
3. Scope of the Work

There are several ways to increase a driver's sense of roadway security. It should be noted that the development of cutting-edge driver assistance frameworks is one of the major mainstream techniques that have been established in previous logical explorations. These safety systems make it possible to reduce traffic accidents and improve communication and cooperation with drivers. For these kinds of frameworks, some typical examples of driver safety improvements are the vehicle impact shirking system, the path keeping partner, the driver laziness and interruption monitoring as well as the warning.

The general use of such frameworks may be represented as the following arrangement of sequential orders: using special intrinsic helper devices, such as short- and long-range radars, lasers, lidars, and cameras that stream video to see the surrounding environment to observe driver behaviour, vehicle condition, or street situation; Continuous sensor reading analysis and risk assessment while driving; warning driver of allegedly dangerous conditions on the road and in lodgings; and if there is no or insufficient response from the driver, taking over the wheel. The information gathered by various in-vehicle sensors is now a major component of driver security systems.

4. Proposed System

The Driver Drowsiness Detection System uses a webcam to take pictures of the driver and identify faces. We use facial landmark detection to extract the eye areas after the face has been identified. We can determine the eye aspect ratio after we know the eye regions. If the eye aspect ratio indicates that the driver's eyes have been closed for a sufficient amount of time, an alert will be sounded to rouse him or her up.



4.1 Proposed System Architecture

1) Arduino nano - A crystal oscillator with a 16 MHz frequency is included with the Arduino Nano. It is used to generate an accurate clock with a steady voltage. In a more compact design, it provides the same connections and specifications as the Arduino Uno board.

2) OpenCV - OpenCV (Open Source Computer Vision Library) is a machine learning and computer vision software library that is available for free. A standard infrastructure for computer vision applications was created with OpenCV in order to speed up the incorporation of artificial intelligence into product.

- Required Python Packages –

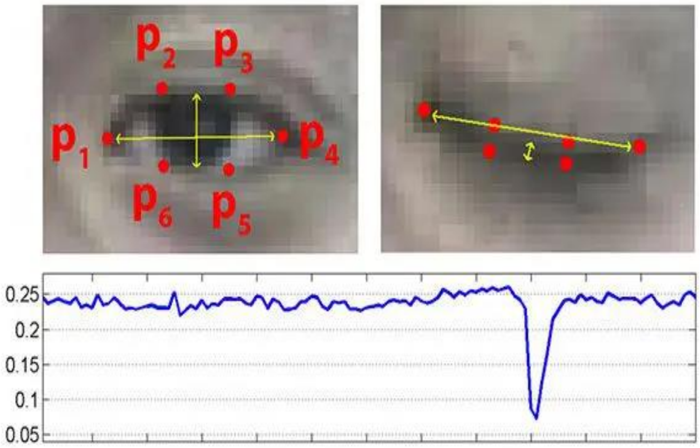
1. SciPy Package : To determine the Euclidean distance between the locations on the face that represent the eyes' aspect ratios.
2. imutils package : a number of computer vision and image processing features to simplify using OpenCV.
3. The dlib library is required to locate facial landmarks and detect them.

The eye aspect ratio function, which measures the ratio of distances between horizontal and vertical eye landmarks, must be defined.

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

When the eye is open, the eye aspect ratio will roughly remain constant. The value will then drop dramatically in a blink, eventually reaching zero.

Even though it will be far smaller than it is when the eye is open, the eye aspect ratio will essentially remain constant if the eye is closed.



An eye that is fully open and marked with facial landmarks can be seen in the top-left image. Then, in the upper right, there is a closed eye. The eye aspect ratio is then plotted over time at the bottom.
When the eye is open, the aspect ratio remains constant; when a blink occurs, it swiftly drops to zero and then increases once again.

When looking for signs of sleepiness, we monitored the eye aspect ratio to check if it dropped but did not immediately increase, indicating that the person had closed their eyes.

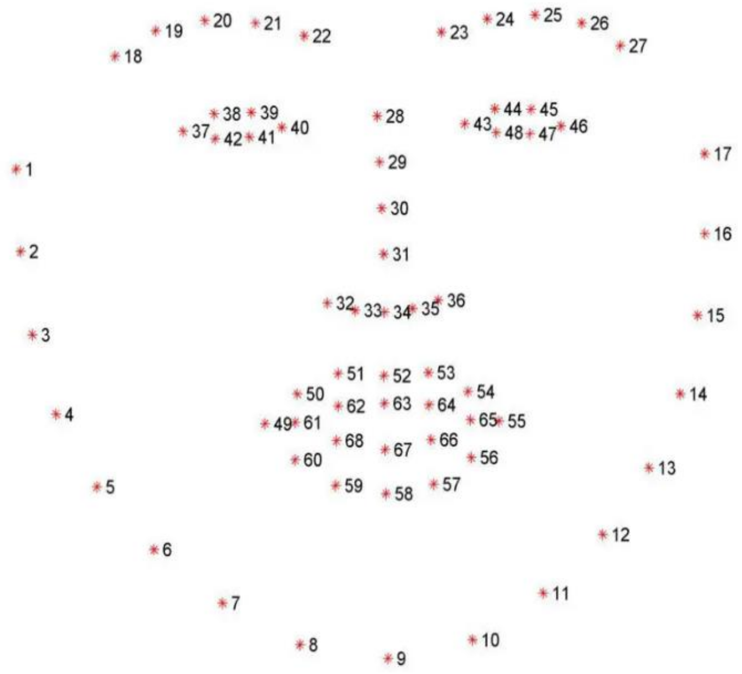
Our drowsiness detector requires the following one essential command line argument, followed by two optional ones, each of which is outlined below:

1) shape-predictor - This leads to the pre-trained face landmark detector in dlib.
2) alarm - With this option, you can choose the location of the audio file that will serve as the alarm.
3) webcam - The webcam/USB camera index on your computer is managed by this integer.

A facial landmark predictor and Histogram of Oriented Gradients-based face detector are included in the dlib library, and the facial landmarks generated by dlib are a list that may be indexed.

To identify and depict important areas of the face, facial landmarks are employed, such as:

1. Eyes
2. Eyebrows
3. Nose
4. Mouth
5. Jawline



The 68 facial landmark coordinates

This process begins by utilising:

1. a collection of face landmarks on an image for training with labels. The particular (x, y) coordinates of the areas around each face structure are specified in the manual labelling of these pictures.

2. Priors, or more precisely, the likelihood of the separation between adjacent input pixel pairs.

An ensemble of regression trees is trained using this training data to predict the locations of face landmarks solely from the pixel intensities (i.e., no "feature extraction" is happening).
The outcome is a face landmark detector with high-quality predictions that can be used to identify facial landmarks in real-time.

5. RESULT

As a result, the drowsiness detector can recognise when there is a chance of falling asleep and will play a loud alert to get the user's attention.
The sleepiness detector can even function in a variety of environments, such as bright sunlight when operating a motor vehicle and dim or artificial lighting inside a concrete parking garage.

6. Conclusion and Future Scope

The created driver drowsiness detection system is able to quickly identify the drowsy, inebriated, and reckless driving behaviours of drivers. The suggested technique can stop accidents brought on by drivers who are sleepy. If the camera produces better results, the system still functions well even when the driver is wearing eyeglasses and in low light. The monitoring system can determine if the eyes are open or closed. after an excessively lengthy period of eye closure.

Future research may concentrate on using environmental parameters, such as vehicle conditions, weather, sleeping patterns, mechanical data, etc., to quantify weariness. One important step in preventing risks is to monitor the driver's level of alertness and drowsiness and alert them about it so they can respond appropriately. Because the camera's zoom or direction cannot be changed while it is operating, future work may involve zooming directly into the driver's eyes.

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