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Driver Drowsiness and Yawn Detection

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Abstract: ***Drowsiness of the drivers is the primary reason for accidents within the global. Because of lack of sleep and tiredness, drowsiness can occur while driving. The nice manner to keep away from injuries caused by the driver's distraction is to locate the drowsiness of the motive force and warn them earlier than falling asleep. To come across drowsiness and distraction many techniques like eye retina detection, facial characteristic popularity, and yawning detection were used. Right here in this project, we propose a method of detecting driving force drowsiness with the usage of eye retina detection, face detection, and yawning detection of the driver. As soon as the motive force is discovered drowsy an alert can be generated and a message might be printed on the display screen with the alarm for you to alert the driver quickly.***
Keywords: Neural Networks, OpenCV, Python, SciPy, dlib.

I. INTRODUCTION

Drowsiness is surely described as “a country of near-sleep due to fatigue”. It’s far technically distinct from fatigue, which has been defined as a “disinclination to keep appearing the assignment at hand”. The outcomes of sleepiness and fatigue are very much identical. Fatigue affects mental alertness, decreasing an individual’s capability to function in a car effectively and increasing the danger of human errors that would result in fatalities and accidents. Sleepiness slows reaction time, decreases consciousness, and impairs judgment. Fatigue and sleep deprivation impact all transportation operators (for example airline pilots, truck drivers, and railroad engineers).In each situation, the driver can’t attend on the number one mission of riding which may additionally beautify the likelihood of crash occurrence. The interplay between driver and vehicle such as monitoring and assisting each other is one of the vital answers for maintaining ourselves safe in the cars. Although energetic safety structures in motors have contributed to the lower variety of deaths happening in visitor’s injuries, the quantity of visitor’s injuries continues to be growing consistent with to be had statistical information, over 1.3 million humans die each year on the road and 20 to 50 million human beings suffer non-deadly injuries because of road injuries. Exhausted drivers who fall asleep on the wheel are accountable for approximately 40% of road accidents, says a take a look at through the crucial road studies Institute (CRRI) at the three hundred-km Agra-Lucknow limited-access highway [1]. Driver drowsiness and Distraction is a chief issue which results into numerous vehicle accidents. Growing and maintaining technologies that may correctly hit upon or prevent drowsiness at the wheel and alert the driving force before a mishap is a first-rate mission inside the area of twist of fate prevention systems. Because of the dangers that drowsiness can cause on the roads some strategies want to be developed for preventing counteracting its consequences. With the appearance of a present-day era and actual-time scanning structures the use of cameras we will prevent predominant mishaps on the road by using alerting car motive force who is feeling drowsy via a drowsiness detection device. The point of this venture is to accumulate a prototype drowsiness and distraction detection machine. The spotlight could be placed on making plans a framework so that it will exactly display the open or shut condition of the driving force's eyes continuously. By tracking the eyes, it miles believed that the signs and symptoms of motive force fatigue may be detected early enough to avoid a car twist of fate. Detection of fatigue entails the remark of eye actions and blink patterns in a sequence of pictures of a face.

II. METHODOLGY

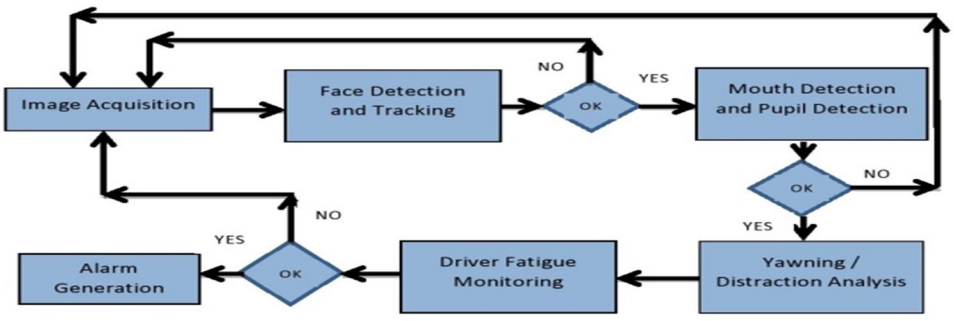


Fig.1. Flow chart

The flowchart of the proposed machine has been proven inside the above discern. The digital camera captures the picture and sends it to the processor of the pc which consists of a 32-bit memory card installed with Open CV which facilitates image processing. If the signal crosses the threshold of a set of continuous frames with EAR much less than the threshold fee, it will automatically make the alarm beep and the velocity of the automobile receives reduced. In any other case, that signal is rejected and the subsequent signal is processed. The driver's face is monitored at some stage in using a video or net digital camera. To discover the drowsiness the first step is to stumble on the face the usage of the set of frames taken via the camera. Then the vicinity of the eyes is detected and the retina of the attention is continuously monitored. The captured image is sent to the processor for photo processing. It converts the acquired image to virtual sign the usage of Open CV. If the signal crosses the brink fee of the EAR for a given quantity of frames, then the alarm beeps and the velocity of the vehicle is automatically decreased.

A. Image Sequences Input and face Detection

OpenCV changed into developed retaining image processing in thoughts. Each feature and data structure of OpenCV worries itself with an image processing library. Comparatively, Matlab is high of commonplace use & gradual. Any usefulness can be achieved through strategies for tool kits in OpenCV, it is probably cash-associated device compartments or explicit DNA device stash. The dlib library serves us with a facial landmark detector as well as a facial landmark predictor. Beneath are the facial landmarks that can be produced by using the library. Now from these landmarks, it just churns out the attention areas efficiently.

Fig.2. Facial landmarks set by dlib

B. Eye Detection

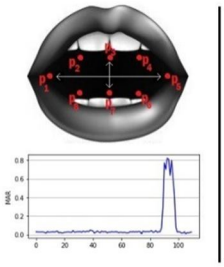
$$\mathrm{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Fig.3. Eye aspect ratio equation

This equation reflects this relation referred to as Eye Aspect Ratio (EAR). Where p1… p6 are 2d facial landmark regions. The numerator of this equation computes the space among the vertical eye landmarks which the denominator computes the space among horizontal eye landmarks, weighting the denominator appropriately due to the fact there's handiest one set of horizontal points but two sets of vertical points. Now for calculating the eye-element ratio we need to compute the Euclidean distance among the facial landmarks factors which in turn wishes SciPy bundle in python. (It, not a strict requirement however SciPy is needed if paintings associated with laptop imaginative and prescient or photo processing is intended). Also, the package named utils is wanted for photo processing and laptop vision capabilities to assist the operating with OpenCV. The thread class is imported so that we can beep the alarm in a special thread from a foremost thread so that it is ensured that our script doesn't prevent/pause executing whilst the alarm beeps. So that you can play a file of the wav or mp3 format, we want to play sound library. For detecting and localizing facial landmarks we can require the dlib library hence we import it. Eye aspect ratio function is defined to calculate the gap between the attention landmarks taken vertically and distances between the eye landmarks taken horizontally. So, while the eye is open, the price again for the eye aspect ratio could be constant approximately. Then the cost will hastily lower accomplish 0 in case of an eye fixed blink. When the eye is closed, eye element ratio once more procedures to an approximate consistent fee which may be very smaller in comparison to that when the attention is open. Therefore, the dip within the component ratio suggests a blink of the eyes.

C. Mouth and Yawn detection

Yawning is characterized by utilizing an extensively opened mouth. Like the ocular perceiver closure detection, the facial landmarks are acclimated to locate an open mouth shown in fig 2. Lip distance is the parameter used to decide if the situation's mouth is open. If the lip distance calculated from the frame is above the lip distance threshold, the difficulty is resolute to be yawning. An alarm is raised if the situation has yawned greater than the set boundary price consecutively. Minuscule apertures that in authenticity are construed due to verbalizing, orally eating are not noted as shown in fig 4.



$$\text{MAR} = \frac{\|p_2 - p_8\| + \|p_3 - p_7\| + \|p_4 - p_6\|}{2\,\|p_1 - p_5\|}$$

Fig.4. Mouth and Yawning detection

III. RESULT

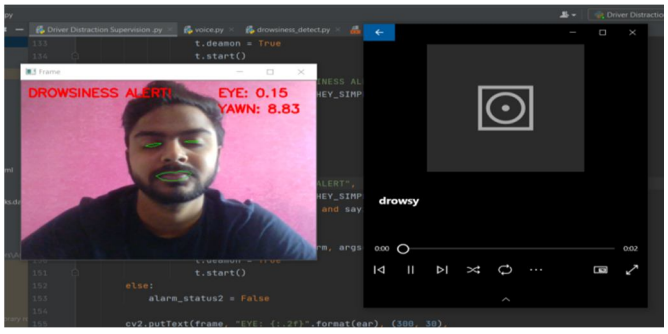
Following is the table representing four test instances which are too encountered even as doing this venture that issues with the drowsiness of the driver.

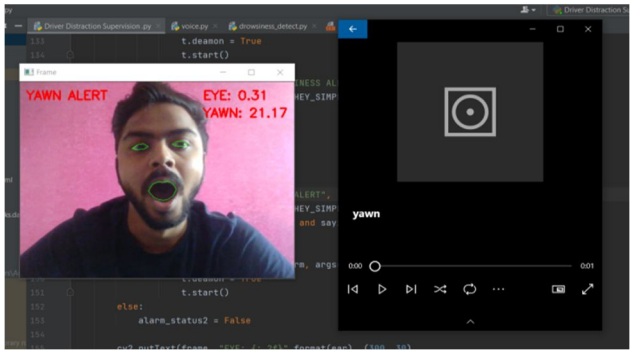
Test Cases	Eyes Detected	Eye Closure	Result
Case1	NO	NO	NO RESULT
Case2	NO	NO	NO RESULT
Case3	YES	NO	NO ALARM
Case4	YES	YES	ALARM BEEPS

Table.1. Test Instances

On the factor, while the eyes are closing for greater than the positive degree of edges then we find that the driver is feeling tired. Henceforth these instances are prominent is and a caution sounded. To get the final results a large no. of images were taken and their accuracy in deciding eye glints and drowsiness was tried. For this assignment, we utilized a five-megapixel webcam associated with the pc. The webcam had built-in white LEDs connected to it to reveal it is running. In a real-time scenario, infrared LEDs should be utilized rather than white LEDs with the intention that the framework is non-meddling. An inbuilt speaker is applied to supply sound output to awaken the driving force while drowsiness is detected. The framework turned into tried for numerous individuals in diverse surrounding lighting situations (daytime and evening time). At the factor when the webcam backdrop illumination turned into turned ON and the face is stored at a super distance, at that factor, the framework can become aware of blinks and drowsiness with over 95% accuracy. This is a respectable final result and can be achieved through real-time systems as well. Pattern outputs for diverse conditions in one-of-a-kind pix are given beneath. Three images were taken; one in which simply the eyes have been diagnosed and the opposite in which they had been no longer and another in which drowsiness is detected.

A. Sample Images





B. Accuracy

For accuracy detection of Eye Detection and Drowsiness Detection is as follows:

1) *Formula for Eye Detection Accuracy:* Eye Detection Accuracy = total quantity of instances eyes detected / (general no. of eyes detected+ overall no of times eyes no longer detected)
2) *Formula for Drowsiness Detection Accuracy:* Drowsiness and Distraction Detection Accuracy = Total no. of times alarm sounds / (general no. of instances alarm sounds + overall no of times alarm didn't sound)

INPUT	Eyes Detection Accuracy	Drowsiness and Yawn Accuracy
Sample 1	100%	87.5%
Sample 2	95%	100%
Sample 3	80%	62.5%
Sample 4	100%	87.5%
Sample 5	100%	100%
TOTAL	95%	87.5%

Table.2. Accuracy of Drowsiness and Yawn Detection

IV. CONCLUSION

An accurate and efficient Driver Drowsiness and Distraction system have been developed which achieves comparable metrics with the existing state-of-the-art system. This project is using recent globally known techniques in the field of computer vision and deep learning. This system is efficiently designed and evolved partial implementation of the driving force Drowsiness and Distraction Detector the use of Python and OpenCV together with the cam to detect the face. The device to be developed is to be tested and barriers are diagnosed. The relaxation of the work can be finished under what is deliberate already.

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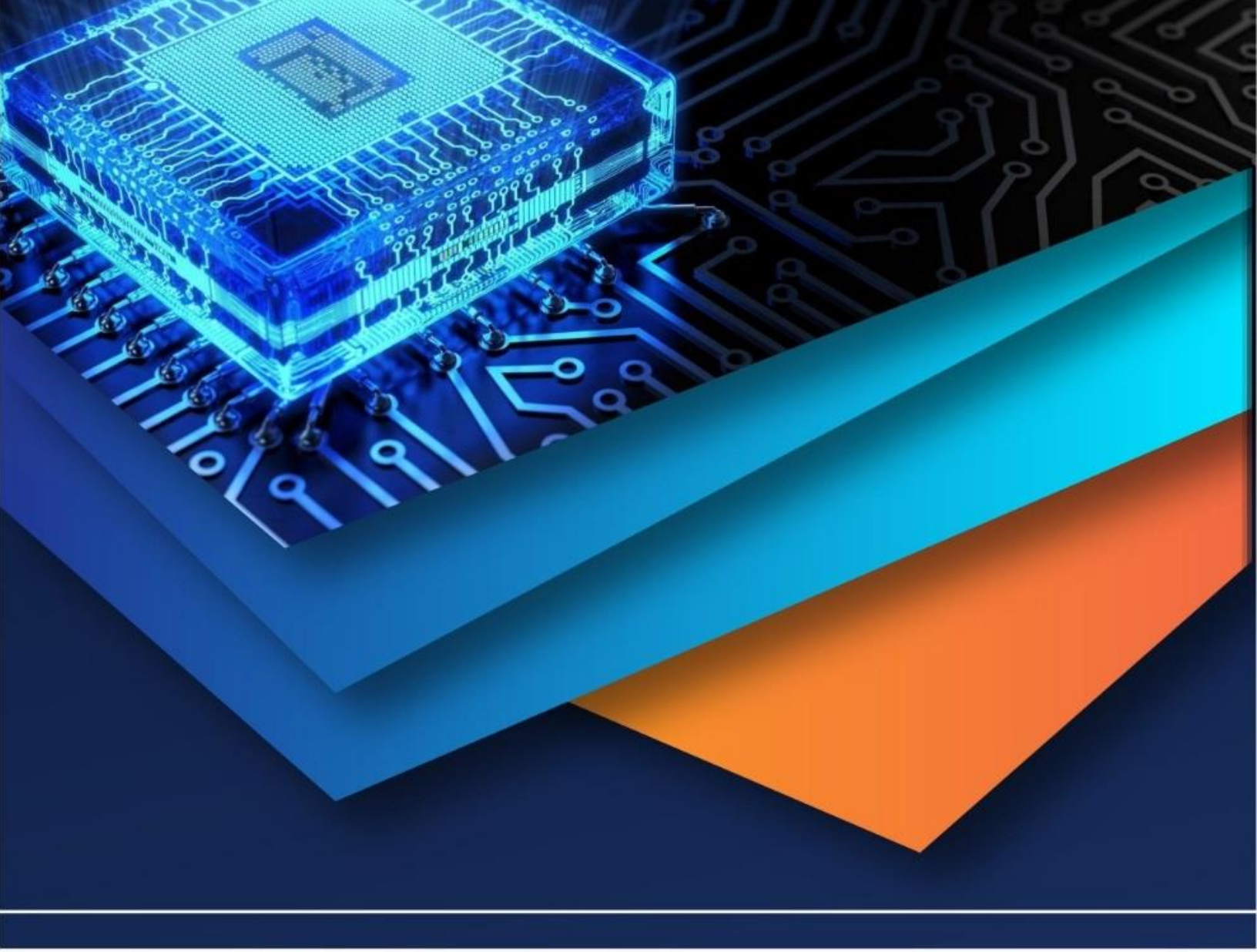

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