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DRIVER DROWSINESS VISUAL BEHAVIOUR AND MACHINE LEARNING MONITORING SYSTEM

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ABSTRACT

Drowsy driving is one of the major causes of deaths occurring in road accidents. The truck drivers who drive for continuous longhours (especially at night), bus drivers of long- distance route or overnight buses aremore susceptible to this problem. Driver drowsiness is an overcast nightmare to passenger in every country. The main aim is to prevent the road accidents that are causing due to driver drowsiness. In order to solve this problem, we use a night vision camera which records the video and driver's face isdetected in each frame employing image processing techniques. Facial landmarks on the detected face are pointed and subsequently the eye aspect ratio, mouth opening ratio are computed by using Euclidean Distance Formula. If Eye Aspect Ratio (EAR) is less than threshold value then system detects that driver is feeling drowsy and thus it gives alert to the driver.where as if Mouth Aspect Ratio (MAR) is greater than threshold value then system detects that driver is feeling drowsy and gives alert to the driver. Thus, depending on their values, drowsiness is detected and gives the alert to the driver**.** If we develop the Driver Drowsiness Detection system by using the three types of behaviour like Vehicle Based, Behavioural Based and Psychological basedthen it leads to high cost and there may be high chances of failure and cannot generate accurate results. So, in order to develop a low-cost system, we use a simple night vision camera and by using image processing method like Adaptative Threshold Technique and Machine Learning algorithm like SVM (Support Vector Machine) we develop a system which detects driver drowsiness.

Key Words: Eye Aspect Ratio (EAR), Mouth Aspect Ratio (MAR), Adaptive Threshold Technique, Support Vector Machine (SVM).

1. INTRODUCTION

Drowsy driving is one of the major causes of deaths occurring in road accidents. The truck drivers who drive for continuous longhours (especially at night), bus drivers of long-distance route or overnight buses are more susceptible to this problem. Driverdrowsiness is an overcast nightmare to passengers in every country. In the developed system, a webcam records thevideo and driver's face is detected in each frame employing image processing techniques. Facial landmarks on thedetected face are pointed and subsequently the eye aspect ratio, mouth opening ratio andare computed and depending on their values,drowsiness is detected based on developed adaptive thresholding.

2. METHODOLOGY

The developed consists of three modules they are: acquisition system, processing system andwarning system.

- In data acquisition system we extract images from the video.
- In processing system Facial land marking is done by importing open cv and dib modules where face detection and pointing of features like left eye, right eye and mouth is done through feature extraction. Then EAR and MAR are calculated by Euclidean distance formula and find the condition of driver.
- The warning system will gives alert if EAR<threshold value or MAR>threshold value so that the driver can be conscious while driving.

  Since this is a non-intrusive measurement therewill be no distraction to the driver it leads to decrease in the cost of the system.

2.1 Modules

Data Acquisition System: This module involves the collection of driver- related data, such as eye movements, facial expressions, eyes closing and yawning. This data can be acquired through the cameras placed inside the vehicle. Real-Time Monitoring is done in Data Acquisition Systemwhere it captures the live video of a driver and gives it to the processing system.

Processing System: The live video from data acquisition system is taken and convert it into frames and then converts to binary images by adaptive threshold technique**.**

The facial detection and feature extraction can be done by importing the modules. The adaptive threshold technique is only to identify the movements of eyes and mouth and converting the video into images and then converting those grayscale images to binary images. But the identification of left eye, right eye, mouth from those images and also calculation of EAR and MAR is done only by importing modules. The cv2 module provides Many functionalities for image processing. Thiscv2 module will detects the face of the person accurately rather than detecting other objects in the vehicle. It's a landmark's facial detector with pre-trained models, the dlib is used to estimate the location of 68 coordinates that mapthe facial points on a person's face.

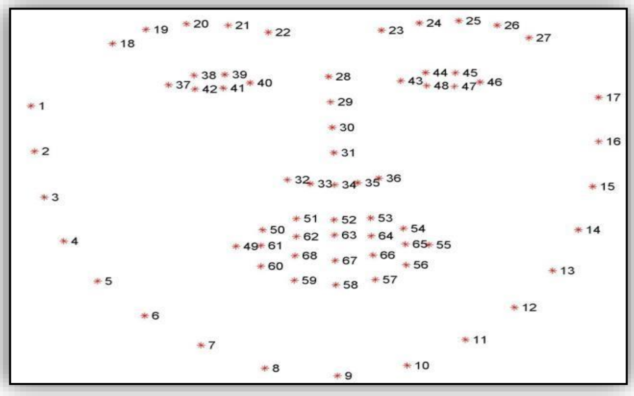

Fig 2.1 Facial Land Marking

The 68 facial landmarks identified by the dlib model are based on a standard set of points thathave been established by the facial landmark community. These points were chosen because they are located at specific anatomical features on the face, such as the corners of the eyes, the nose, and the mouth. Overall, the 68 facial landmarks identified by the dlib module provide a powerful and accurate way to analyze and understand facial images in computer vision applications. The features of the person's face like left eye, right eye and mouth are extracted by importing imutils package.imutils will extract this information and develop the svm classifier data which is used to analyze the driver drowsiness. We calculate the EAR and MAR values as follows:We import the distance module from scipy.spatial package using the from…import statement and then use the Euclidean function provided by the distance module to calculate the Euclidean distance between two points(p1and p2).

Eye Aspect Ratio:Eye Aspect Ratio is defined as height of the eye to width of the eye.

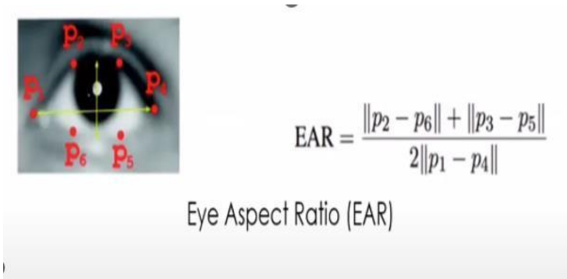

Fig 2.2 Eye Aspect Ratio

Mouth Aspect Ratio:Mouth Aspect Ratio is defined as height of themouth to width of the mouth.

Fig 2.3 Mouth Aspect Ratio

Warning System:

The warning system will give alert if EAR<threshold value or MAR>threshold value so that the driver can be conscious while driving.

2.2 Algorithms:

Implementation of SVM in Driver Drowsiness Detection:

STEP 1: Calculate the EAR and MAR values by using the Euclidean formula

STEP 2: EAR and MAR values are categorizedby using SVM algorithm

STEP 3: Trained dataset is used to sort , wherevalues are taken and represent them as decisionboundaries.

1. maximum margin is the decision boundary.
2. The positive margin and negative marginhelps to give the max distance to which can separate two regions.

The points on PM(Positive Margin) and NM(Negative Margin) are called support vectors.

STEP 4: The value which can differentiate theeye closure ratio and eye open ratio is taken from the trained data, and give the alert if EAR < threshold value.

STEP 5: And as same as EAR the MAR data get classified. if MAR > threshold value then the alert is given to make the driver to get out of drowsiness.

Implementation of Adaptive Threshold Technique in Driver Drowsiness Detection:

STEP 1: Convert into gray scale to binary scale.

STEP 2: Divide the binary scale image into pixels.

STEP 3: Take one pixel and calculate its meanor gaussian value. By comparing the neighbouring threshold values we adjust the brightness the pixel. This process done until the pixels in entire image can obtain the same brightness conditions and forms a clear image.

STEP 4: The process of adjusting the brightness under different circumstances like moving under bridge and crossing the tunnel done by using Adaptive Threshold Technique.

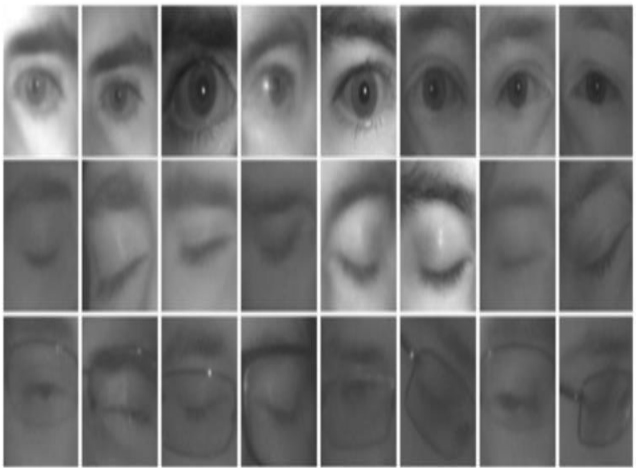

Fig 2.4 Different Lightning Conditions

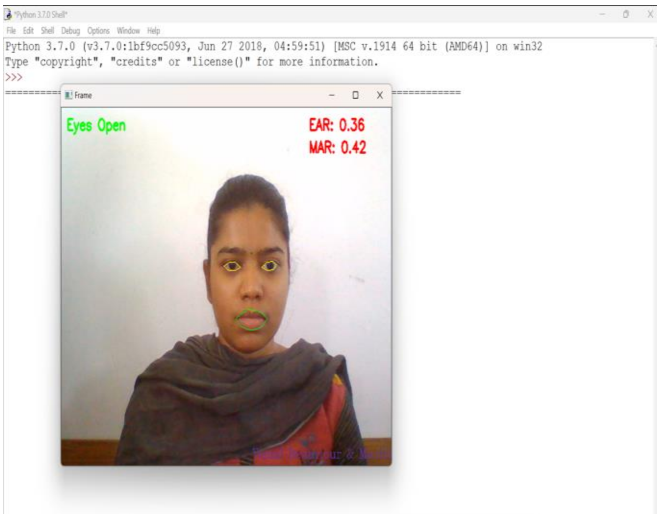

Fig 2.5 **Normal Situation**

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3. RESULT AND DISCUSSION

Double-tap the 'run.bat' file to see the screen below to begin this project.

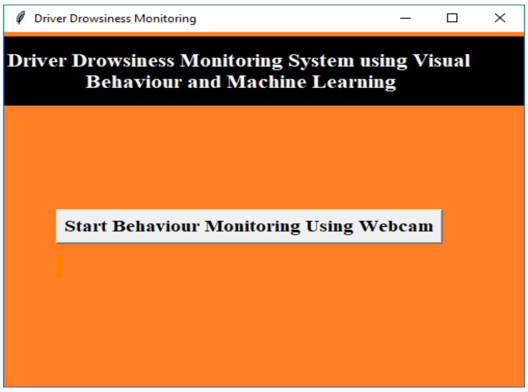

Fig 3.1 User Interface

The webcam is connected with the laptop for further processing and classification of the video streaming in an online manner. Start Behavioural Tracking Using Camera by selecting the 'Start Behaviour Monitoring UsingWebcam' button in the top screen.We can see the webcam stream in the above screen, and the application checks each imagesto see if the person's eyes are open or closed; ifthey are, we'll see the message below.

Fig 3.2 Drowsiness Alert for Closing Eyes

Similarly, an alert message will display if yourmouth begins to yawn.

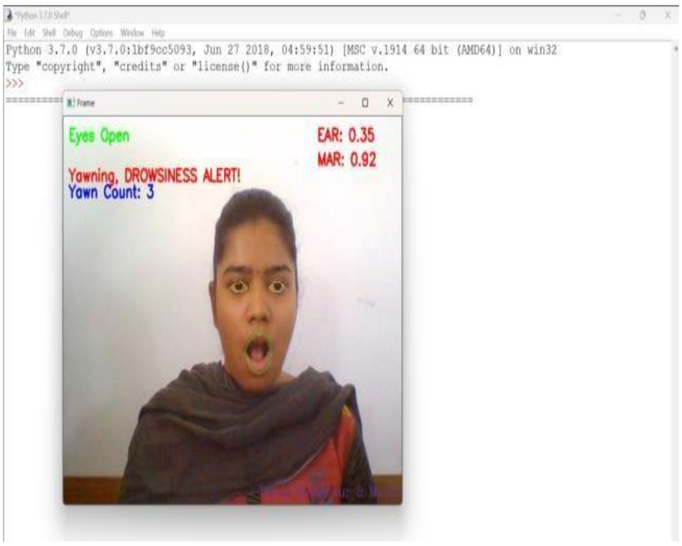

Fig 3.3 Drowsiness Alert for Yawning

4. CONCLUSION

Thus, we have developed a driver drowsiness monitoring system using visual behaviour and machine learning to avoid road accidents that occurs due to driver drowsiness. Visual behaviour means we use a simple camera to detect the driver face and use machine learning algorithm like svm and gives alert to the driver. This system will leads to reduce in cost and accuracy will be more when compared to existing system.

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