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Driver Drowsiness Detection System Using Deep Neural Network

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Abstract - Currently, the most important contributing cause to a traffic collision is a sleepy driver. The goal of the study is to develop a practical method of warning drivers when they are getting weary. Consequently, a reliable mechanism must be created to prevent mishaps. In this planned research, we focus on a drowsy 1alert system that has created using a technique in which the VSP is assessed by an inborn reflex construct using an Eye ratio (EAR) and geometrical attentional distance. Additionally, a face landmark algorithmic programme is applied for accurate eye detection. program is additionally used as correct eye detection. In order to prevent a serious accident, the module alerts the driver and admin person when the driver is showing signs of being asleep.

Index Terms - Image Processing, Deep Neural Network, Drowsy Detection, EAR, MAR

I. INTRODUCTION

Due to bad weather and road conditions, driver drowsiness has been the leading factor in accidents; the NHTSA and WHO reported that 1.35 billion accidents occur each year. Road accidents typically result from poor driving behavior. These issues can occur if the motorist is intoxicated or sleepy. The majority of fatal accidents are thought to be caused by the driver's extreme tiredness. Drivers lose control of their vehicles when they nod off. In this work, eye detection is used. both distance and mouth detection. These traits support live driver fatigue in the behavioral-based method, promptly inform him through voice speaker, and forward an associated email to someone (the car owner) who can make him acutely aware. Associate e-mail is being sent to a wirelessly dependent destination victimization module, but the new system is maintained by a camera that might observe the activity.

One of the causes of car accidents is any motorist who is feeling drowsy. We prefer to suggest a "Driver somnolence Detection System" that could help reduce car accidents brought on by fatigued driving. We tend to propose a Convolution Neural Network (CNN) model that can recognize sleepiness while the motive force's eyes are closed. The future of a cost-efficient and low-power consuming stand-alone system that might be installed inside the automobile is essentially a Convolution Neural Network (CNN) model interfaced with a digital camera to record facial photographs of the driver. The amount of time used to compute the score assumes that the eyes are closed. This score triggers the software system to play a beeping alarm and notify the motive force if it exceeds a predetermined level. As long as the eyes are open, the score remains zero. The technology will be installed inside a car and, if linked with the batteries of a power-driven vehicle, might serve as a driver's constant monitor.

What signals does the driving force send that can be identified if automotive technology is going to save you or alert you of driving fatigue? The first involves watching someone's behaviour on video. This entails observing their pupils, checking for yawning, watching their mouth, and a number of other characteristics. Voice recognition is the next development in this technology. A person's voice can frequently give away signs of their level of fatigue. The rationale behind the fundamental sleepiness detection techniques that are frequently employed for detection purposes is as follows:

- ECG and EEG
- LBP (Local Binary Pattern)
- Steering Wheel Movement (SWM)
- Optical Detection

We utilised the Maytapi WhatsApp API to deliver the notice here. Maytapi offers greater uptime than the other API because this Whatsapp for many devices no longer need a phone connection.

II. LITERATURE REVIEW

The following sections discuss various aspects of misusing vehicle-based, psychological, and activity measurements enforced by various predictive algorithms to assess the driver's drowsiness.

R. Jabbar first used machine learning to detect faces and eyes. Mil rule's neural network technique for detecting light sleep and transient states. Applying CNN allows for the landmark detection of the driver. Here, eye detection classification is carried out using a variety of information sets, such as isotope eyesight or wearing glasses or not wearing glasses during the day. Therefore, using automata modules allows for highly accurate temporary state detection [1].

The rule that Deep CNN was accustomed to notice incitation and its state recognition was first put forth by R. Sanyal. It is known that FSO systems with fixed detection thresholds and OOK can experience irreducible error floors as well as power inefficiencies. In light of this, the resulting error floors for lognormal turbulence channels are examined here (and verified using simulations) and quantified for the general case with low and large state offsets [2].

K. Saleh created an RNN and rule of algorithm to identify driver behaviours using sensors. Here, they made use of sensor data gathered by internal smartphone sensors and created a time-series classification job to categories driving behaviour. We supplied a stacked LSTM model a sequence window of 9 fused sensor feature vectors [3].

Through the use of the RNN rule, Y. Ed-Doughmi examined the driver's behaviours. Its main objective is to develop period fatigue detection to prevent edge accidents. To identify sleepy drivers and provide ninety-two share acceptance rates, this method creates a variety of driver faces that are tested on CNN models [4].

S. Vitale began. Using a programmable gate array, a minimally intrusive sleepiness detection device has been developed. This technique focuses on eyes with brilliant pupils that can be seen by IR sensor element light that is integrated into a vehicle. In order to prevent serious accidents, the retinas up to the ninetieth century are known to assist in locating drivers' eyes for analysing tiredness through various frames [5].

S. Navaneethan created a time mechanism to identify people using cyclones. Wave Network algorithmic rule was backed by the Eye Recognition System. They have created a technique for detecting pupils based on thresholds. 100 human eyes were used in an experiment to evaluate pupil detection, and 95% of the tests were successful. Additionally, hardware reduction is superior than the current approach. [6].

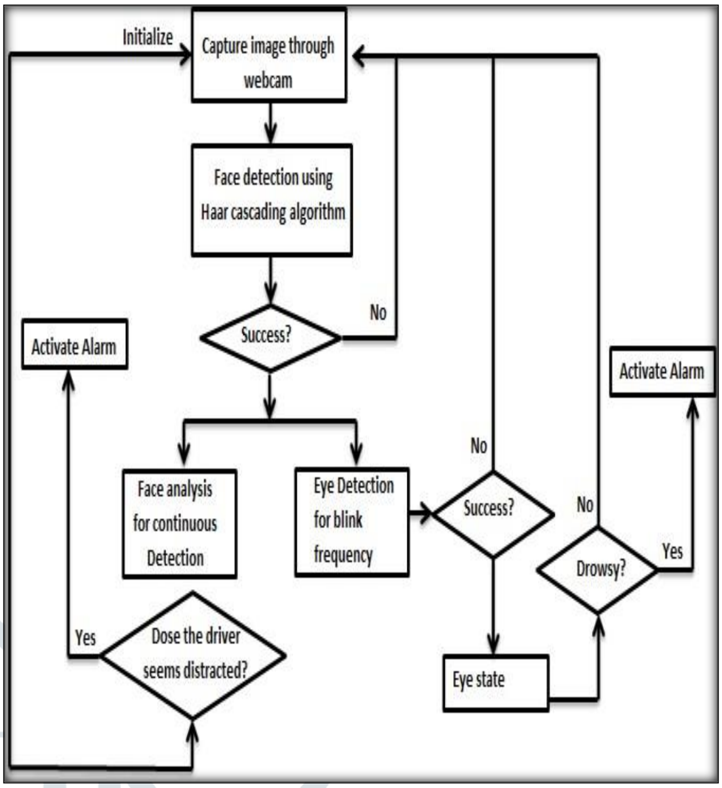


Fig.1 System Architecture

Category	Accuracy	Technique
Driver Vigilance	90%	ECG System and SVR
Driver Behavior Informatio n	Male -87.5 % Female - 70%	ECD , EEE , SVR
Abnormal Driver Behavior Monitoring	93.36%	Support Vector Machine
Aggressive Driving Behavior	83%	SVM
Real-time driver behavior informatio n	93.37%	Artificial Intelliange
Drowsiness Detection during Driving	93%	Haar Cascade Classifier LBPH Face Reorganiza tion Algorithm
Real-time abnormal driving behaviors identificati on	95.36%	Support Vector Machine and Neural Networks

Table1 Comparative Analysis of Literature

Table 1 presents a comparative examination of the literature review along with some examples of actual accuracy and methodology. Since image processing techniques have been the focus of all previous research, our new strategy focuses on image processing and deep neural networks.

III.PROPOSED SYSTEM

Basic cognitive functions of the driver may be impacted by driver distraction and insufficient awareness. When an item or event draws a person's attention away from the task of driving, driver distraction occurs. Driver drowsiness does not have a specific cause; rather, the driver's current state and the state of the road are what determine it. However, each driver's tiredness and distraction may have ongoing impacts that result in poorer driving performance, longer pauses, and a higher probability of being involved in a crash.

The architecture for detecting the transient driving force state is shown in Fig. 1. The initial system uses a digital camera to take pictures, then afterward uses the haar cascade rule to identify faces in the images. It employs haar choices that could locate the start. Victimisation of haar cascade possibilities for eye blink frequency also draws notice. The level of awareness will be determined by the EAR calculation. We will learn how much of the time you spend with your eyelids closed through this. Create an alarm and transmit a notification to the admin if the system detects eyes that are closing. Continuous monitoring may be used in some situations to measure this.

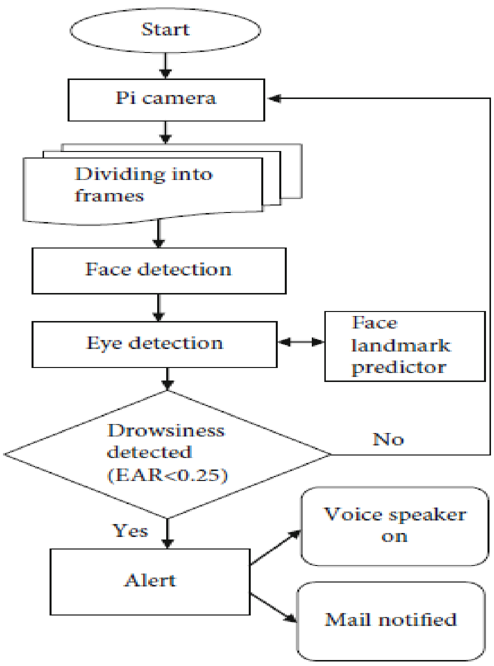


Fig 2 Flow Chart

The android application we developed for this system is installed on the driver's smartphone. The database's entry for the driver's location is updated continuously by this programme. Additionally, the database is updated with the driver's current location with latitude and longitude while the driver's phone is in the ringing mode.

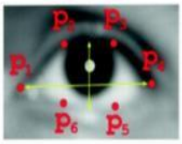
IV.MATHEMATICAL FORMULATION

$$E(x,x) = \sum_{i=0}^{m} \sum_{j=0}^{n} x(i,j)\log(x(i,i))$$

- m represents emotions here
- n represents open, closed, yawn, no yawn information. We are formulation summation and log of all

EAR Aspect Ratio (EAR)

EAR, as the name suggests, is the ratio of the length of the eyes to the width of the eyes. The duration of the eyes is calculated with the aid of averaging over great vertical strains throughout the eyes, as illustrated inside the parent below.

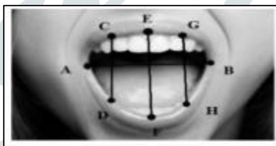


$$EAR = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Fig3. EAR Aspect Ratio

Mouth Aspect Ratio (MAR)

As you may anticipate, the MAR measures the proportion of the mouth's period to its breadth. We reasoned that a character would yawn and lose control of their mouth when in a drowsy mood, which would improve their MAR rather than standard MAR. [11]



$$MAR = \frac{|EF|}{|AB|}$$

Fig4. Mouth Aspect Ratio

$$MAR = EF/AB$$

Face Detection:

This system takes an image from video surveillance. The detected face is in square rectangle format and converted into a grayscale image

Eye Detection:

For eye recognition in this case, we employed the Haar Cascade model. Our eyes are always being watched for signs of shutting. The video camera recognises the eyes and, when they are spotted,draws a rectangle to them.

Face Tracking:

Due to the model's real-time nature, we must continuously check for detection in the face and eyes.

RES NET Model

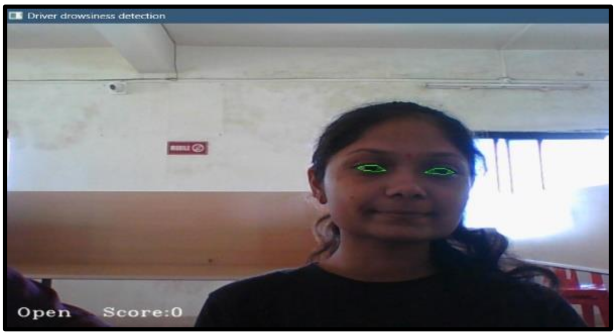


Fig5. Face & Eye Detection

ResNet, short for Residual Networks, is a classic neural network that serves as the foundation for many computer vision applications. Unfortunately, the issue of vanishing gradients made resNet schooling intensive neural networks more difficult.

Dataset Used

Shape Predictor is used. 30% of the testing dataset is used, and 75% of the training dataset. The collection contains a variety of shape predictor images, including open and closed. There are more than 725 photos per category.

Eyes State

The eye state determines whether to categorise the eye into open or closed states. The iris will be located using the Hough rework for circles (HTC) on the image of the eye. To find the circles with printed rays, which we usually pick at the end of the process and place at the tip of the process that has the highest value among the accumulator of Hough for all the beams, we have a tendency to use the HTC to the sting picture of the eye. Then, by measuring the "S" level of intersection between the edges picture and the entire circle acquired by the HTC, we usually apply the logical "AND" logic.

V. EXPERIMENTAL RESULT

1. Simple with Open Eyes

Face identification aims to recognise all picture areas that make up a face from a single image, regardless of the function, orientation, or lighting. It is typically thought that the camera is installed in the car through the driver at a specific angle. Because the head function may vary from motive force to motive force, the trouble of the relative digital camera-face pose is significantly less complicated in our instance. Additionally, there is a great degree of variation in the size, colour, and form of faces. The existence of facial features, such as beards, moustaches, and glasses, can significantly alter perception. The conditions of the lighting fixtures are a different critical factor. This is notably affected by the mild environment, which may extrude according on the current weather. Detecting yawning is done in a few simple steps. In the first phase, we find the yawn problem near the mouth and face. Because of the impacts of the large mouth opening, this problem is the hollow inside the mouth. The mouth area can be used to verify the accuracy of the detected problem in the second stage.

1. MODEL SUMMARY

The following figure shows the model of how many parameters are used for each layer distribution of parameter and output shape.

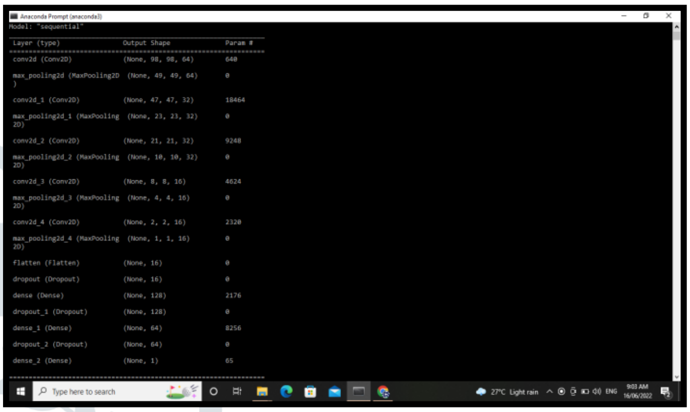


Fig6. Model Summary

5. Location Dashboard in android Application

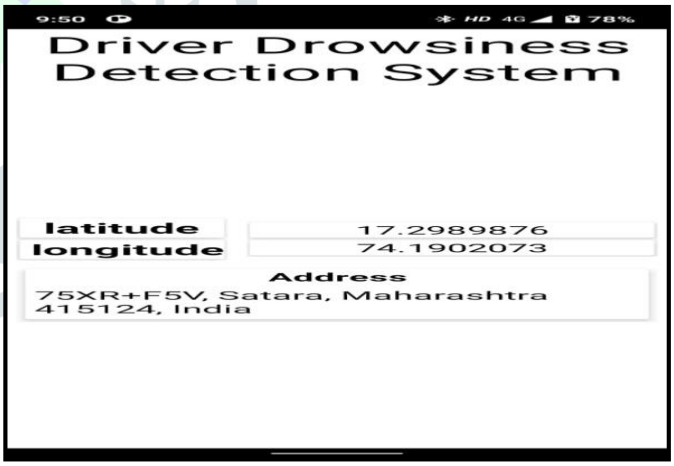


Fig.7 Location Dashboard

6. Phone Ringing Mode Update Location

Fig8. Update Location

When any call comes to driver when driver phone is in ringing mode application automatically updates the location to the database.

7. Whatsapp Send to Mobile

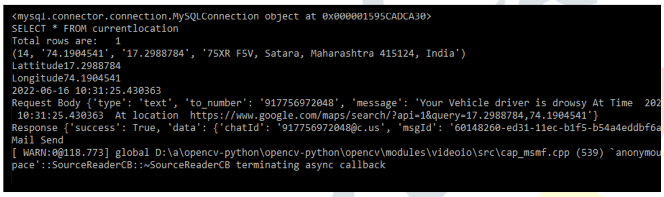


Fig9. Send to Mobile

Fig. 8 shows that when the driver is tired, the system calls the maytapi to send msg, location, and current time to the admin mobile. Also, we print the response of maytapi WhatsApp when in response body success: True that time message is successfully delivered to mobile.

8. Actual WhatsApp Message

Fig9. Actual WhatsApp Notification

10. Eye State Analysis

Total Frames	Open State	Closed State	Correction Rate
600	430/500	110/150	97.00 %

Table1 Eye State Analysis, The Table1 Shows the Eye State Analysis with the current frame execution

9. Confusion Matrix

Confusion Matrix is the visual illustration of the particular VS foretold values. It measures the performance of our Machine Learning classification model and appears as a table-like structure.

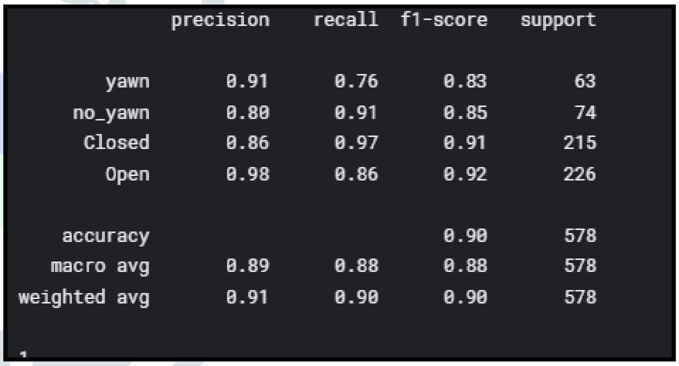
This is however a Confusion Matrix of a binary classification downside seems like

Precision: It may be outlined because of the range of correct outputs provided by the model or, out of all positive categories appropriately foretold by the model, what percentage of them were actual. It may be calculated exploitation the below formula.

$$\text{Precision} = \frac{\text{TP}}{TP + FP}$$

Recall: - It's outlined because of the out-of-total positive categories. However, our model is expected to be correct. Therefore, the recall should be as high as doable.

$$\text{Recall} = \frac{\text{TP}}{TP+FN}$$



	precision	recall	f1-score	support
yawn	0.91	0.76	0.83	63
no_yawn	0.80	0.91	0.85	74
Closed	0.86	0.97	0.91	215
Open	0.98	0.86	0.92	226
accuracy			0.90	578
macro avg	0.89	0.88	0.88	578
weighted avg	0.91	0.90	0.90	578

Fig. 10 Confusion Matrix

Accuracy is the most intuitive performance live, and it's merely a quantitative relation of properly expected observation to the whole words.

CONCLUSION

This analysis provides a robust methodology for sleuthing of drowsiness of drivers and collision impact (severity) system within the contemporary world. But, the existing techniques area unit supported a psychological or vehicle-based approach to sight sleepiness of drivers and, conjointly, the collision's severity is singly measured. Still, such technology is highly intrusive as it activates the physical setting. So, the planned system is employed to construct a no-intruding technique for measuring the driving force's drowsiness with the collision's severity. This system's main parts unit is the laptop camera module, mainly used to monitor facial landmarks.

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