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REAL TIME DROWSINESS DETECTION

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Abstract - *Driver Drowsiness Detection by Using Webcamis being introduced to limit and lower the number of accidents involving vehicles, lorries, and trucks. It recognizes the symptoms of tiredness and warns drivers when they become drowsy. Machine vision-based non-intrusive conceptshave been used to construct the Drowsy Driver Detection System. To identify driver weariness, the device uses a tiny camera that is pointed straight at the driver's face and watches the driver's eyes. In such a scenario, a warning signalis sent to the driver when weariness is identified. The system locates the margins of the face using data from the binary version of the image, which reduces the size of the area around the eyes and mouth. By computing the horizontal averages in the area after locating the face, the eyes and mouth are then located while bearing in mind that the intensity of the eye areas in the face changes significantly. Finding the substantial intensity fluctuations in the face helps pinpoint the eyes. Once the eyes have been identified, the state of the eyes is determined by monitoring the distances between changes in intensity in the eye region. A considerabledistance corresponds to eye closure. If the eyes are closed for a frame, similarly to the mouth located, measuring the distances between the intensity changes in the lips area determine whether they are wide open mouth. A small distance corresponds to mouth closure. If the mouth is opened for a frame, the system concludes that the driver is yawning, inhaling deeply due to tiredness, and issuing a warning signal.*

***Key Words: Drowsiness, eye aspect ratio, eye blinked detection, mouth aspect ratio, mouth yawning detection*.**

1.INTRODUCTION

The drivers' drowsiness is one of the critical issues for mostroad accidents. Drowsiness threatens road safety and causes severe injuries sometimes, resulting in victim fatality and economic losses. Drowsiness implies feeling lethargic, lack of concentration and tired eyes of the drivers while driving vehicles. Most accidents happen in India due to the driver's lack of concentration. Due to sleepiness, the driver's performance gradually declines. We created a system that can recognize the driver's tiredness and inform him immediately to prevent this abnormality. This system uses a camera to collect images asa video stream, locates the eyes, and recognizes faces. The Perclose algorithm is then used to evaluate the eyes to lookfor signs of tiredness. Finally, the driver is informed of drowsiness using an alarm system based on the outcome. Different approaches have different advantages and drawbacks.

1.1 Problem Definition

Current drowsiness detection systems that monitor the driver's condition include electroencephalography (EEG) and electrocardiography (ECG), which measure heart rhythm and brain frequency, respectively. However, these systems are uncomfortable to wear while driving and inappropriate for driving conditions. A camera mounted in front of the driver is a better option for a sleepiness detection system; however, finding the physical indicators of drowsiness is necessary before developing a reliable and effective drowsiness detection algorithm. The issues that arise while identifying the eyes and mouth region are lighting intensity and whether the driver tilts their face left or right. In order to propose a method to detect sleepiness using video or a webcam, this project aims to analyze all previous research and methods. After analyzing the recorded video images, it develops a system to examine each movie frame.

1.2 Objective

The project focuses on these objectives, which are:

To suggest ways to detect fatigue and drowsiness while driving. To study eyes and mouth from the video images of participants in the experiment of driving simulation conducted by MIROS that can be used as an indicator of fatigue and drowsiness. To investigate the physical changes of fatigue and drowsiness and To develop a system that uses eyes closure and yawning to detect fatigue and drowsiness.

1.3 Scope

A drowsiness detection system's basic concept is to familiarize oneself with the signs of drowsiness. The determine the drowsiness from these parameters Eye blink, area of the pupils detected at eyes, yawning, data collection and measurement, integration of the methods chosen, coding development and testing, complete testing and improvement.

2. EXISTING SYSTEM

The Driver Safety ecosystem has to be given to the customers of the automobile industry. With the advent of intelligent automobiles, there is a crucial need for smart utilities that assist the user. Manual seat belt safety and airbags are more of a precaution than a prevention. Therefore, we try to implement a system that prevents it. In the previous systems, they have only used Eye Aspect Ratio, EEG.

3. PROPOSED SYSTEM

The proposed system mainly aims at implementing a better safety system for customers. This system mainly consists of

3 components: Face Detection, Feature Extraction, and Classification. The system provides a better solution for road safety for the drivers. This system uses Eye Aspect Ratio and Mouth Aspect Ratio to detect driver drowsiness. The alert message(SMS) sent to the given emergency phone number is also implemented in this system.

4. METHODOLOGY

4.1 Facial Landmark

Recognizing faces in images or videos is cool, but it is insufficient to build robust applications. We need more details about the face of the person, such as location, whether the mouth is open or closed, if the eyes are open or closed, whether they are looking up, etc. This post will swiftly and objectively introduce you to the Dlib, a library that can provide you with 68 points (landmarks) of the face. It is a historical facial detector with models that have been trained. The 68 coordinates (x, y) that map the facial points on a person's face are estimated using the dlib, as seen in the graphic below. Dlib is a cutting-edge C++ toolkit with machine learning techniques and tools for developing sophisticated software to address real-world issues. It is utilized in businesses and academics across various fields, including robotics, embedded technology, mobile technology, and massively parallel computing systems. Dlib can be used for free in any application, thanks to its open-source licensing.

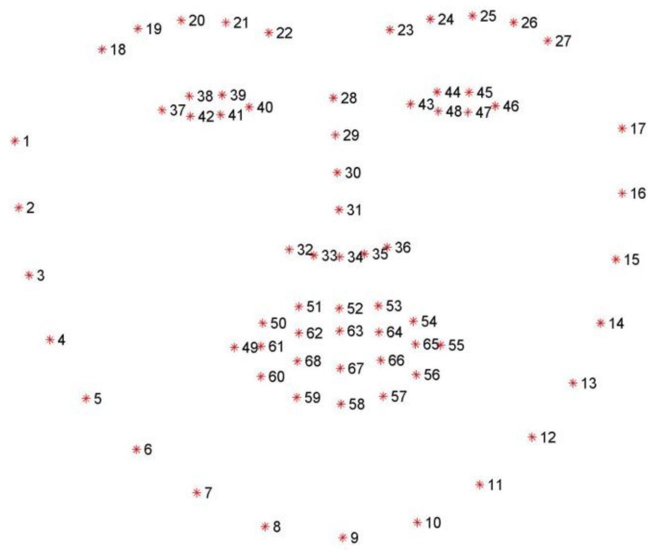


Fig. 1: Dlib

4.2 Feature Extraction

Object recognition using cascaded classifiers based on the Haar function is a practical object recognition method. This algorithm follows a machine learning approach to increase its efficiency and precision. Different degree imagesare used to train the function. This method trains the cascade function on many positive and negative images. Both Face images and images with no face are used to train at the beginning. Then extract features from it. For this, Haar traits are used. They are similar to the convolution kernel. Each feature is a separate and single value, which is obtained by removing the sum of the pixels falling under the white rectangle from the sum of pixels falling under the black rectangle.

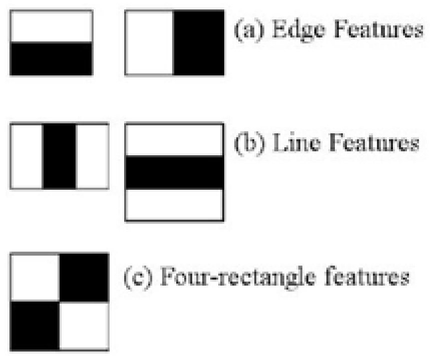


Fig. 2: Haar Features

Detection of feature points: It detects feature points on its own. The RGB image is first converted into a binary image for facial recognition. Then, if the average pixel value is less than 110, black pixels are used as substitute pixels. Otherwise white pixels are used as substitute pixels.

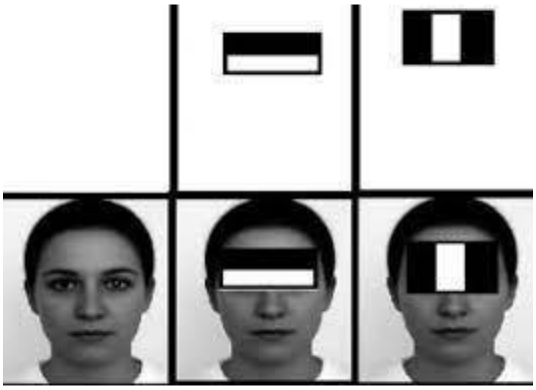


Fig .3: Haar Feature Extraction Of Face

Now, all possible models and positions of all cores are usedto estimate many functions. But of all these functions we calculated, most of them are not relevant. For example, The below figure shows two good attributes in the first row. The first function selected seems to focus on the attribute that the eye area isusually darker than the nose and cheek areas. The second function selected is based on the fact that the eyes are darker than the bridge of the nose.

4.3 Eye Blink Detection

Driver Drowsiness System based on non-intrusive machine-based concepts. The system consists of a web camera which is placed in front of the driver. Online videos for simulation purposed are considered. Firstly, camera records the driver's facial expressions and eye and mouth positions. Then the video is converted into frames and each frame is processed individually. Finally, the face is detected from frames using

Viola-jones algorithm. Then the required features like eyes and mouth from face are extracted using cascade classifier. The sphere indicates the Region of interest on the face. Here the main attribute of detecting drowsiness is eyes blinking, varies from 12 to19 per minute indicates the drowsiness if the frequency is less than the normal range. Instead of calculating eye blinking, average drowsiness is calculated. The detected eye is equivalent to zero (closed eye) and non-zero values are indicated as partially or fully open eyes.

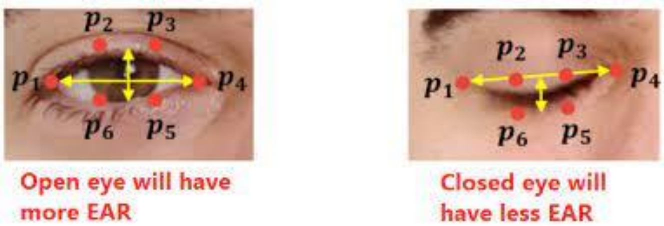


Fig. 4: Detecting the facial landmarks

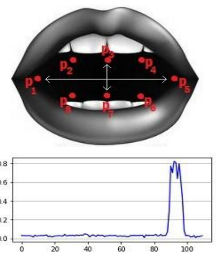
$$EAR = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Fig. 5: Formula for calculating Eye Aspect Ratio

The equation is used to calculate the average. the value is more than the set threshold value, then system generates the alarm to alert the driver.

4.4 Mouth Yawning Analysis

Fatigue is the primary reason for road accidents. To avoid the issue, The driver fatigue detection system based on mouth and yawning analysis. Firstly, the system locates and tracks the mouth of a driver using cascade of classifier training and mouth detection from the input images. Then, the images of mouth and yawning are trained using SVM. In the end, SVM is used to classify the mouth regions to detects the yawning and alerts the fatigue. The authors collected some videos and selected 20 yawning images and more than 100 normal videos as datasets. The outcomes demonstrate that the suggested system outperforms the system based on geometric features. The proposed system detects yawning, alerts the fatigue earlier and facilitates making the driver safe.



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

Fig. 6: Formula for calculating Mouth Aspect Ratio

4.5 Real Time analysis of eye and mouth

The essential purpose of the proposed method is to detect the close eye and open mouth simultaneously and generates an alarm on positive detection. The system firstly captures the real time video using the camera mounted in front of the driver. Then the frames of captured video are used to detect the face and eyes by applying the viola-jones method, with the face and eyes training set provided in OpenCV. Next, small rectangle is drawn around the center of eye and a matrix is created that shows that the Region of Interest (ROI) that is eyes used in the next step. Since the both eyes blink at the same time that's why only the right eye is examined to detect the close eye state. The eye will be regarded as closed if it is closed for a predetermined period, First the eye ball color is acquired by sampling the RGB components on the center of eye pixel. Then the absolute thresholding is done on the eye ROI based on eye ball color and an intensity map is obtained on Y-axis that show the distribution of pixels on y-axis which gives the height of eye ball and compared that value with threshold value which is 4 to distinguish the open and close eye. After that, if the eye blink is detected in each frame it will be considered as 1 and stored in the buffer and after the 100 frames, eye blinking rate is calculated. Then to detect the yawning portion of the mouth, a contour finding algorithms is used to measure the size of mouth. If the height is greater than the certain threshold. It means person is taking yawning. The effectiveness of the suggested approach has been evaluated over 20 days at various points while being utilized by individuals with and without mustaches and those who wear glasses. The system operates at its optimum when the drivers are without their glasses.

4.6 Alert Signals

To confirm the average of EAR reading during eye open, 20 trials was conducted on the same person. The trial's objective is to ascertain the lowest threshold at which the alarm will begin to respond, arousing the driver and lowering the risk of accidents. Based on the EAR and MAR, initially, a threshold is set to the value of 2 EAR, and the MAR counter will start counting the total number of frames whenever a person's EAR falls below the minimum threshold, in this case, is 2. In this test, the ALERT text will be displayed in the resized window. Next, the threshold is set to the value 4 EAR, and the MAR counter will start counting the total number of frames. Whenever a person's EAR and MAR fall below this threshold, the alarm will buzz and alert the driver when the counter reaches the frames. At last, the threshold value is set to 6, EAR and MAR counter will start counting the total number of frames. Whenever a person's EAR and MAR fall below this threshold, the driver is frequently drowsing and at this stage, the alert message(SMS) containing the message will be sent to the given emergency phone number. Since the code developed uses the loop method in the script, the alarm will not stop until the driver is alerted and gain consciousness on the road. Once the driver's eyes open, the counter will reset to zero, thus stopping the alarm from beeping continuously. The alarm's sensitivity can be adjusted by changing the number of threshold frames; the lower the number of frames, the higher the sensitivity.

5. RESULTS

Following are the screenshots of the interface and output of the proposed system.

```
(drs_env) C:\Users\DARSHAN\Desktop\PROJECT\Drowsi_new>python drowsy_v4.py
Enter that mobile1 number u need to send alert Message
---->>7760850906
Enter that mobile2 number u need to send alert Message
-----$$9513871093
```

Fig. 7: Reading the python file and entering the emergency number

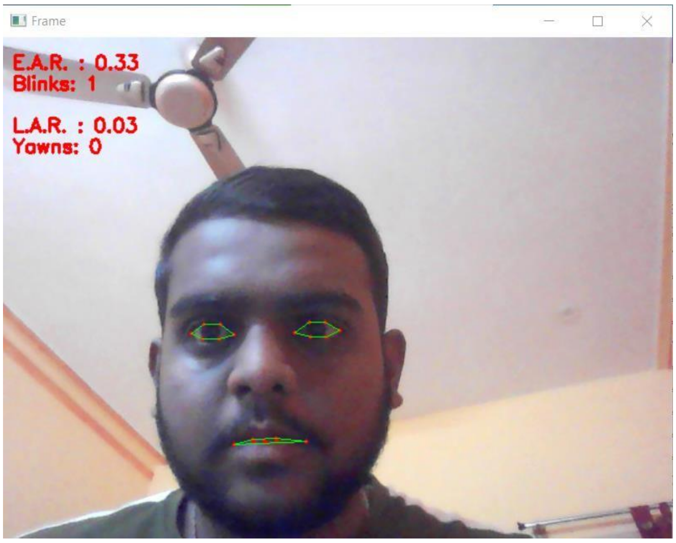


Fig.8: Detecting eyes and mouth for EAR & MAR calculation

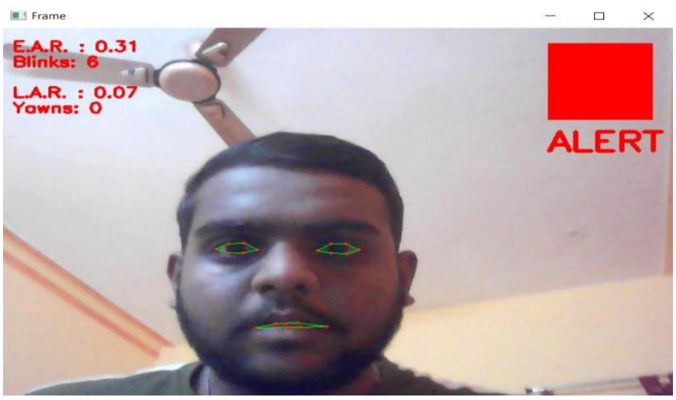


Fig.9: Alert Text with Symbol

Fig.10: Playing the alert sound and sending the SMS successfully

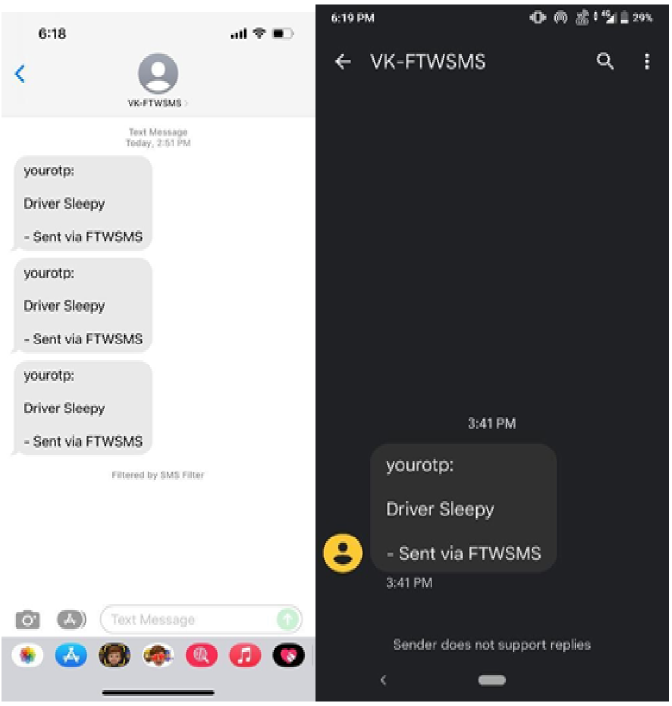


Fig.11: SMS sent to the emergency number via Fast2SMS

6. CONCLUSIONS

We have reviewed the various methods available to determine the drowsiness state of a driver. Although there is no universally accepted definition for drowsiness, the various definitions and the reasons behind them were discussed. Detect drowsiness include subjective, vehicle-based, physiological and behavioral measures. The eyes and mouth weariness might be localized using a non-invasive technique. The position of the eyeballs is determined using an image processing technique. The monitoring system can determine if the eyes are open or closed. A warning signal is given when the eyes have been closed or blinking. An image processing algorithm gets information about the mouth's location. The monitoring device can determine if the mouth is open or closed. When the mouth is open or when the person yawns, the technology can instantly identify any eye-localizing mistakes that might have happened during monitoring. The system can recover and correctly localize the eyes and mouth in the event of this error.

The following conclusion were made:

- Drowsiness may be detected with excellent accuracy and reliability using image processing.
- A non-intrusive method of detecting sleepiness without discomfort or disturbance.
- Based on constant eye closures, a sleepiness detection system created based on image processing assesses the driver's state of attentiveness.

7. REFERENCES

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