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Driver Drowsiness Detection Alert System using Haar Method

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Abstract - *Driver drowsiness detection is the major confront in reducing traffic accidents to improve safety and security technology, so it plays a vital role in preventing road accidents. Researchers have done lots of study and various techniques that are incorporated to take care of safety and security measures. In this paper, a real time face detection implementation is carried out by monitoring driver eye and mouth by using high-resolution camera that monitors directly towards the driver's face. The recorded video of driver face is converted into many image frames, detects the features like eyes (blink) and mouth (yawn). If the eye blinks is closed and mouth yawn is detected based on performance metrics, the driver detection system immediately warns red signal beep alarm as the output. We use LBPH technique and Haar detection method for accurate results.*

Keywords: Haar detection method, Local Binary Patterns Histogram (LBPH), Root Mean Square Error (RMSE), Eye Aspect Ratio (EAR).

1. INTRODUCTION

Most of the road accidents occur due to driver drowsiness. In current survey, it shows that out of 5 accidents one accident is due to drowsiness of the driver which is approximately 20% of road accidents and it increasing gradually in every year. Every year, nearly 100,000 traffic crashes occurred due to drowsiness of the driver, including more than 1,500 deaths and over 70,000 injuries, according to the National Highway Traffic Safety Administration. Drivers can reduce the danger by aware of risk factors and taking precautions. Drowsiness of driver, drunk and drive are becoming major cause for road accidents. Traffic Safety's study found that in a normal week, 42.4% of drivers were driving without at least one or more days of sleep, less than six hours of sleep. The reasons for driver drowsiness may be due to less concentration, lack of sleep, the total number of traffic deaths are more [4]. To take safety precautions of driver, and to alert the driver from drowsiness during driving, we use LBPH technique for face recognition of eyes and mouth. Then, we use Haar detection method of eyes(blink) and mouth(yawn) recognition is measured and controlled with immediate beep alarm in this paper.

2. LITERATURE SURVEY

The real-time driving behavior monitoring plays a big role in intelligent transportation systems. These sort of monitoring will reduce and also decreasing within the rate of traffic accidents. These vision-based includes the video cameras for dangerous situation this is often one among the foremost help full to seek out the out how the drive position. Due to efficiency and performance of smartphones in online mode, the driving dangerous states are determined in real time on the mobile devices with aid of computer vision libraries OpenCV and Dlib while driving. The offline mode is predicated on the results of statistical analysis provided by a cloud service, utilizing not only the accumulated statistics in real time, and also the previously stored and produced by machine learning tools [1].

The vehicle accident has become a common scene in our traveling path. Every year many people being stricken, many of them losses their lives and a huge amount of property extermination being occurred because of vehicular misadventure. According to analysis reports on road accidents of recent years, it's renowned that the main cause of road accidents resulting in deaths, severe injuries and monetary losses, is due to a drowsy or a sleepy driver. Drowsy state may be caused by lack of sleep, medication, drugs or driving continuously for long time period. The aim of our work is to figure a system which will monitor driver's drowsiness and distraction level based on eye tracking. A comparison has been made between the proposed method pupil method and mean shift method. It has been shown that proposed method gives better accuracy than other system [2].

The amelioration of technology from the past 50 years accommodated a good amount of accidents occur to the driver by providing a great level of comfort and safety in the vehicles. The accidents may occur because of many reasons and one of the reason which we are going to portray and solve in this paper is driver fatigue. By developing a Machine Learning, Pattern Recognition and Computer Vision-based algorithm that will use all the relevant features for fast and accurate classification of drowsiness in a driver. They also develop an algorithm

that will determine the level of drowsiness of the driver called the rate of drowsiness. They used eye aspect ratio to identify the frames weather the person is drowsy, Mouth aspect ratio is used for mouth region. In this project they have used the Eye vertical distance (EVD) and also mouth vertical distance (MVD). They calculated the ratio of vertical distance for both EVD and MVD [3].

3. PROPOSED SYSTEM

In this paper, the recorded video of driver face is recorded and converted into many image frames. The image frame is taken as input, and perform pre-processing for face detection from the input image to extract the features like eye and mouth. The system includes the detection of features like eyes and mouth using LBPH technique. The block diagram of driver drowsiness detection system is shown in below Fig- 1:

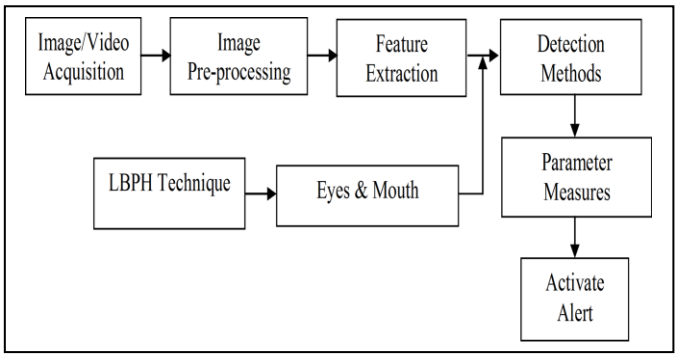

Fig-1: Block Diagram for driver drowsiness system

From the above Fig-1, we input the recorded video of driver face which is converted into streaming image frames, stores the image frames in a dataset to perform image pre-processing. Image pre-processing is to improve the quality of image data if any distortions or enhance some image features by using geometric transformations like rotation, translation, scaling., to enhance the features of face detection. The features of eyes and mouth are extracted using LBPH technique [5, 6]. We detect the features of eye (blink) and mouth (yawn) by using Haar detection method [7, 8] and find the parameter measures like Root Mean Square Error (RMSE), Eye Aspect Ratio (EAR) are calculated. If the eyes are opened or closed, we check the blink rate of each eye and if blink rate of the eye exceeds the normal criteria then it alerts the warning beep system showing the red signal and if not the steps continues executing showing the green signal as shown in below Fig-2:

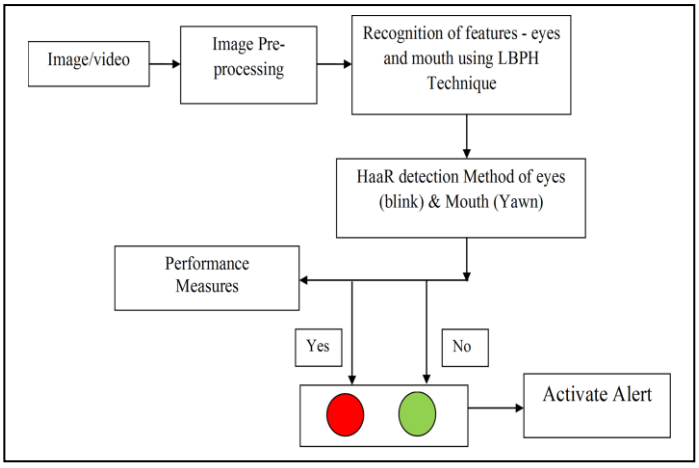

Fig -2: Flow diagram of proposed system

4. METHODOLOGY

The methodology in our proposed system "driver drowsiness detection alert system" is as follows:

Step 1: Image/Video Acquisition

Image acquisition is used to convert input image into an array of numerical data then it is used for processing on a computer. In the first step, acquire the recorded video of a driver face as a input and is convert into image frames stored in dataset. Each of these frames are extracted and processed separately.

Step 2: Image Pre-processing

Image pre-processing step mainly improves the input image which suppresses unwanted distortions in an image or enhances image features that are mainly important for processing. In this step, based on the image frame size of the pixel neighborhood, we apply geometric transformation like rotation to enhance the features using point-based detection as shown in below Fig-3:

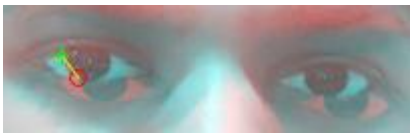

Fig-3: Point detection

Step 3: Feature Extraction using LBPH technique

Face recognition has become interesting field in research to improve the accuracy of many real-time applications. The enhanced feature extraction approach to improve human face recognition using LBPH technique is presented in this paper. We extract the features based on the landmark point-based and neighborhood pixels of eyes & mouth to enhance the performance measures like speed to improve the recognition rate.

Step 4: Detection of eye (blink) and mouth (yawn) using Haar detection method

Haar detection method is an effective object detector method to detect the features in an image. Once we find the features of eyes and mouth, we use Haar detection method to detect the features like eye blink and mouth yawn to a particular time limit. By using this method, we achieve accurate and faster results.

Step 5: Calculation of performance measures like RMSE, EAR

The proposed method can be evaluated using few measures like RMSE and EAR. The RMSE is calculated as:

$$RMSE = \left[\frac{1}{m*n}\sum_{i=0}^{m=1}\sum_{j=0}^{n=1}[L(i,j) - R(i,j)]^2\right]^{1/2}$$

In the above RMSE formula: m, n represents the size of input image, L and R are the left eye & right eye images, and (i, j) are the pixel values in an image.

The EAR is calculated using the following formula:

$$EAR = \frac{|p2 - p6| + |p3 - p5|}{2 * |p1 - p4|}$$

In the above EAR formula: p1, p2, p3, p4, p5, p6 indicates the points landmark to calculate the blink rate in EAR. If the 'EAR' value is greater than 0 it detects as eyes open and if 'EAR' value is equal to zero detects as eyes close.

Step 6: Display alarm beep signal to detect driver drowsiness

Based on the parameters we found taking input image dataset, we could able to detect driver state weather he is sleeping state or active state. When the driver eyes (blink) i.e., eye open and eye close is found based on the parameters we identify, our system gives us immediate warn beep alarm. And also when the mouth (yawn) i.e., mouth open and mouth close is found based on the parameters we identify, our system immediately warn an beep alarm.

5. Results

The results in our proposed system is implemented using OpenCV tool. The below Fig-4 shows the driver drowsiness detection system – menu login page:

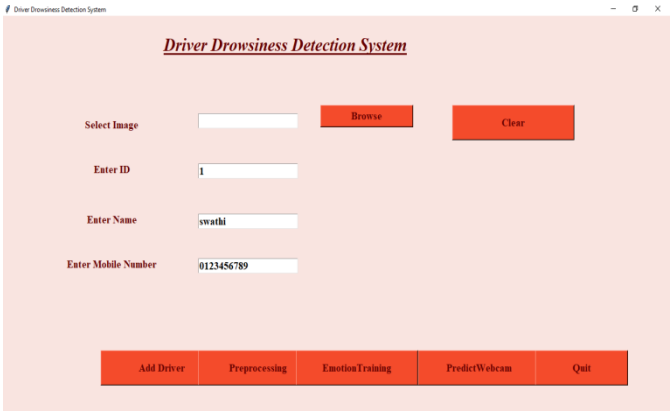

Fig- 4: Menu Page – Add driver button

In the Fig-4, in the menu page we enter the driver details like ID, Name, Mobile number then the system starts recording. These credentials are used to recognize the face of the driver. When 'Add Driver' button is clicked, the recorded video takes a half minute video of users input face which stores as a frames dataset as shown in below Fig-5:

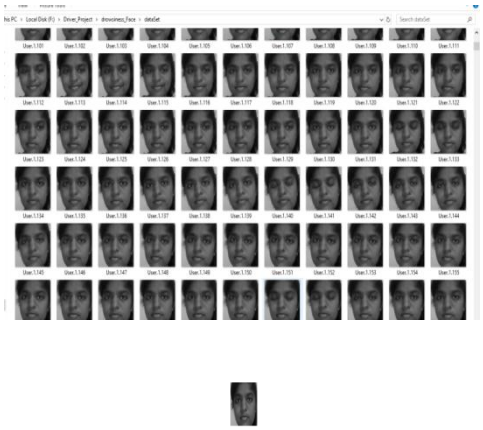

Fig-5: Image dataset

Images are stored in the form of frames which are converted into grey scale. On clicking pre-processing button, we perform geometric transformation (rotation) for the input image to improve the quality of the image and once the features are detected using point-based, we display pre-processing is complete as shown in below Fig-6:

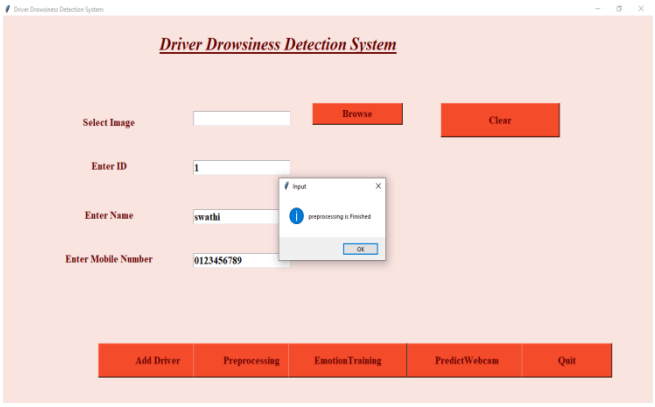

Fig-6: Menu Page – Preprocessing button

Once we complete pre-processing, we extract the features of image. The features like eyes and mouth are extracted using LBPH technique as shown in below Fig-7:

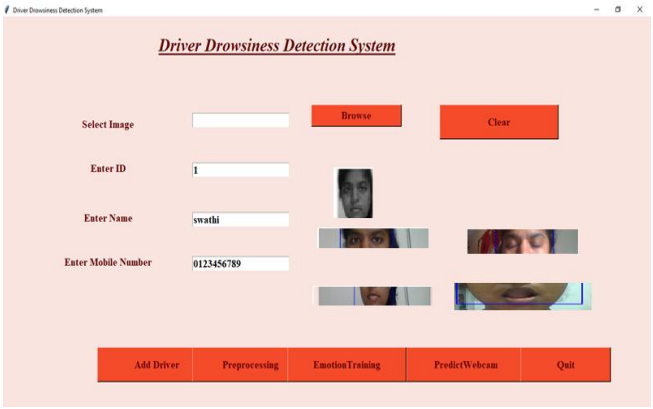

Fig-7: Emotion Tracking – Feature extraction of eyes & mouth using LBPH technique

After the features are extracted, we detect the eyes blink (Close & open) and mouth yawn (close & open) as shown in below Fig-8(a) & in Fig-8(b):

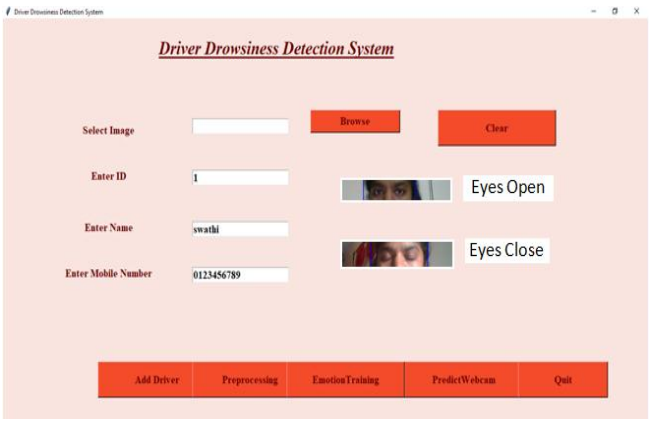

Fig-8(a): Emotion Tracking - Detection of eyes blink (open & close) using Haar detection method

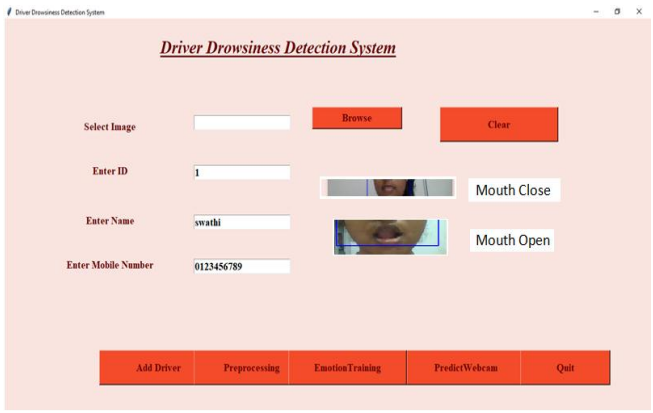

Fig-8(b): Emotion Tracking - Detection of mouth (yawn - open & close) using Haar detection method

While clicking on predict webcam button, it opens a prompt window frame that capture the driver's face while driving. If driver falls asleep or feels drowsy it calculates RMSE, EAR to predict the eye blinking rate and mouth yawning alert. If the criteria exceeds, it plays an alarm for the sake of driver's awareness. The results are shown in below Table-1:

Table-1: Parameter metrics

PARAMETERS	RMSE	EAR	Warning Signal
Eyes Closed	0.00100	0.0000	
Eyes Open	0.00020	3.0000	
Mouth Closed	0.00006	4.0000	
Mouth Open	0.00452	0.1000	

6. CONCLUSION

In conclusion, a mechanism to alert the driver drowsiness implementation of image processing is carried out to alert with the immediate buzzer in less than a second once the eyes blink and mouth yawn based on the parameters are detected to reduce road accidents. After image acquisition, we apply geometric transformation – rotation for performing image pre-processing to improve the quality of image. And we extract features like eyes and mouth of the input image using LBPH technique. Once the features like eyes and mouth are extracted, we use Haar detection method to detect the eye (blink) and mouth (yawn). Based on the parameter measure like RMSE and EAR results, we immediately get a warning alert that driver drowsiness is detected. We can further extend this work by identifying few more parameters like PSNR, Entropy, MI, and achieve better accuracy results to

implement this driver drowsiness detection system using more real-time data sets.

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