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Drowsy Driver Detection Using Viola Jones Algorithm

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ABSTRACT: - We have only one life. Therefore, safety is very important. Now-a-days, road accidents are the major problem. Most of the vehicle accidents are due to falling asleep during driving. Therefore, the main idea of the paper is to find the drowsy state of a driver. The detection of drowsiness is due to the help of computer vision based concepts[3]. In this, the system uses a camera that is fixed towards the face of the driver to observe the eyes of the driver in order to detect drowsiness. A warning signal is provided to wake them, if drowsiness is detected. At first stage, the system detects the face by using Viola Jones Algorithm[1] and at the second stage, it detects eyes, and then determines whether the eyes are in open or closed state[6]. The system uses information obtained from the image and determines drowsiness. If the eyes are closed for long period, it concludes that the driver is sleepy and a warning signal is issued to wake him/her up[9][4].

Index terms:- *Live video, segmentation, viola Jones algorithm, Vision Cascade Object Detector*.

I. INTRODUCTION

Everyone loves to travel. Driver drowsiness causes major accidents because they tend to travel long distance[7]. Maximum accidents are by cars, and other four wheeler vehicles. In these vehicles, the driver easily goes to a drowsy state due to tiredness and lack of sleep. The term drowsiness refers to tired state between sleeping and being awake which can lead to the loss of alertness by some psycho physiological changes. Due to the driver fatigue, 57% of a catastrophe occurs in the trucking industry. A study by Central Road Research Institute (CRRI) says that 40% of road accidents are due to exhausted drivers who doze off while driving[8]. Numerous efforts have been made by researchers to invent new methods to detect drowsiness of the driver by measuring facial movements. In this thesis, we proposed direct method which detects the drowsiness of a driver by using computer vision technology without any help of implantable electrodes which checks the state of the eyes.

II. EXISTING SYSTEM

Some of the existing systems use hardware devices which may affect the body of the driver and aging of components reduces the function of the system. If the hardware device gets damaged, it will affect the whole system.

III. PROPOSED SYSTEM

In the proposed method, an image is taken from a live video. In an image, it detects the face and eyes by using Viola Jones algorithm, and then determines whether the eyes are closed or open to detect drowsiness to alertthe driver to open his/her eyes.The block diagram of the proposed system is shown within the Fig.1.

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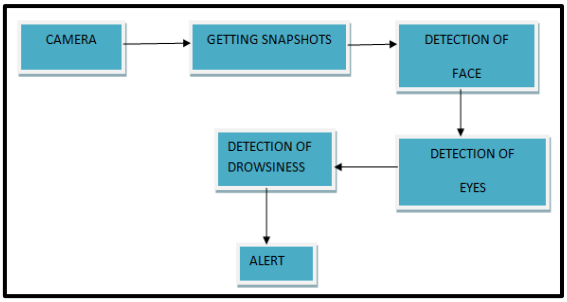


Fig. 1. Block Diagram of Proposed System

3.1 Image Acquisition: -

It mainly involves getting an image from the video of a person who is driving. An image is acquired from a camera by taking snapshots. A live image is taken into consideration to perform different operations.

3.2 Face detection: -

At a time, 't', a snapshot is taken into consideration to detect face, and then it tries to detect the face of the driver at each snapshots. With the help of vision Cascade it can be performed.

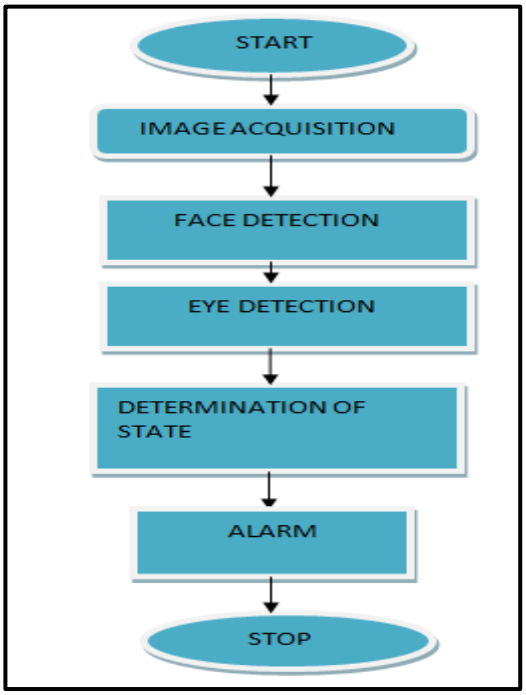
3.3 Eyes detection:-

TheDetection of the eyes is done by using the eye detection function, after detecting the face of the driver by the face detection function. It can be done by an algorithm called Viola Jones.

3.4 Drowsiness detection:-

After detecting the eyes of the driver, the drowsiness detection function detects whether the driver is in drowsy state or not, by considering the state of the eyes that are whether the eyes are open or closed, and alert the driver to open his/her eyes.

IV. FLOWCHART



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V. PSEUDO CODE

```
clc;
clear all;        FaDetect=vision.CascadeObjectDetector();
 BBf=step(FaDetect,e);
          detFace=insertObjectAnnotation(e,'Rectangle',BBf,'Face');
       imshow(detFace);

        [a,fs]=audioread('BeepSound.mp3');
        p=audioplayer(a,fs);
        play(p)

clc;
clear all;
[a,fs]=audioread('BeepSound.mp3');
       p=audioplayer(a,fs);
       play(p)
       info=audioinfo('BeepSound.mp3');
       disp(info);
end
```

VI. DESCRIPTION

Here, an image is acquired from a live video by using the function ‘snapshot()’. The obtained image is processed by using Viola Jones Algorithm. In the first step, it detects face of the driver and then the eyes are processed to detect drowsiness. The function ‘rectangle()’ helps to find the length, and width of the eyes. ‘Cascade Object Detector’ which is an inbuilt object detector in MATLAB, uses to find the position of the eyes. The function ‘audioread()’ is used to read an audio file from the matlab and ‘audioplayer()’ is used to play the audio file to alert the driver.

VII. RESULT AND DISCUSSION

An image is acquired from the camera which is fixed in front of the face of the driver. The image shown in the Fig.2 is of 346*368 pixels.

Fig.2. Image Acquisition

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After acquiring image from the camera, it searches for the face of the driver by using Viola-Jones algorithm and the face is annotated by a yellow rectangular box labelled as face as shown in the Fig. 3.

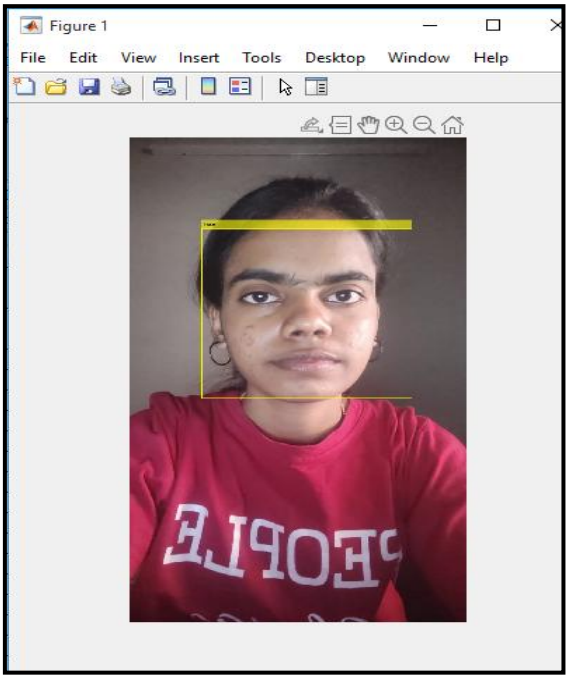

Fig.3. Face Detection

An image is acquired from the camera which is fixed in front of the face of the driver. The image shown in the Fig.4 is of 270*286 pixels

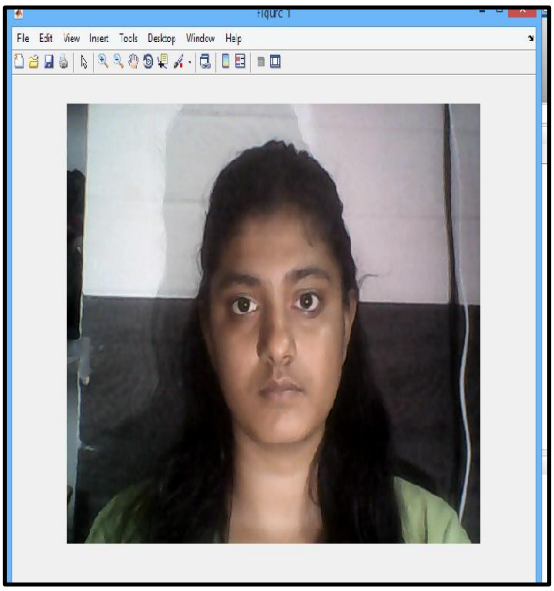

Fig.4. Image Acquisition

After acquiring image from the camera, it searches for the face of the driver by using Viola-Jones algorithm and the face is annotated by a yellow rectangular box labelled as face as shown in the Fig. 5 and then searches for eyes which is annotated by red rectangular box.When the eyes are open, it

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shows as ‘Eyes Open’ as shown in the Fig. 5.

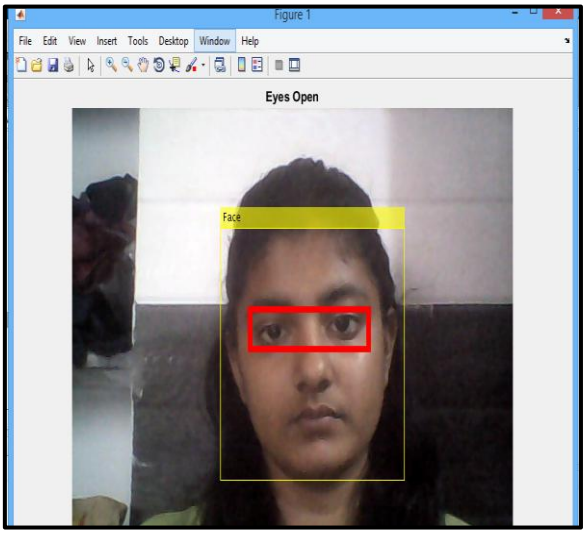

Fig.5. Eyes are in open state

In the result of proposed when the eyes are in closed state, it shows as eyes closed as shown in the fig.6, and alerts the driver to open his/her eyes by producing a ‘Beep Sound’.

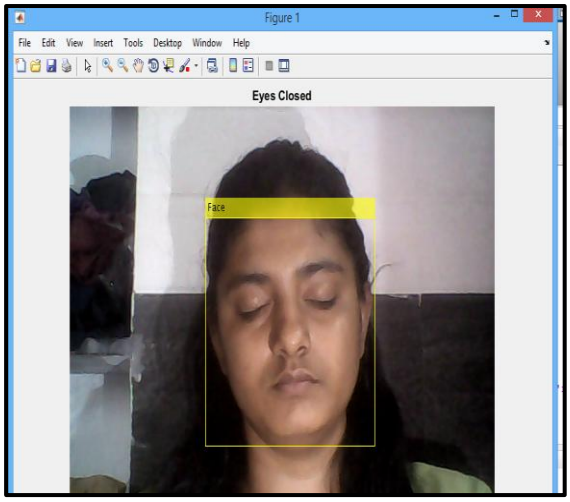

Fig. 6. Eyes are in closed State

When eyes are in closed state, it produces a ‘Beep Sound’ which is having a sample rate of 44100 Hz and duration of 0.7835 seconds as shown in the Fig. 7. The waveform of Beep Sound is shown in the Fig.8.

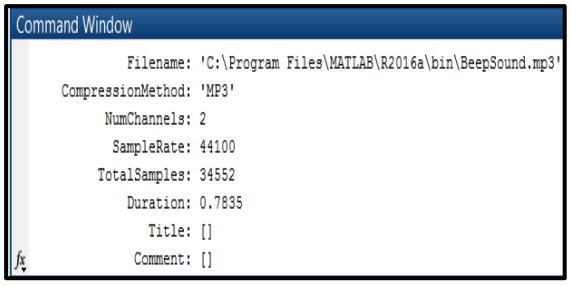

Fig. 7. Properties of Beep Sound

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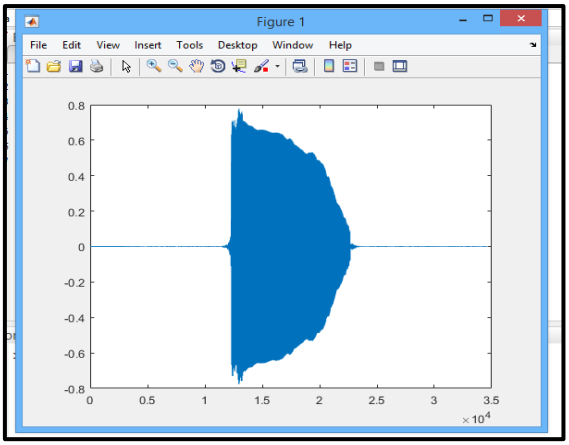

Fig. 8. Waveform of Beep Sound

The TABLE 1, shows analysis of the result of the proposed system on the study of 3 users.

TABLE 1: Survey on Drowsy Driver Detection to find correct rate.

S.NO	USER	GENDER	AGE	TOTAL SNAP SHOTS	FAILURE OF DETECTION	CORRECT RATE
1.	User 1	Female	21	15	3	80
2.	User 2	Male	13	30	5	83.33
3.	User 3	Female	18	10	1	90.0

The equation used to find the correct rate of the proposed system is detection failure subtracted from the total number of snapshots divided by the total snapshots.

$$\text{Correct Rate} = \frac{\text{Total snapshots} - \text{detection failure}}{\text{Total snapshots}}$$

For the Proposed System, the Average Correct Rate is 84.4 percentage for different users, both male and female of different ages, and skin color. The Bar chart for Correct Rate is shown in the Fig. 9.

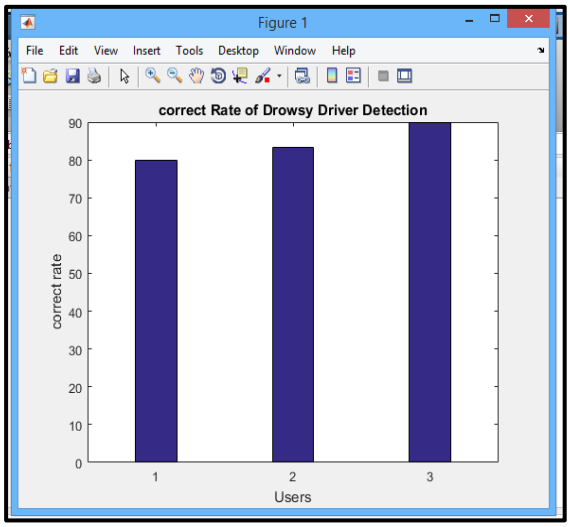

Fig. 9. Correct Rate of the Drowsy Driver Detection

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. TABLE 2: Accuracy Rate of the Drowsy Driver Detection.

S.NO	USER	EYES CLOSED	WARNING GENERATED	CORRECT WARNING	ACCURACY RATE	AVERAGE
1.	User 1	11	12	11	91.66	
2.	User 2	17	18	17	94.44	95.36
3.	User 3	7	7	7	100	

To calculate the Accuracy Rate of the Drowsy Driver Detection, the formula used is given below. It is the ratio between the correct warning and the warning generated.

$$Accuracy\ Rate\ =\ Correct\ Warning/\ Warning\ Generated$$

For the proposed system, the Accuracy Rate is 95.36 percentage for different users, both male and female of different ages, and skin color. The Bar Chart for Accuracy Rate is shown in the Fig.10.

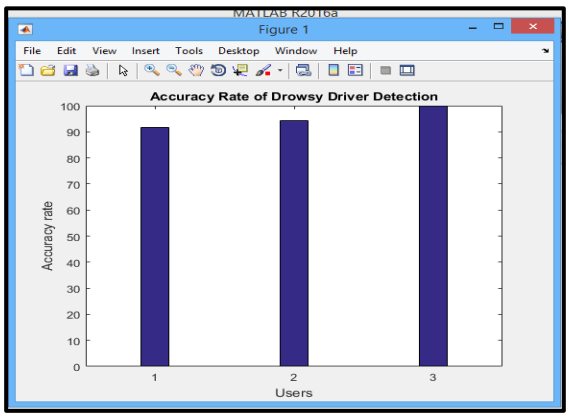

Fig. 10. Accuracy Rate of Drowsy Driver Detection

TABLE 3: Accuracy Rate comparison b/w method 1 and our proposed system.

METHOD	ACCURACY
Method 1 proposed by Rateb Jabbar, Khalifa AI-Khalifa, Mohamed Kharbeche, Wael Alhajyaseen, Mohsen Jafari, Shan Jiang named 'REAL-TIME DROWSINESS DETECTION FOR ANDROID APPLICATION USING DEEP NEURAL NETWORKS TECHNIQUES'.	

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	80.92
Our Proposed Method named 'DROWSY DRIVER DETECTION USING VIOLA JONES ALGORITHM'.	95.36

The Accuracy for Method 1 is 80.92 percent, and for Method 2 is 95.36 percent as shown in the TABLE 3 and the Fig.11. The Difference between the method 1 and our proposed method is about 14.44 percent. The Bar chart for the Accuracy Rate comparison is shown in the Fig. 11. Therefore, our algorithm performs better than method 1 is shown in the TABLE 3 and the Fig. 11.

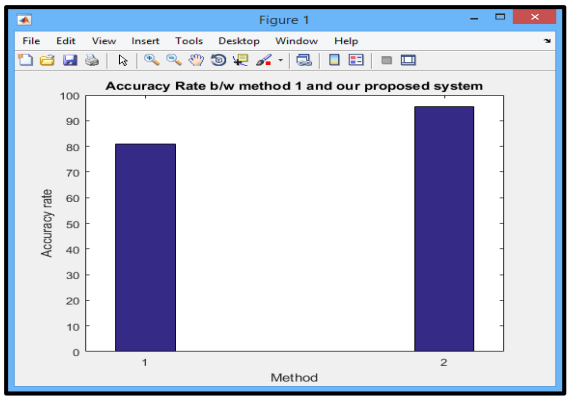

Fig. 11. Accuracy Rate b/w method 1 and our proposed system

VIII. CONCLUSION

Therefore, we have successfully implemented drowsy driver detection using Viola Jones Algorithm. The system has been developed successfully, tested and its limitations are identified. Limitations of the proposed system are

- If the driver wears any glasses then the computation doesn't work.
- If light directly strikes the camera, the system doesn't work.
- If the surrounding is dark, the accuracy will reduce.

The applications are
1. This system helps to reduce the number of crashes occurs due to drowsiness.
2. In the medical field, it helps to alert the doctor when a patient is not opening his/her eyes for a long time.
3. In educational institutions, it is used to detect the drowsy state of students during lectures.
4. This can be used to detect drowsiness of employees in companies to alert them.

IX. FUTURE SCOPE

The future work may be to detect drowsiness by using external environmental factors such as weather and fatigue measurement by analyzing neural networks.

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