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Optical Interpretation to Recognize Bus Driver Fatigue

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Abstract: One needs to think regarding an automobilist's weariness in order to stop the possibility of threats. One of the significant sources of traffic crashes is motorist's fatigue, mostly for motorists of huge vehicles specifically public transport, trucks, etc., due to their extended driving span. The goal of this paper is to present a vision reliant tiredness recognition architecture for bus driver surveillance in that an interface is used that again and again audits face and eyes to find an automobilist's tiredness with the help of notification. To avoid accidents this system is very useful.
Keywords: Optical Interpretation, ECG, EEG, EMG, Open CV, Haar Classifier.

I. INTRODUCTION

We can see the ratio of accidents is increasing day by day all over the globe. The reasons behind these traffic collisions are mainly huge vehicles like buses, trucks, lorries etc., Basically the drivers won't have the intention to do such accidents. Their tiredness is the crucial element that makes to happen such mishaps. Although people die due to various diseases or natural deaths, but the death rate is higher due to accidents. This is because when the driver is about to sleep, he looses his consciousness, realization and the ability to master the vehicle. People around the world are concerned regarding the higher fatality rate due to traffic collisions. Therefore it is important to think about this matter and try to prevent these accidents. It will have a great impact on both our social as well as economical life. To protect the lives of people, it is necessary to develop something that will help in finding out the driver's drowsiness. This paper represents a framework that detects the bus driver fatigue using image processing technique.

Earlier a number of ways were used to find out the driver's drowsiness. The electrodes were fitted to the driver's body as a result of which the driver was disturbed. Also GSR, ECG, EMG etc., methods were used. The difficulty level for driver was increasing because of these methods. Thus a simple, easy, exact and reliable method of optical interpretation is planned. This method aims to analyze the motion of eyes and their blinks. The surveillance is done with the help of front camera. The driver is alerted with the help of an alarm sound. In this way we can reduce the number of accidents.

II. PROPOSED SYSTEM

The critical factor behind the occurrence of traffic collisions is the driver's weariness that is to be solved. From this we come to know that how crucial it is to develop a system that identifies the motorist's exhaustion and notifies him at an early stage before the accident is about to happen. This proposed framework monitors both the face and eyes of the driver. First of all the face and eyes are supervised. Next the computations related to iris and jaw angle are done using Haar (cascade classifier algorithms) that will analyze whether the eyes are open or closed and if the driver is falling asleep then the notification is given with the help of alarm.

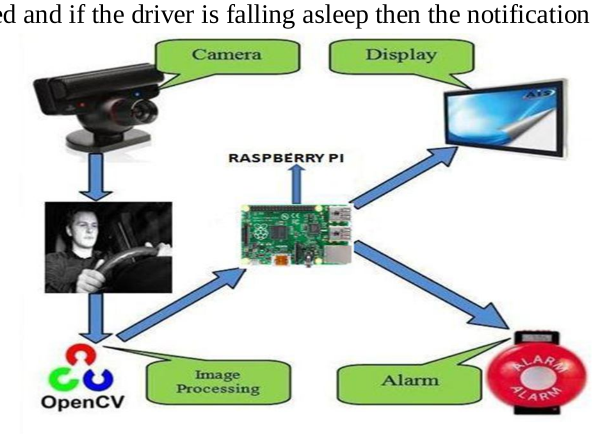

Fig. 1 The architecture of Proposed Optical-Based Structure for Drowsiness Disclosure.

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III. SYSTEM DESIGN AND IMPLEMENTATION

The stages involved in automobilist's tiredness detection: Optical detection function and Drowsiness computation function.

Firstly the image of the driver is to be taken with the help of web camera by applying the algorithm on every frame of the video stream, the camera produces a video clip.

Secondly, the driver's face is to be noticed. Haar Cascade Classifier is used to identify the face region inspite of having various methods. Haar Cascade Classifier has two phases: training and identification of the object. The region that doesn't contain the object, the Haar Cascade classifier will dismiss thar region and will continue further to recognize the object.The input values are continuously taken from the webcam until the face is observed. Further the eyes are detected.

Next thing is to detect the eyes because eyes are the elements with the help of which we can detect the driver's fatigue. Various techniques are available to detect eyes but here we can make use of intensity change, since these are the darkest part of the face. If the left and right corners of the eye are $(x_1$ and $x_2)$, and the central positions of the upper and lower eyelids are $(y_1$ and $y_2)$, the corresponding level of eye openness can be calculated(1).

$$u = \frac{|y_2 - y_1|}{|x_2 - x_1|} \quad (1)$$

The agreement measures of the two eye detectors for the left and right eyes as (2) and (3).

$$a_1 = \exp\left[-\left(\frac{\left|x_{12R}^{lc} - x_{CV}^{lc}\right|^2}{\sigma_X^2} + \frac{\left|y_{12R}^{lc} - y_{CV}^{lc}\right|^2}{\sigma_Y^2}\right)\right] \quad (2)$$

$$a_2 = \exp\left[-\left(\frac{\left|x_{12R}^{rc} - x_{CV}^{rc}\right|^2}{\sigma_X^2} + \frac{\left|y_{12R}^{rc} - y_{CV}^{rc}\right|^2}{\sigma_Y^2}\right)\right] \quad (3)$$

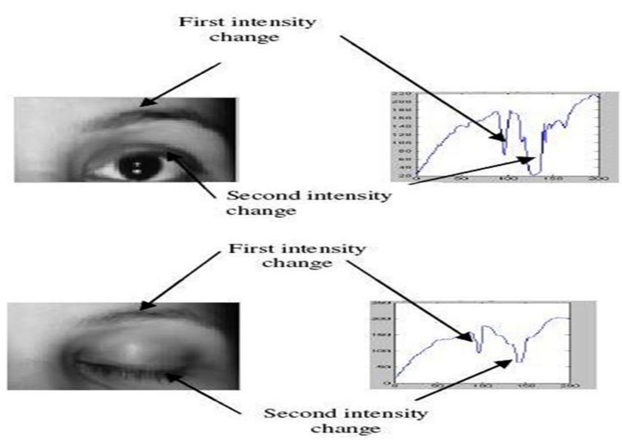

Fig. 2 Intensity computation of eye.

A weight for eyelid closure is defined as

$$w_{ec}(u_i) = \begin{cases} 1 \\ 1 - \frac{u_i - 0.07}{0.06} \\ 0 \end{cases}$$

The weight of eyelid closure is 1 when $u_i < 0.07$, $1-\frac{u_i - 0.07}{0.06}$ $when\, 0.07 \le u_i \le 0.13$ and 0 when u_i >0.13.

The PERCLOS defined on eye openness can be calculated as

$$\text{PERCLOS}=\frac{\sum_{i=t-N_t}^{t} w_{ec}(u_i)\Lambda t_i}{\sum_{i=t-N_t}^{t} \Lambda t_i} \qquad (4)$$

The driving states can be classified as Normal and Fatigue on PERCLOS values as

$$S=\begin{cases}1\\0\end{cases} \quad \text{if PERCLOS} \le 0.2 \text{ then 1 otherwise 0.} \qquad (5)$$

IV. RESULTS AND DISCUSSION

TABLE I
Threshold Values of 5 Random Persons

Test Images	Threshold Value for left eye	Threshold Value for right eye
Subject 1	43	42
Subject 2	67	66
Subject 3	8	53
Subject 4	34	34
Subject 5	27	30

V. CONCLUSION

The proposed method that detects the face and eye regions is a simple, understandable, authentic and trustworthy. The ratio of success is higher for this method when compared to other methods. Without specs the result is more accurate for eye blinks. Along with showing the results for driver's exhaustion, it also shows the updated condition of the driver. In order to save the lives of people from traffic collisions this method is more appropriate and efficient.

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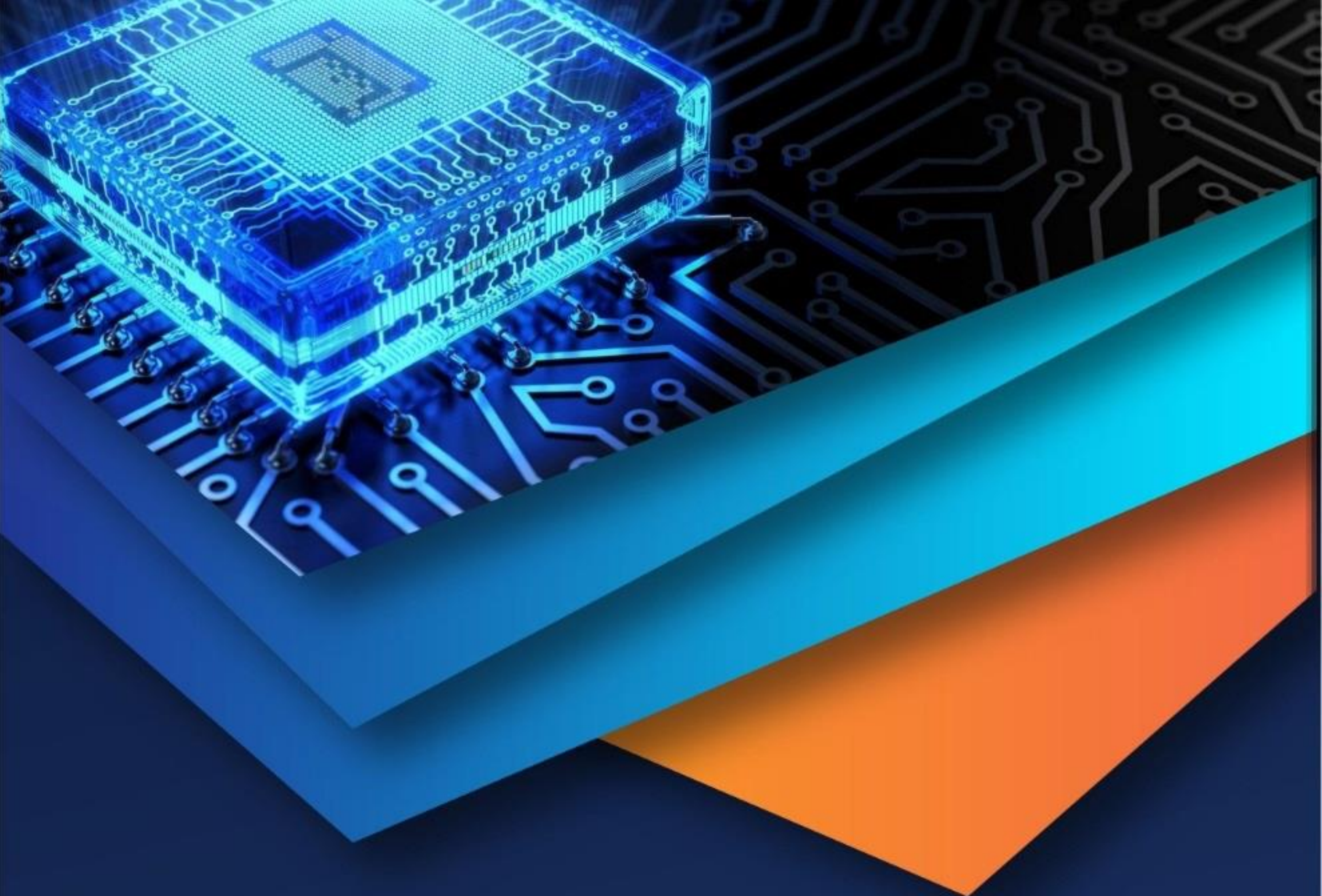

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