Detection of Drowsiness of Bus Driver based on Robust Visual Analysis of Eye State

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Abstract— In this paper a system for detection of drowsy driver through camera is explained. Proposed system works in such a way that it is non-invasive. A Fatigue detection system has been designed for the detection of the fatigue/drowsiness of the driver by using vision based system. The basic requirement of the system is Camera, facing towards the driver face. The camera can be used to monitor the behavioural aspects of the driver's face. Accordingly the driver will be warned if found to be sleepy.

Keywords: Bus Driver, Fatigue/Drowsiness, PERCLOS

I. INTRODUCTION

The idea behind developing the project is to avoid, accident and reduce the number of accidents. Most of the times reasons for accidents is drowsiness/fatigue. According to survey of road accidents, most accidents occur when the driver travel for long period or does any boredom work. If the driver exceeding the normal travelling time then the chances of accidents arises. Drowsiness is the condition where there is decrease in alert and conscious level. There is no direct method to detect the drowsiness but indirect methods can be used to detect the drowsiness.

Initially there are different method that can be used for measuring drowsiness:

1) Vehicle based approach
2) Physiological measures
3) Behavioural based approach

By using any of the method an intelligent system can be developed that will help in alerting the driver in drowsy condition and prevent from accident. The initial working start with capturing the real time video continuously. Then divided into frames and each frame is analyzed. The face is located in the frame. If face is located, then the eye are searched in the frame. If eyes are located then the closure of eye are calculated and then compared with the reference with the value of drowsiness. After that drowsiness value is calculated for jaw position. If drowsiness condition is found then the driver is alerted. And this process is looped so that it continuously check the openness of eyes and jaw position.

II. PROPOSED SYSTEM

Among many of the technique available for detection of drowsiness the proposed system uses behavioral approach. Some of the approach are such that can irritate the driver.

This approach will mostly focus on PERCLOS (Percentage of Closure) as it can provide accurate information on drowsiness. Also the approach is non-intrusive in nature, so the state of the driver will remain unaffected. The driver can travel comfortably.

The drowsiness is checked according to the threshold value that will be specified.

Algorithm that are developed recently mostly focus on more general cases. For our case it may be face in the tilted position.

A. *System Architecture:*

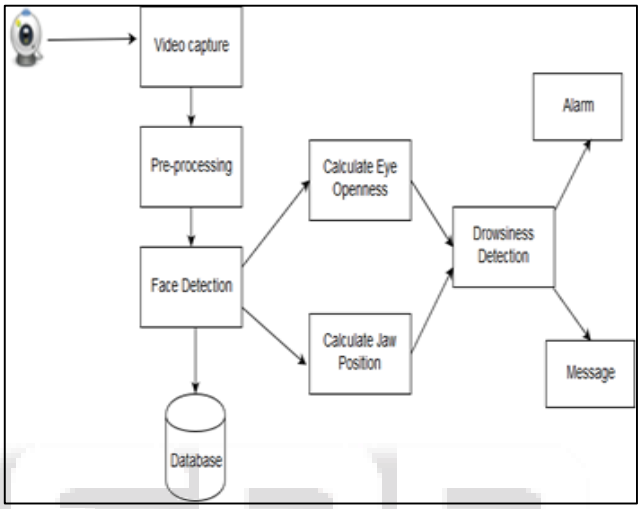


Fig. 1: System Architecture

III. WORKING

Drowsiness detection system uses image processing for analysing the state of eye and jaw position of driver. There are different methods that can be used but some of them are invasive and some are no-invasive.

The working starts with the recording the real time video through camera. The processing of video is done so that the noise from the video is removed.

The proposed system is a monitoring system that can specially works on drivers eyes and face region. Firstly the eyes and face regions are monitored by camera. Secondly, Iris structuring, jaw angle finding and calculation is done using regression analysis, Haar (cascade classifier algorithms) which will examine the eyes are open or closed, then system will detect whether driver is sleeping or not sleeping. If driver is sleeping the alarm rings.

There are different ways to make an effective drowsiness detection system:

1) An non-invasive type of system that will not disturb the driver.
2) A real time system that will give accuracy in detection of drowsiness.
3) System that will work at both daytime and night time.

System works in the following way:

1) Camera capture the live video of driver.
2) The video captured is processed and the face region is detected in the frames.
3) Feature extraction is done on the frame.

4) When eye region is extracted the calculation is done on the eye region by using Euclidean algorithm.
5) After that the jaw position is also calculated.
6) If the condition are satisfied for drowsiness then alarm is raised.

IV. SETUP

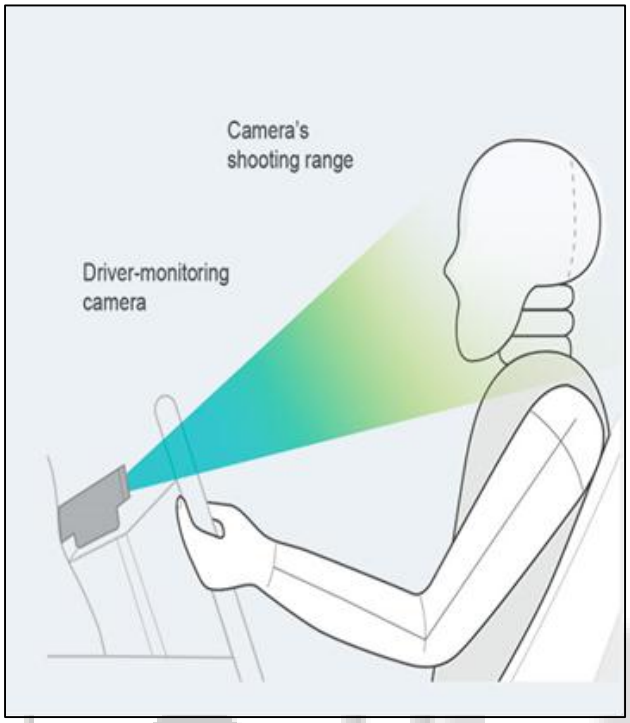
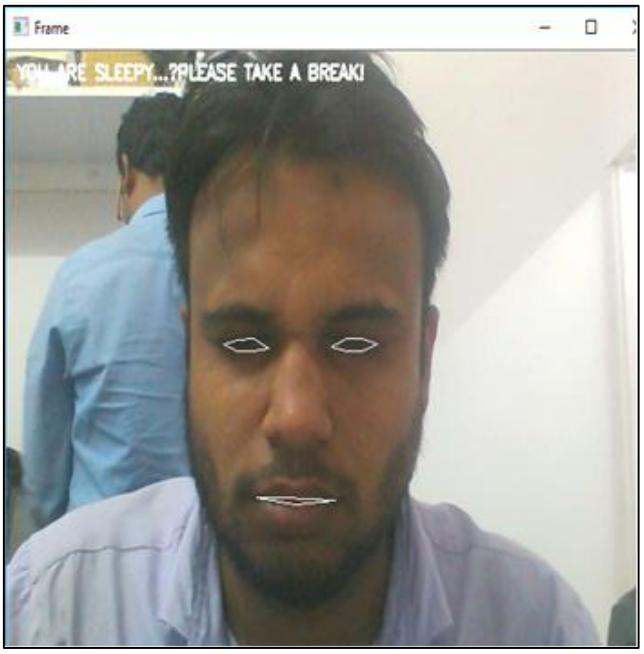


Fig. 2: Operational setup

V. RESULT



VI. BASIC CONCEPT

A. *Facial Landmark:*

Points of interest can be found by using the process of Face landmark detection in an image of human face. In computer Vision this concept is being used at very great amount. There are many application available where Facial landmark is used like Emotion detection through facial gestures, estimating gaze direction and many more. Facial Landmark start with face detection and finding for faces in the image.

Facial landmark can be used to improve the efficiency of face recognition. Facial landmark is used to align facial images in mean of shape that are aligned in the shape of face.

By using some landmark point the head pose can also be estimated.

B. *Euclidean Algorithm:*

The Euclidean distance is the "ordinary" straight-line distance between two points in Euclidean space.The Euclidean distance between points p and q is the length of the line segment connecting them ($\overline{\mathbf{pq}}$). In Cartesian coordinates, if considered

$p = (p_1, p_2,..., p_n)$ and
$q = (q_1, q_2,..., q_n)$
are two points in Euclidean n-space, then the distance (d) from p to q, or vice-versa q to p is given by the Pythagorean formula:

$$d(\mathbf{p},\mathbf{q}) = d(\mathbf{q},\mathbf{p}) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2}$$

$$= \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2}.$$

1) Advantages:
1) It is noninvasive in nature.
2) Provides almost accurate result.

VII. CONCLUSION

There are different methods that can be used to detect the drowsiness. Some are intrusive and some are non-intrusive. In proposed system consider method that will be non-invasive. System work on real time video captured by camera and video is divide into frames. The frames are analyzed and preprocessed. After the successful detection of face, eye detection is done. The closure of eyes is measured by using Euclidean algorithm. Also the jaw position is checked. If both parameter satisfy the condition of drowsiness then alarm is raised to alert the driver. And also message is displayed whether driver is drowsy or not.

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