A Paper on "Detection of driver's fatigue"

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***Abstract*- A number of approaches have been developed to reduce the risks of drowsy drivers. Almost all the statistics have identified driver drowsiness as a high priority vehicle safety issue.**
In our project we are using behavior- based approach mechanism for detecting driver's fatigue. We are predicting fatigue or drowsiness by calculating Euclidean distance of eye and the Eye Aspect Ratio.
There is an increased interest with respect to the design and advancement of computer controlled automotive applications to overcome those problems by enhancing safety to reduce accidents, increase traffic flow, and enhance comfort for drivers.
Additionally, a number of technical aspects should be seriously considered, including correctly capturing face and eye characteristics from unwanted movements, unsuitable task environments, technological limitations, and individual differences.

***Index terms*- EAR, Euclidean Distance, Haar Cascade, PERCLOS, Alcohol**

I.INTRODUCTION

Drowsiness while driving has been a critical issue within the context of transportation safety. Fall-asleep crashes are very serious in terms of injury severity and more likely to occur in sleep-deprived individuals. Drowsiness has been estimated to be involved in 20-50 per cent of crashes on motorways. Drowsiness influences mental alertness, decreasing an individual's capability to handle a vehicle safely and expanding the possibility of human mistakes that could lead to deaths and injuries. Furthermore, it has been indicated to slow response time, decreases awareness, and impairs judgment. A drowsy driver is unable to predict when he or she will have an uncontrolled sleep onset

Motor vehicles, bus and truck accidents is a major problem in World. Fatigue and drowsiness among the drivers have been identified as one of the main reasons behind fatal crashes and injuries especially driving in long and monotonous motorway. Driving fatigue which is describe as a feeling of drowsiness due to extended driving period monotonous road condition, adverse climatological environment or driver's individual characteristics are direct or contributing factor to road accidents.

Vehicle accidents are most common if the driving is inadequate. These happen on most factors if the driver is drowsy or if he is alcoholic. Driver drowsiness is recognized as an important factor which leads to enormous fatal accidents. The driver loses his control when he falls asleep which leads to accidents. It was demonstrated that driving performance deteriorates with increased drowsiness with resulting crashes constituting more than 20% of all vehicle accidents. But the life lost once cannot be re-winded. Advanced technology offers some hope avoid these up to some extent. The mechanisms in detecting fatigue and sleepiness while driving has been categorized into three broad approaches including vehicle-based, physiological-based, and behavior-based approaches.

II. LITERATURE SURVEY

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 [8]. Drowsy state may be caused by lack of sleep, medication, drugs or driving continuously for long time period. An increase rate of roadside accidents caused due to drowsiness during driving indicates a need of a system that detects such state of a driver

and alerts him prior to the occurrence of any accident.

During the recent years, many researchers have shown interest in drowsiness detection. Their approaches basically monitor either physiological or behavioral characteristics related to the driver or the measures related to the vehicle being used [6].

To deal with such kind of problem. [1] propose an eye blink monitoring algorithm that uses eye feature points to determine the open or closed state of the eye and activate an alarm if the driver is drowsy. Detailed experimental findings are also presented to highlight the strengths and weaknesses of our technique. An accuracy of 94% has been recorded for the proposed methodology.

An automatic drowsy driver monitoring and accident prevention system that is based on monitoring the changes in the eye blink duration [2]. Their proposed method detects visual changes in eye locations using the proposed horizontal symmetry feature of the eyes. Their new method detects eye blinks via a standard webcam in real-time at 110fps for a 320×240 resolution. Experimental results in the JZU eye-blink database showed that the proposed system detects eye blinks with 94% accuracy with a 1% false positive rate.

It is a difficult problem to make drivers drowsiness detection meet the needs of real time in embedded system; meanwhile, there are still some unsolved problems like drivers' head tilted and size of eye image not large enough. So, there is proposes an efficient method to solve these problems for eye state identification of drivers' drowsiness detection in embedded system which based on image processing techniques.[3] This method break traditional way of drowsiness detection to make it real time, it utilizes face detection and eye detection to initialize the location of driver's eyes; after that an object tracking method is used to keep track of the eyes; finally, we can identify drowsiness state of driver with PERCLOS by identified eye state. Experiment results show that it makes good agreement with analysis.

There is proposed a novel on drowsiness detection algorithm using a camera near the dashboard [4]. The proposed algorithm detects the driver's face in the image and estimates the landmarks in the face region. In order to detect the face, the proposed algorithm uses an AdaBoost classifier based on the Modified Census Transform features. And the proposed algorithm uses regressing Local Binary Features for face landmark detection. Eye states (closed, open) is determined by the value of Eye Aspect Ratio which is easily calculated by the landmarks in eye region. The proposed algorithm provides real time performance that can be run on the embedded device. We obtained the dataset using video records from the infrared camera which is used the real-field. The proposed algorithm tested in the target board (i.mx6q). The result shows that the proposed algorithm outperformed in the speed and accuracy.

A new approach towards automobile safety and security with independent region based automatic car system is proposed in this concept [5] proposed three distinct but closely related concepts namely, a Drowsy Driver Detection system and a traffic detection system with external vehicle violation avoidance-based concept. In recent time's automobile fatigue related crashes have really magnified.

In order to minimize these issues, they have incorporated driver alert system by monitoring both the driver's eyes as well as sensing as well as the driver situation based local environment recognition-based AI system is proposed.

III. PROPOSED SYSTEM

Steps for detection of Drowsiness: -
Step 1 - In first step when we run the program, the system will find or detect face.
Step 2 – In next step or this step after the face is detected the using the spatial SciPy the left eye and the right eye are detected.
Step 3 – After the detection of left and right the Euclidean distance of each eye is calculated and the EAR is also calculated.
Step 4 - While step 3 is working on simultaneously side-by-side the video of driver's face is also running where we can see the drowsiness alert and the eye aspect ratio (EAR).

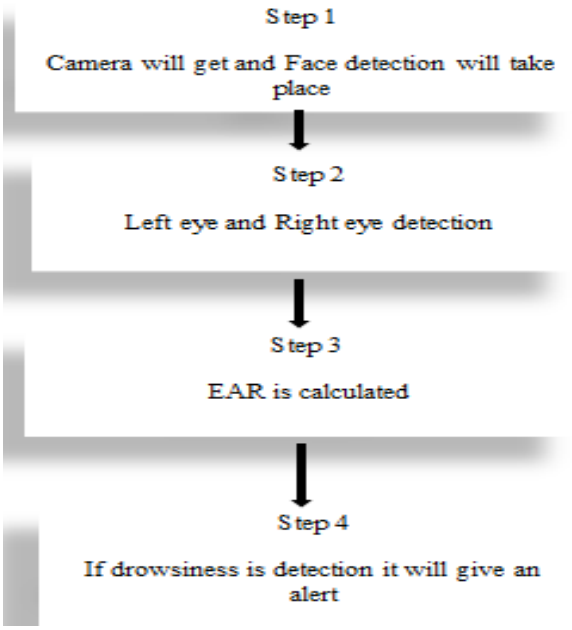

Fig. 2 System flow

WORKING PRINCIPLE

Haar Cascade Classifiers: -

In Haar Cascade Classifiers, a lot of similar and dissimilar images are trained in order to detect fatigue of the driver. OpenCV is a learning-based method, packed with a detector as well as a trainer. For training, a separate database is maintained for face and eye with several positive and negative images having eye closed and opened conditions and different set facial images.

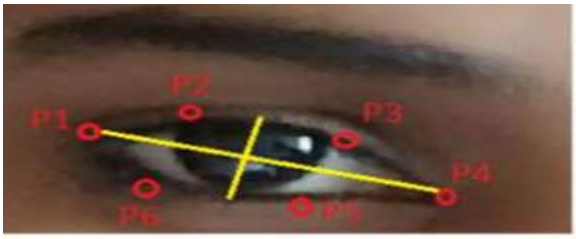

Fig.1 Eye Aspect Ratio

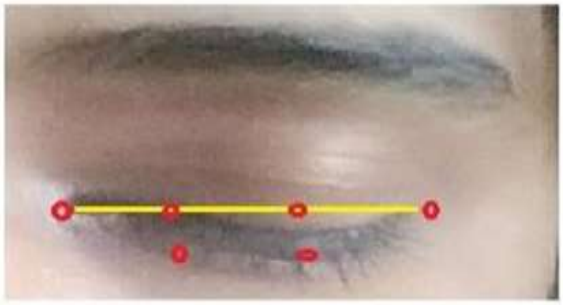

Fig.2 Shape predictor Facial Landmark detection and Eye Aspect Ratio (EAR)

In order to predict the face and eye region in the live video stream, shape predictor is used. Fig. shows the sleepiness which is measured by calculating the eye aspect ratio (Euclidean distance between the eyes are calculated), the arguments are passed to the predefined dataset and facial landmark detection is carried out. For every video sequence, the eye landmarks are located. The aspect ratio between width and height of the eye is calibrated.

Fig.1: Close and open eyes with landmark detected automatically by. The EAR is calculated for several frames of a video. A single blink is represented.

$$EAR = \frac{\|p2-p6\|+\|p3-p5\|}{2\|p1-p4\|} \quad (1)$$

Where p1, p6 are the two-dimensional landmark location, represented in

Fig.2: The EAR is mostly stable when an eye is open and is getting close to zero while the eye is not in open state. If the person viewing the camera continuously, the Eye Aspect Ratio (EAR) is found to be normal and it reaches low value when he/she closing the eye for a longer time. When the lower value is reached, then drowsiness is detected.

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