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A Survey on Driver's Drowsiness Detection System Using an Effective Face Expression Recognition

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ABSTRACT: Drowsiness is a process in which one level of consciousness is reduced due to lacking of sleep or exhaustion and it may cause the driver fall into sleep quietly. A Drowsy or sleepy driver is unable to determine when he/she will have an uncontrolled sleep. Fall asleep crushes are very serious in terms of injury. Recent statistics estimate that annually 1,200 deaths and 76,000 injuries can be caused to exhaustion or drowsiness related crashes. More than 25% of highway traffic accidents are caused as result of driver exhaustion. Reduce the risk of an accident by warning the driver of his/her drowsiness. This project is mainly based on four components 1) Face and Eye detection: Performs scale invariant detection using Haar Cascade Classifier perform through a webcam. 2) Eye feature extraction: Eye features are extracted using Hough Circle and 3) Extract single eye 4) Edge detection and perform drowsiness detection on it. In the proposed method, following the face detection step, the facial components those are more important and considered as the most effective for drowsiness, are extracted and tracked in video sequence frames. The system has been tested and implemented in a real environment. The contribution work is when drowsiness detected, after it will give alarm warning signal to the driver.

KEYWORDS: Drowsiness, Haar Cascade Classifier, Hough Circle, Image Processing, Real Time Drowsiness Detection, OpenCV

I. INTRODUCTION

Drowsy driving is quickly becoming a leading cause of accidents all over the world. Identifying drowsiness as the cause of an accident is also extremely difficult, as there are no available tests that can be run on the driver. Therefore, mitigation is the best way to reduce such accidents. The most accurate way to gauge driver drowsiness is to monitor physiological signals such as heart rate, skin conductance and brain activity. However, such measurements require the attachment of electrodes to the body of the driver, which may cause discomfort and distraction. Majority of the accidents caused today by cars are mainly due to the driver's sleep or exhaustion. Driving for a long period of time causes excessive sleep or exhaustion and tiredness which in turn makes the driver sleepy or loose awareness. With the rapid increase in the number of accidents seems to be increasing day to day. Therefore a need arises to design a system that keeps the driver focused on the road. The real time drowsiness behaviors are dangerous which are related to drowsiness in the form of the eye blinking, head movement and brain activity. The aim of this system is to detect the human behaviors and mood like eye blinking, yawing etc. There are mainly four parts in this system (1) Face detection (2) Facial feature extraction like detect the eye portion (3) Extract Single eye and (4) Edge detection of the open or closed eye. Face is detected in the real time in the OpenCV using the face detection algorithm and facial features like detect the eye portion and then detect the open or closed eye by self-developing algorithm and reduce the accidents caused by sleep or exhaustion related and also save the money and the reduced human suffering.

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1.1 MOTIVATION

Vision based real time driver drowsiness systems have been proposed and developed by different institutions; most of the systems are based on eye tracking, head tracking and other facial features that manifest in drowsy drivers. Also gives the alarm signal to the driver for reduce the accidents. This has been highly motivated by the advancement in video image processing algorithms.

II. RELATED WORK

The paper [1] focuses on a driver drowsiness detection system in Intelligent Transportation System, which focuses on abnormal behavior exhibited by the driver using Raspberry pi single board computer. In the proposed system a non-intrusive driver drowsiness monitoring system has been developed using computer vision techniques. Advantages are: This system detects the drowsiness of the driver when the eyes are closed for 4 frames or more (i.e., more than 2 seconds). The system is non- intrusive and can be easily equipped with any vehicle. Disadvantages are: This system is expensive.

The paper [2] represents for enable the vehicle to detect drowsiness or discrepancies in the driver's behavior and alert the user when it occurs. The main function of drowsiness-/fatigue-detection (DFD) systems is to monitor the driver's condition and take action accordingly. Advantages are: The vision systems with better time response were the ones that analyzed the driver's physiological features.

The paper [3] presents visual analysis of eye state and head pose (HP) for continuous monitoring of alertness of a vehicle driver. The proposed scheme uses visual features such as eye index (EI), pupil activity (PA), and HP to extract critical information on non-alertness of a vehicle driver. Advantages are: It gives highest classification accuracy. Minimize the number of errors. Disadvantages are: The SVM classifier shows a low Type-I error, which is more critical.

The paper [4] presents a nonintrusive drowsiness recognition method using eye-tracking and image processing. A robust eye detection algorithm is introduced to address the problems caused by changes in illumination and driver posture. Six measures are calculated with percentage of eyelid closure, maximum closure duration, blink frequency, average opening level of the eyes, opening velocity of the eyes, and closing velocity of the eyes. Advantages are: The video-based drowsiness recognition method that provided 86% accuracy. Disadvantages are: Need to improve accuracy.

The paper [5] proposed WE in a sliding window (WES), PP-ApEn in a sliding window (PP-ApEnS), and PP-SampEn in a sliding window (PP-SampEnS) for real-time analysis of driver fatigue. The real-time features obtained by WE, PP-ApEn, and PP-SampEn with sliding window were applied to artificial neural network for training and testing the system, which gives four situations for the fatigue level of the subjects, namely, normal state, mild fatigue, mood swing, and excessive fatigue. Advantages are: The driver fatigue can be estimated better by using the method based on EEG, EOG, and EMG signals.

III. EXISTING SYSTEM

Nowadays more accident occurs in trucks and cars than vehicles due to drowsiness. Nearly 97% of crashes of vehicles happen due to drowsiness of driver. It results into loss for e.g. human loss, money loss, and medical loss. The accident or crashes not only affect the internal system but also to outside world. 70% injury occurs in internal system and 30% injury happen to the external system. Environmental loss is one of the disadvantages of accident. Accidents results in human as well as non-human loss. Recently most of the accidents occur due to drowsiness of drivers in cars and trucks. Annually 1200 deaths and 76000 injured. This approach includes analysis of police reported crash data, in-depth on-site investigations immediately following a crash of the general driving population.

IV. SYSTEM OVERVIEW

The system starts with continuously capturing the video. The proposed system will generate the frames of driver's face and eye. Select one frame form the list of frames as known as image. The face and eye detection is based on the PCA

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algorithm. Detecting the face and eye with such method is proven to be a faster and efficient way of eye detection. This method stays good even under improper/extreme light conditions, as long as the data captured and provided for training includes these conditions. The image of drivers face will be processed and the eye images will be derived out of it. Then the eye region along with the boundary of iris will be detected in the frame using Circular Hough Transform. Circular Hough Transform helps in extracting the circles with a center point (xc; yc) and a radius r. The CHT will detect bright spots based on the circles.

The proposed system consists of three components:
1. **Capturing:** Camera mounted on the automotive dashboard captures the video of driver's face including eyes.
2. **Processing:** Captured video is converted in frames. Select every frame as facial image is used to determine driver's eye i.e. open or closed. The driver's current eye state can be determined using HARR classifier cascades and Circle Hough Transform in OpenCV.
3. **Detecting:** When systemis to read images and detect drowsy condition when eye is closed.

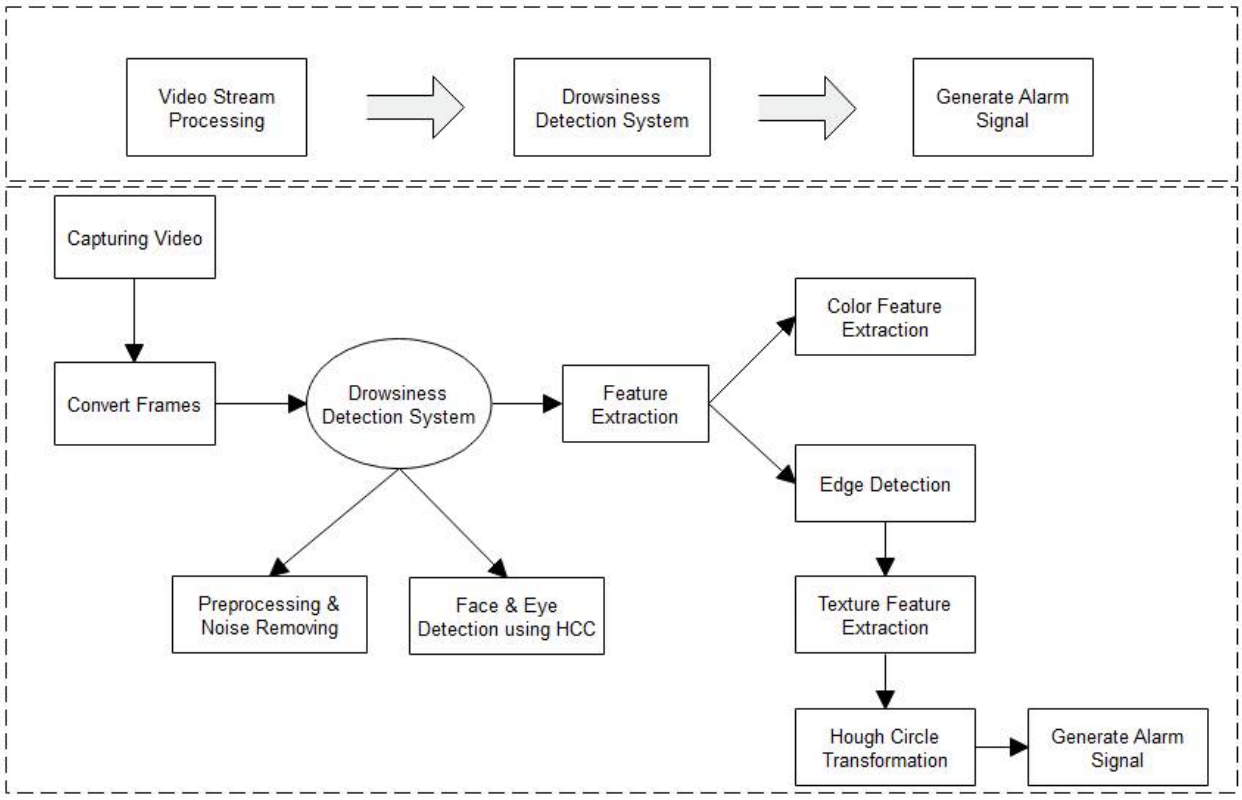

Fig.1 Proposed System Architecture

Advantages are:
1. Detects drowsiness.
2. Decreasing road accidents.
3. System implemented without using database storage.
4. No wires, cameras, monitor or other devices are to be attached or aimed at the driver.
5. Due to the non-obtrusive nature of these methods they are more practically applicable.
6. High accuracy in segmentation, low error rate and quick processing of input data distinguishes this system from similar ones.

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V. CONCLUSION

When we analyze the drowsy videos, we realized that drowsiness has stages and the situation is the same in alert videos, as well. The real time drowsiness detection system here to locate driver eyes and monitor them for fatigue is capable of detecting drowsiness in a rapid manner. Thus we have implementing an effective drowsiness detection system using OpenCV software and Haar Classifiers. The system can be further improved and used in the automotive commercially.

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