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Driver Fatigue Detection Based On Eye Track: A Survey

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Abstract: Most of the road accident is caused by sleepiness of the drivers during the night time. Monitoring the driver and detecting the sleepiness by sensor is expensive. Some of the driver fatigue system is built fully with wire that may disturb the driver. To avoid this issue of expensiveness and other disturbance, here an image processing technique is used to find the driver's sleepiness detection. It is used for preventing the accidents caused by driver's sleepiness and the detection is based on tracking the eyes of the driver. The IR camera is fixed in front of the driver to obtain the PERCLOS. Through that, the driver state has been captured by the mounted camera and the further process is composed of three different stages, first stage is detection of face, eye detection and normalizing it, second stage performs driver position detection and characterization for light filtering. Final stage is for calculating the PERCLOS. This system does not need any calibration process and includes techniques in order to efficiently overcome the typical problems of the image processing algorithms such as: changes of lighting conditions, user appearance and fast head movements.

Key Words: Face and eye detection, PERCLOS, drowsiness parameter, calibration process.

I. INTRODUCTION

Driver sleepiness state detection is based on DIP methodology. In this methodology the system is attending to perform an image processing techniques like standardization, segmentation and recognition. First step is to monitor the face of the driver through IR camera which is fixed in front of the driver's face. Hence, an IR illumination system is used in this project by using a high resolution firmware camera pointing to the driver's face and a double pedal is installed to avoid the security problem. This infrared red camera captures the video of the driver and forward to the system. An CAN bus and a camera are used to collect the data. CAN is a serial bus protocol to attach individual system and sensor as an alternate to traditional multi-wire looms. It permits automotive elements to speak on one or dual wire networked information bus up to 1Mbps.

The system extracts the videos into frames and these frames are the inputs to the face and eye detection process. Face detection is one of the foremost challenging tasks, eye detection and localization of eye from the face is the typical work. For detecting the face, facial feature detection is used and it identifies the presence and location of the features like eyes, eyebrows, nose, lip, ears, etc., by this, the belief of the external body part of human face is realized. The face and eye localization, are the main aim of this process which is used to separate the face from the frame, conjointly localize the eyes from the face. Normalization techniques are applied on the frames. It is a process, that changes the range of pixel intensity values and used to get rid of shadows or lighting changes on same color pixels. In our project normalization is employed for decreasing the impact of glare in input image frame.

The position of the driver is detected from the frame and it is absolutely characterized through noise removal. Face detection and eye tracking algorithm applied on the characterized image. The eye closure evolutions take place on the localized eye image. Eye closure evaluation is based on the PERCLOCE system. PERCLOSE system gives the value of closure in percentage by human psychological activity of eyes before the drowsiness. According to the PERCLOSE evaluation, sleepiness of the driver is being detected.

II. EXISTING SYSTEM

The system consist of four phases, they are face and eye detection, eye image filtering, eye closure evaluation and drowsiness parameter estimation.

The sequence of frames were extracted from the video captured by camera and given as an input for the face and eye detection phases. The system grabs the primary frame and tries to detect the facial features in the image. If the system can't notice the facial feature within the frame then system will consider that the driver's head position has been changed, means the driver is not in sleepiness. Thus it checks the next frame until it gets the face and eye detection. If the eyes were detected then it is localized from the frame [8] as shown in the figure1,(a) and 1,(b)., which is the input for eye closure evaluation phase. In evaluation phase it collects the histogram for the eye filtered images as shown in the figure 2,(a) and 2,(b).

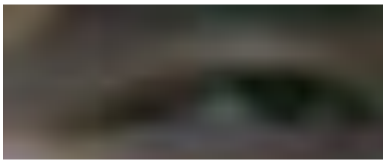

Figure: 1,(a)

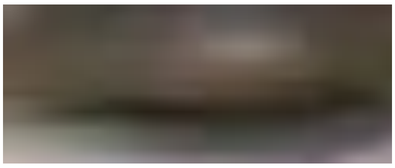

Figure: 1,(b)

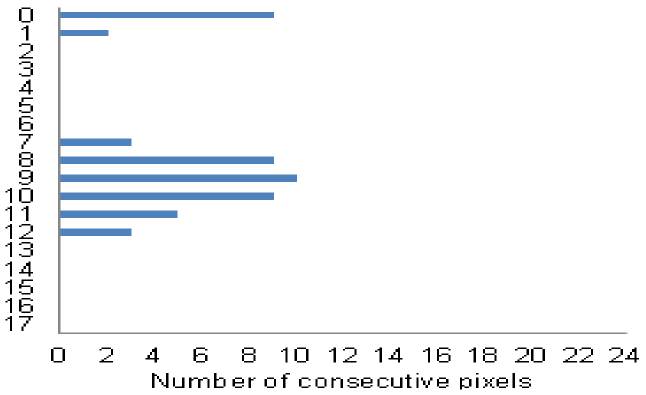

Figure: 2(a) Histogram for fig.1,(a)

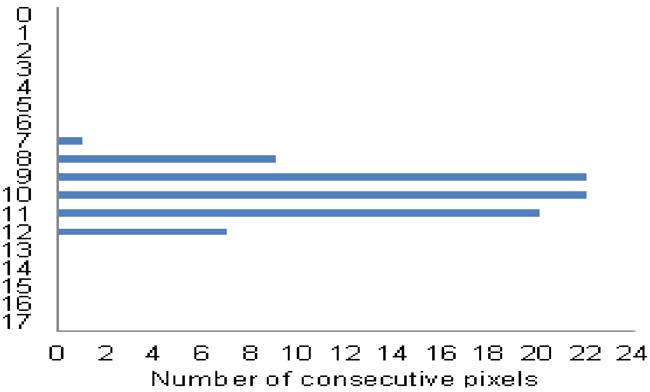

Figure: 2(b) Histogram for fig 1,(b)

The calibration process is occurring between the histogram values. For example, figure 1(a) and 1(b) is that the open eye and closed image of identical eye. Figure 2(a) and 2(b) is the corresponding histogram image of the respective eye pictures. The variation between the two images has been clearly identified within the histograms. According to the differences the histograms has been calculated. It is difficult to find the differences in histogram values. Finally calibration process act on the calculated value. Here the neural network is employed to find the optimized solution. According to the calibration process eye closure estimation is performed. The maximum percentage for eye closure to estimate the sleepiness is 80% of eye was closed, by this value sleepiness were detected.

A. Related Work:

For detecting the driver fatigue several systems was introduced, some of the driver fatigue system used sensors to vigilance the driver health condition. It forced to inject the chips in the human body of the driver to analyze the body temperature and heart beat for detecting the unconsciousness.

Using the image processing techniques, the detection is based under the vision based [3]. In this system, it captures the driver's reaction through a video camera by exploiting the frames that are captured by the camera ,then the face reaction of the drivers were identified and the alerts were given. These reduce the cost of the system and injection of the chips in the human body is also avoided.

The system which is based on LDW, Lane departure warning [1] has emerged as a key tool for driver safety. In most common LDW system, a camera is mounted high up in the windshield, often as part of the rear view mirror mounting block. It captures a moving view of the road ahead. The digitized image is parsed as straight or dashed lines, lane markings. The driver supposed to be center the car between the two lines. As the car deviates and approaches or reaches the lane marking, the driver gets a warning: a visual alert plus either an audible tone, a vibration in the steering wheel, or a vibration in the seat. If the turn signal (indicator) is on, the sensor assumes that the driver is intentionally crossing over the lane, and there will be no alert. That is lane departure warning and finally they used the combination of all those three stage features to get better results for the system.

According to the facial reaction of the driver, the sleepiness was detected. The attribute is to grant some reactions before they get sleepiness. Those reactions were watched out through camera. The reactions like blinking their eyes consecutively for a specific time [2], sleepiness parameter estimated through yarning out of drowsiness, etc., monitor's these reactions and compares it with the existing state of the driver and gives the alert.

The driver fatigue is divided into S-R and T-R conditions [5], Sleep-Related and Task related respectively. S-R problem is detected by the Lane Departure Warning and the T-R is detected through the collision avoidance warning systems.

The vision based detection technique is executed with different algorithms for the efficient outputs. Eye state estimation by the histogram value [6], neural network technique accustomed realize the variations appeared within the pictures [7], eye glass removal algorithm is additionally been used for the drivers who are using spectacles [10].

III. PROPOSED SYSTEM

In proposed system the face and eye detection, eye image filtering, eye closure evaluation and drowsiness parameter estimation are modules.

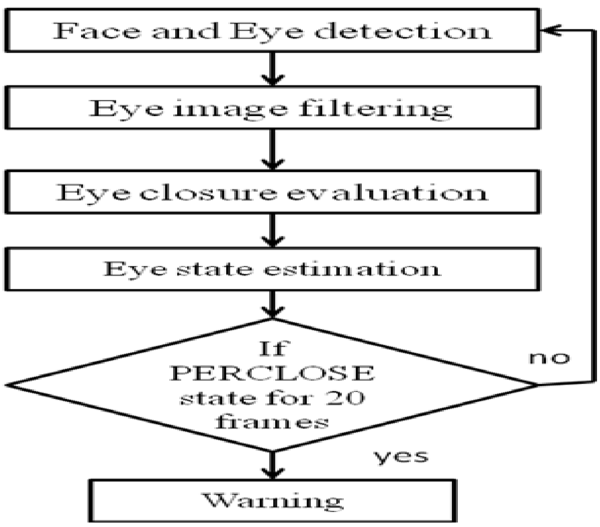

Figure 3:Overall System Architecture

The captured videos are extracted as a sequence of frames and provide the frames as input in one by one manner. For detecting the face and eyes, Viola and Jones algorithm is used [4]. It detects the face and eyes by using ROI (Region of Interest). The detected eyes were filtered by Kalman tracker. Kalman tracker is to remove the noise from the image. It filters the image and provides the localized eye image as an output. For eye closure estimation the system is about to calculate the standard deviation of the localized image. The values of the localized eye image standard deviation values were used to eye closure estimation by comparison method. The SVM classifier is employed to induce the better solution for eye closure evaluation. If the eye closure ranges cross the limitation of PERCLOS system, then the system automatically begin the warning alarm to alert the driver.

A. Face And Eye Detection:

At first, the video frames were extracted separately as an input data for the primary module. Here the frame is normalized to remove lighting, glared effect. Segmentation process is needed for partitioning the extremely contrasted areas and darkness by converting the image into binarisation. It provides the clear view of the frame, now the Viola and Jones algorithm applied on the frames [4].

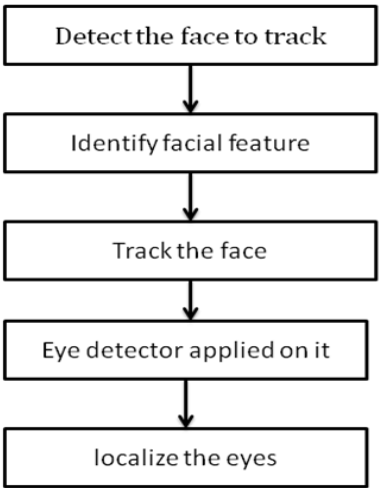

Figure 4: Face and Eye detection System Architecture

Detect the face by ROI applied on the frame, here the ROI is the facial feature like eyes, eyebrow, nose, lips, ears, etc., and it identifies them. By tracking the face again the system apply the ROI for eyes tracking. Finally the eye image has been filtered from the frame.

IV. CONCLUTION

In this paper, we have presented the survey of fatigue detection of the driver by eyes track using image processing technique. It have a tendency to use image process as a result, to cut back the value of the system. Here the Kalman tracker is proposed, for filtering the image in the face and eye detection module. It decreases the noises within the frames. IR camera is used in the system, so it can be also used in the night time. Adaptive algorithm in eye closure estimation gives the accurate result. The SVM classifier is used for the classification process to get accurate estimation. However, PERCLOS assessment needs a nominal eye closure value. This nominal value is dependent on the constraints of the driver's eye and the selected camera lens. since it is estimated in an initial automatic process, which makes this system flexible to be installed in any vehicle.

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