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Eye Tracking based Drowsiness Detection System, using Heart Rate Monitoring

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Abstract: This paper describes and eye tracking system for drowsiness detection of a driver. It is based on application of algorithm and percentage of eyelid closure. The system alerts the driver when he/she is in the drowsiness condition and crosses a pre-specified level. Driver fatigue become one of the main causes of traffic accidents. There are two main types of anti-fatigue driving system: the first one is to capture driver's face image by camera to predict the degree of drowsiness based on the change of the image. The second one is to predict the degree of drowsiness based on the driver's heart rates. This paper develops a system based on heart rate monitoring, which calculates pulse rate of driver by detecting electrocardiogram.

Keywords: Driver fatigue, Anti-fatigue driving system, Heart rate, Pulse rate sensor, Breaking system.

I. INTRODUCTION

Due to road accidents, every year thousands of people in India lost their lives. Most of these accidents are mainly caused by driver's drowsiness and its ratio is above 25 percent and up to 60 percent of road accidents result in death or serious injury. So a driver's drowsiness state is a major factor in severe road accidents that claim thousands of lives every year.

In this concept, it is very important to control the drowsiness of a driver. Among other approaches driver's fatigue level can be evaluated using the face analysis through several typical visual cause on human face.

As far as active safety system is concerned, there are two main type of anti-fatigue driving system. The first one is to capture driver's face image by camera to predict the degree of drowsiness based on the change of the image. The first system imposes a certain requirements on driver's sitting posture and angle due to the camera. Then there also has an important issue how to accurately determine the state of driver at night, and its dark environment such as tunnels. The second system needs to measure heart rate of driver and to install many electrocardiogram sensor that are directly contacted with skin of the driver.

II. PRESENT TECHNOLOGY

The detection is mainly based on the result of the face or eye detection or the pupil of the eyeball to determine whether the driver is in the fatigue condition or not. By previous studies assume that the driver does not wear the eyeglasses. However, the eye detection is easily detected by the eyeglasses and thus decrease the correct detection ratio.

With the latest wireless wearable devices such as biosensors, it is possible to find new ways to design a reliable driver drowsiness detection system.

A. Problem Definition

Drowsiness while driving has been a critical issue related transportation safety. A number of approaches has been developed to reduce the risk of drowsy drivers. The mechanism in detecting fatigue and sleepiness while driving has been categorized into 3 broad approaches, including vehicle based, Physiological-based, and behavior-based approaches. The system recognizing drowsy drivers based on their behavior. Particularly changes in eyes and facial characteristics and also address challenge in capturing aspects of natural expressions, driver responses, behavior, and task environment associated with sleepiness. 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.

III. PROPOSED WORK

Eye tracking system for drowsiness detection includes a camera module, simple alarm, and vibrator. The system performs real time processing of the input image stream so to compute the level of fatigue of the driver. The analysis is depended on calculating a number of frames of the data stream where the driver eyes are closed. Result of the processing is sent to the alarm which activates an alarm signal when the drowsiness index exceeds a pre-specified parameters. The system developed which is based on heart rate monitoring which calculates pulse rate.

A. System Configuration

The system is based on eye tracking system that means it works on web camera and also based on heart rate monitoring which means it is work by using heart beat sensor

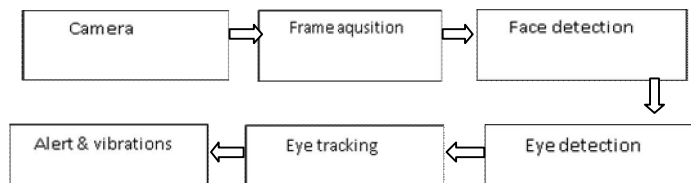
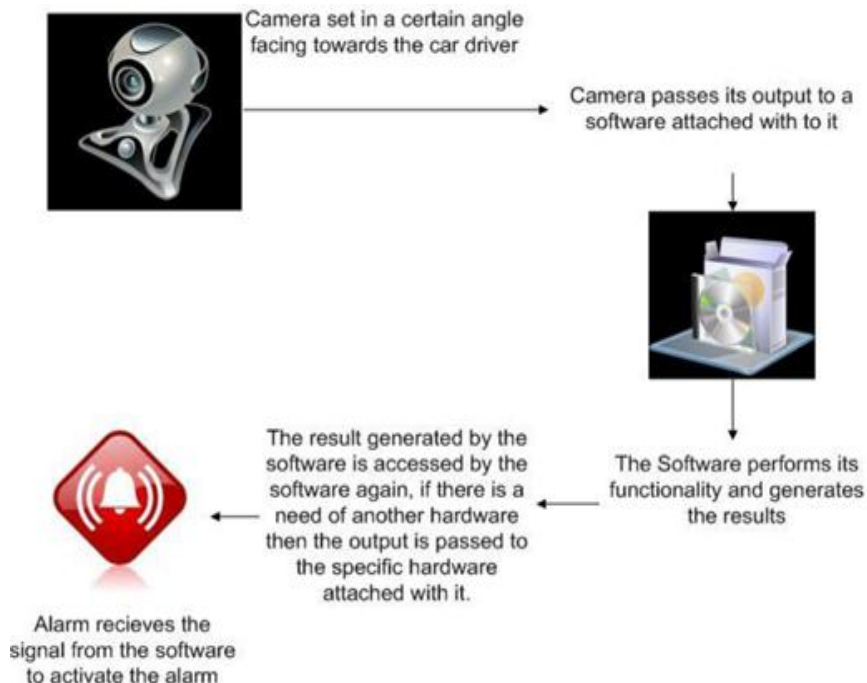


Fig. Block dig for drowsiness detection

B. Camera Module

The prototype eye tracking system for drowsiness detection includes camera module, heart rating monitoring, simple alarm. The system performs real time processing of the input image stream to compute the level of fatigue of the driver. The analysis is based on calculating a number of frames of the data stream where the driver’s eyes are closed. Result of the processing is sent to the alarm board, which activates an alarm signal when the drowsiness index exceeds a pre-specified parameter. In order to effectively capture the face, the webcam is placed on the vehicle dashboard at a standard distance from the driver’s face. The alarm board is installed in the car console closed to the driver. Webcam QHM 495LM is employed for image acquisition. The camera uses high-speed USB 2.0 and it is connected to the processor while supplying stream video with the resolution of 500k pixels processor converts the video signal, grabs every frame of input video and performs the required image processing so to determine in a real time the state of the driver’s eyes: open or closed.

Based on the number of frames where the eyes are opened or closed, the processor calculates the drowsiness index and transfers the result to the alarm board. The driver’s eyes rating is goes below from the standard eyes’ detection ratio then drowsiness will be detected and the system will be alert simultaneously vibrations will be generated.

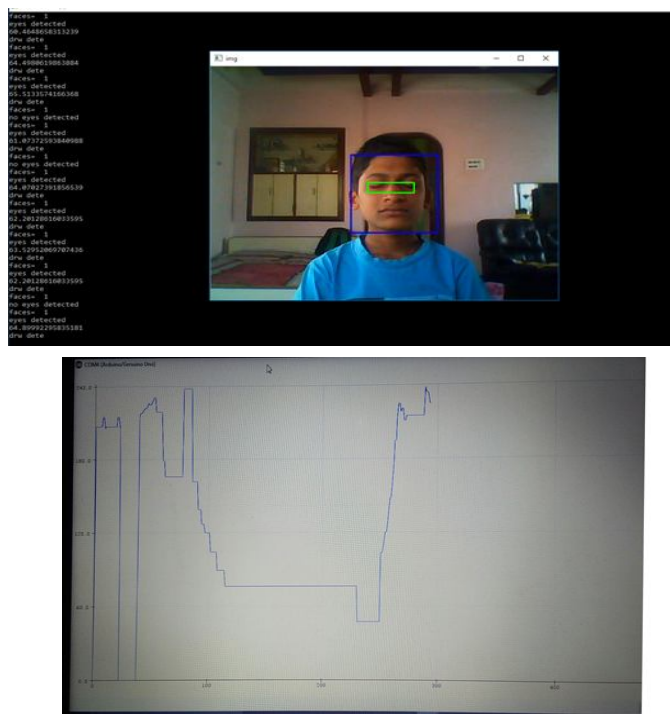


C. Heart Rate Monitoring

The heart beat pulses causes an emitted by the LED, if either reflect or transmits the light. Some part of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The amount of light absorbed based on the blood volume. The detector output is proportional to the heart beat rate and is in the form of electrical signal.



D. Results



IV. CONCLUSION

This paper proposes a method for estimating the relationship of drowsiness and the number of pulse rate based on heart rate data. The experiment results show that the pulse rate calculated from the heart rate data is basically consistent with the actual respiratory rate. In addition, using the pulse rate can more effectively infer the degree of drowsiness than using heart rate directly. Hence, it can be used for the development of a warning. Traffic accident system for driver fatigue. However, the accuracy of the system need to be improved and there also are some false negative points. Hence, in the future the authors intend to find a new characteristics value and method to improve the accuracy of the system.



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