Drowsy Driver Detection System

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***Abstract*—Thiselectronicdocumentisa "live" template. Driver fatigue is a significant factor in a large number of vehicle accidents. The development of technologies for detecting drowsiness at the wheel is a major challenge in the field of accident avoidance systems. Because of the hazard that drowsiness presents on the road, methods need to be developed for counteracting its affects. The main aim of this is to develop a drowsiness detection system by monitoring the eyes; it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident. Detection of fatigue involves the observation of eye movements and blink patterns. The analysis of face images is a popular research area with applications such as face recognition, and human identification security systems. This project is focused on the localization of the eyes, which involves looking at the entire image of the eye, and determining the position of the eyes, by a self-developed image-processing algorithm**.

IndexTerms— Driver Fatigue, Threshold, drowsy Driver, binarization, Eye blinking.(keywords)

I. INTRODUCTION

A Drowsy Driver Detection System uses a specially designed matlab based algorithm that points directly towards the driver's eyes in order to detect fatigue. In such a case when fatigue is detected, a warning signal is issued to alert the driver.

The algorithm developed is unique to any currently published papers, which was a primary objective of the project. The system deals with using information obtained for the binary version of the image to find the edges of the face, which narrows the area of where the eyes may exist. Once the face area is found, the eyes are found by computing the horizontal averages in the area.

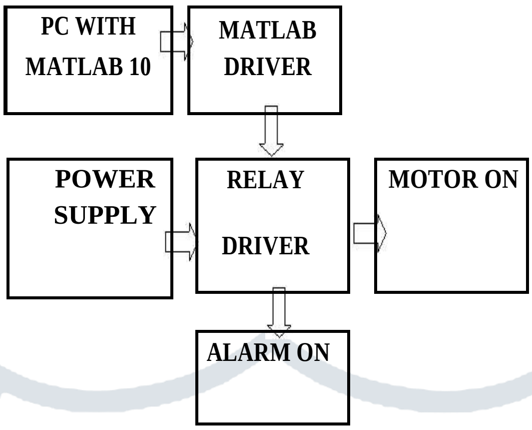
Taking into account the knowledge that eye regions in the face present great intensity changes, the eyes are located by finding the significant intensity changes in the face. Once the eyes are located, measuring the distances between the intensity changes in the eye area determine whether the eyes are open or closed. A large distance corresponds to eye closure. If the eyes are found closed the system draws the conclusion that the driver is falling asleep and issues a warning signal. The system works under reasonable lighting conditions.

To overcome the limitations of current drowsiness detection methods, this proposed research aims to develop a real-time, easy implementable, nonintrusive, and accurate drowsiness detection system.The term ―drowsiness‖ is used here to refer to the state of reduced alertness, usually accompanied by performance and psycho physiological changes, that may result in loss of alertness or being ―asleep at the wheel.‖ The term ―driver fatigue‖ is also widely used to describe this condition, especially on Police Accident Reports and in accident data files. Driver fatigue is a significant factor in a large number of vehicle accidents. Recent statistics estimate that annually 1,200 deaths and 76,000 injuries can be attributed to fatigue related crashes.

The development of technologies for detecting or preventing drowsiness at the wheel is a major challenge in the field of accident avoidance systems. Because of the hazard that drowsiness presents on the road, methods need to be developed for counteracting its affects. The aim of this is to develop a prototype drowsiness detection system. The focus will be placed on designing a system that will accurately monitor the open or closed state of the driver's eyes in real-time. By monitoring the eyes, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident.

2. Proposed Work
2.1. Block diagram

Fig.2.1. Block Diagram of System



In this system whether the eye is open or closed output by using matlab coding given to matlab driver .Then the signals(USB to Serial port) are given to the relay that control the speed of car and ringing the alarm when eye get closed.

The system hardware is to be designed in such a way that it should process the signals from the software generated program and produce the desired output. It should contain a mechanism for processing the output from the software and work out for the decision that is to make the user aware of the drowsiness and possibly raise an alarm. We would need a serial port connector to connect the software part to the hardware kit. We need to design separate power supply for the working of onboard mechanism. We need a set of mat lab drivers on the kit for processing the signal from software to hardware and also the mechanism to work out the signal to a follow up procedure that is rising up an alarm or other mechanisms.

2.2. Flow Chart:

By using algorithm user can find the whether the drowsy detection is done or not. In algorithm system first take the image where it is stored, then Binarization of image take place. Find out position of eye, whether Eye open or closed. If Open Eye Image is detected then signal gets no drowsy found, Alarm is OFF. If Closed Eye Image is detected then signal gets drowsy found, Alarm is ON.

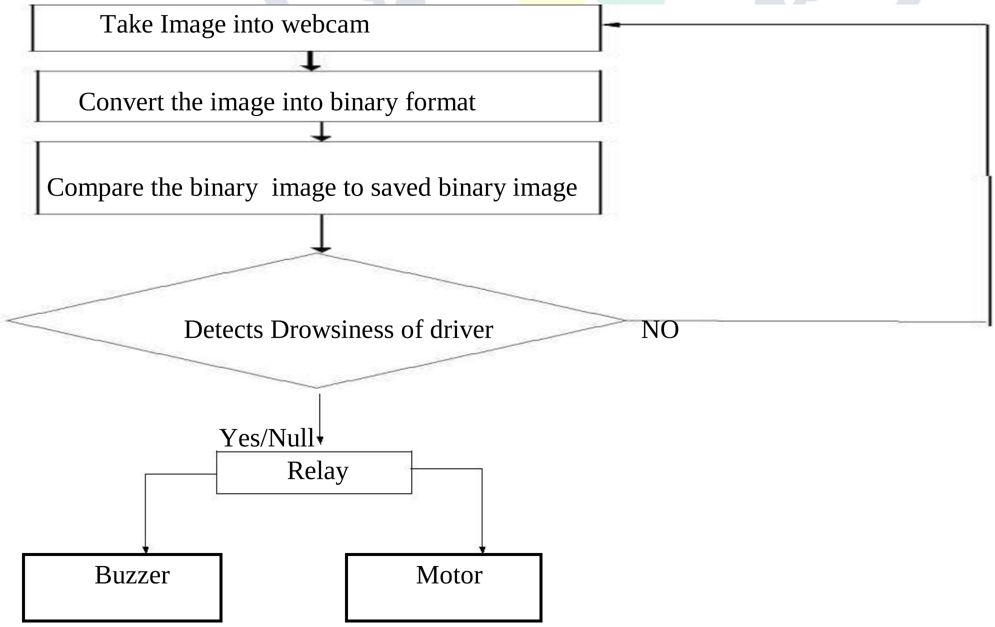


Fig.2.2.Flow Chart of Drowsy Driver system

2.3 Flow of Hardware:

This circuit is designed to control the load. The load may be motor or any other load. The load is turned ON and OFF through relay. The relay ON and OFF is controlled by the pair of switching transistors (BC 547). The relay is connected in the Q2 transistor collector terminal. A Relay is nothing but electromagnetic switching device which consists of three pins. They are

Common, Normally close (NC) and normally open (NO).The relay common pin is connected to supply voltage. The normally open (NO) pin connected to load.

When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero signals is given to base of the Q2 transistor. So the relay is turned OFF state.

When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of Q2 transistor so the transistor is conducting and relay is turned ON. Hence the common terminal and NO terminal of relay are shorted. Now load gets the supply voltage through relay.

This topic aims to present our design of the Drowsy Driver Detection System. Each design decision will be presented and rationalized, and sufficient detail will be given to allow the reader to examine each element in its entirety.

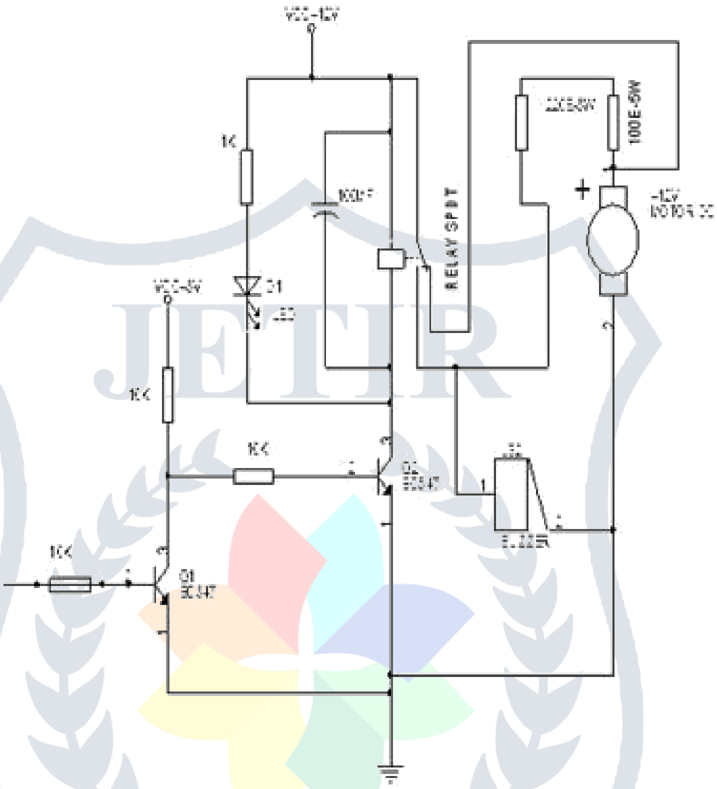


Fig.2.3. Circuit diagram of buzzer and relay

2.4 Flow of Software 2.4.1System Operation:

The drowsy detection system that is designed has following major steps of operation.

I. Binarization and Eye detection

II. Drowsiness Detection Function.

2.4.2 Binarization:

Binarization is converting the image to a binary image.

A binary image is an image in which each pixel assumes the value of only two discrete values. In this case the values are 0 and 1, 0 representing black and 1 representing white.This process is done for the left and right side of the face separately, and then the found eye areas of the left and right side are compared to check whether the eyes are found correctly. Calculating the left side means taking the averages from the left edge to the center of the face, and similarly for the right side of the face. With the binary image it is easy to distinguish objects from the background. The gray scale image is converting to a binary image via thresholding.

Original frame Gray frame binary image

Fig.2.4. Original Image,Gray scale image & Binary Image

The output binary image has values of 0 (black) for all pixels in the original image with luminance less than level and 1 (white) for all other pixels. Thresholds are often determined based on surrounding lighting conditions, and the complexion of the driver. The criteria used in choosing the correct threshold was based on the idea that the binary image of the driver's face should be majority white, allowing a few black blobs from the eyes.

2.4.3 Eye Detection Function

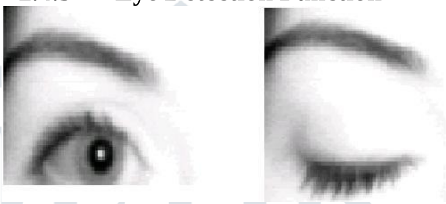


Fig.2.5.Open& Closed Eye

After inputting a facial image, pre-processing is first performed by binarizing the image. Moving down from the top of the face, horizontal averages (average intensity value for each y coordinate) of the face area are calculated. Large changes in the averages are used to define the eye area. The following explains the eye detection procedure in the order of the processing operations. All images were generating in Mat lab using the image processing toolbox.

2.4.4 Threshold Detection

Thresholds are often determined based surrounding lighting conditions, and the complexion of the driver. The criteria used in choosing the correct threshold was based on the idea that the binary image of the driver's face should be majority white, allowing a few black blobs from the eyes.

2.4.5 Judging Drowsiness

Criteria for judging the alertness level on the basis of eye closure count is based on the amount of intensity levels of the image. The binaryized values are thoroughly analyzed and synthesized by the algorithm and detected if the driver eye caught in the image is an open eye or closed eye. Thus if the eye is open the hardware produces no effect but when the driver's closed eye is detected the corresponding signal goes high producing an alarm which wakes up the driver.

3. Experimental Results

The function of code area is to implement correct algorithm for finding whether the eye is open or closed and give the corresponding signal if eye is closed or open. It consists of the determination of eye position or the state of eyes followed by the removal of noise factors of the picture by implementing image processing functions and finally judges the drowsiness of the driver.

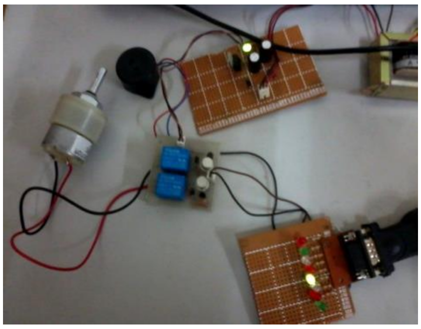


Fig.3.1. Hardware circuitry

The state of the eyes (whether it is open or closed) is determined by distance between the first two intensity changes found in the above step. When the eyes are closed, the distance between the y – coordinates of the intensity changes is larger if compared to when the eyes are open. Criteria for judging the alertness level on the basis of eye closure count is based on the amount of intensity levels of the image.

The binaries values are thoroughly analyzed and synthesized by the algorithm and detected if the driver eye caught in the image is an open eye or closed eye. Thus if the eye is open the hardware produces no effect but when the driver's closed eye is detected the corresponding signal goes high producing an alarm which wakes up the driver.

3.1 Conclusion and Future scope

A non-invasive system to localize the eyes and monitor fatigue was developed. Information about the eyes position is obtained through various self-developed image processing algorithms.

During the monitoring, the system is able to decide if the eyes are opened or closed. When the eyes have been closed for too long, a warning signal is issued. In addition, during monitoring, the system is able to automatically detect any eye localizing error that might have occurred.

In case of this type of error, the system is able to recover and properly localize the eyes. The following conclusions were made:

- Image processing achieves highly accurate and reliable detection of drowsiness.
- Image processing offers a non-invasive approach to detecting drowsiness without the annoyance and interference.
- A drowsiness detection system developed around the principle of image processing judges the driver's alertness level on the basis of continuous eye closures.

With 80% accuracy, it is obvious that there are limitations to the system.

3.2 Future Scope:

This technology is still in the early research stage of development. Based on the work completed thus far, researchers at GWU have identified and recommended the following areas for further research:

- Capture individual driver's steering activity while drowsy,
- Conduct additional simulator experiments to validate the algorithm, test additional road conditions, and test a more diversified group of drivers,
- Test the ANN technology on the road in an instrumented vehicle, and refine the

Algorithm based on the road test data, and Conduct research on warning systems integrated with the detection system.

In future work, we will incorporate motion capture and EEG facilities to our experimental setup. The motion capture system will enable analyzing the upper torso movements. In addition the EEG will provide a ground-truth for drowsiness.

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