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EYE TRACKING BASED DRIVER DROWSINESS MONITORING AND WARNING SYSTEM

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***Abstract*- This project represents a way of developing an interface to detect driver drowsiness based on continuously monitoring eyes and DIP algorithms. Micro sleeps that are short period of sleeps lasting 2 to 3 seconds are good indicator of fatigue state. Thus by continuously monitoring the eyes of the driver by using camera one can detect the sleepy state of driver and timely warning is issued.**

Aim of the project is to develop the hardware which is very advanced product related to driver safety on the roads using controller and image processing. This product detects driver drowsiness and gives warning in form of alarm and as well as decreases the speed of vehicle.Along with the drowsiness detection process there is continuous monitoring of the distance done by the Ultrasonic sensor. The ultrasonic sensor detects the obstacle and accordingly warns the driver as well as decreases speed of vehicle.

Keywords—drowsiness, image processing, ultrasonic sensor, detection, camera, speed.

I. INTRODUCTION

A. Concept of Driver Drowsiness Detection System

The main idea behind this project is to develop a non-intrusive system which can detect drowsiness of the driver and issue a timely warning. An accident involving driver drowsiness has a high fatality rate because the perception, recognition, and vehicle control abilities reduces sharply while falling asleep. Driver drowsiness detection technologies can reduce the risk of a catastrophic accident by warning the driver of his/her drowsiness. The development of technologies for preventing drowsiness at the wheel is a major challenge in the field of accident avoidance systems. Preventing drowsiness during driving requires a method for accurately detecting a decline in driver alertness and a method for alerting and refreshing the driver. Micro sleeps that are short period of sleeps lasting 2 to 3 seconds are good indicator of fatigue state. Thus by constantlyobserving the eyes of the driver one can detect the sleepy state of driver early enough to avoid accident.

The current project is a prototype of the model that can be proposed or built to detect the drowsiness of the driver and save the life of the driver. The components used in the project are microcontroller Atmega AT89S52 which plays the vital role in the functioning of the project, the other components are L293D the motor driver IC used to drive the DC motor, DC motor used as a vehicle, MAX 232 IC is used to convert the voltage levels to TTL and vice versa. The camera is being utilized to capture the images of the driver's eye to detect the state of drowsiness. For powering up the whole system we are using transformer based regulated supply.

B. Motivation

Drowsiness is one of the main issues in road accidents. The fatality rate due drowsiness is higher. An accident involving driver drowsiness has a high fatality rate because the observation, acknowledgement and vehicle control abilities reduce sharply while falling asleep. The growing number of accident fatalities in world in recent years has become a problem of serious concern for the society, so accidents must be prevented before they happen and this thing lies with the driver. Accidents usually lead both economic as well as social loss to the society. If accidents are prevented we can save many lives and along with that the environment is also preserved. The earlier systems used were costly and heavy. Preventing accidents caused by drowsiness requires a technique for detecting sleepiness in a driver and a technique for arousing the driver from that sleepy condition. The project describes a system that uses an image processing technique to recognize the open or closed state of the driver's eyes as a way of detecting drowsiness at the wheel. The electrodes that were attached to the body of the driver were both annoying and tiring for the driver. The driver was also unable to concentrate on driving due to this. Along with that electrodes needed time to time replacement. The other systems that were implemented to detect the drowsiness of the driver used GSR, ECG, EMG. These also needed the attachment of the sensors to the body of the driver. Thus detecting drowsiness and alerting the driver helps in preventing accidents and lives can be saved.

C. Objective

We are searching for a system which will automatically detect drowsiness based on driver's performance. Current systems used to detect drowsiness are slow and consume more time to give the output and warn the driver accordingly. The systems utilized are also very costly and are implemented only in high class or very expensive vehicles. Due to which the normal vehicles lack such systems and even the safety is low. This project aims at building a safety system for vehicles which can be implemented and build at low cost. This will in turn provide both security as well as protection to the vehicle as well as the driver driving the vehicle. If such systems come into existence lots of lives can be saved.

II. CURRENT SYSTEMS USED IN DROWSINESS DETECTION

A. Vision- Based Visual Cues Extraction

Fatigue monitoring starts with extracting visual parameters typically characterizing a person's level of vigilance. This is accomplished via a vision system in computer. In current section, we discuss the computer vision

system we developed to achieve this goal. Figure below provides an overview of our visual cues extraction system for driver fatigue monitoring. The system consists of two cameras: one wide angle camera focusing on the face and another narrow angle camera focusing on the eyes. The wide angles camera monitors head movement and facial expression while the narrow angle camera monitors eyelid and gaze movements.

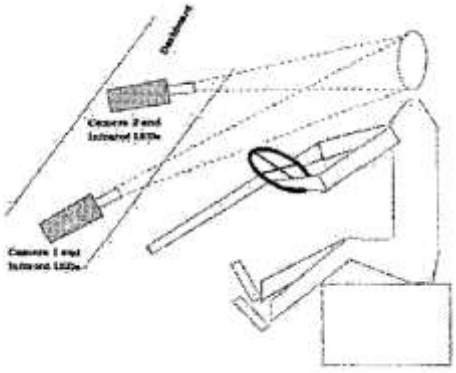

Fig. Vision based visual cues extraction

B. Controller Based Drowsiness Detection

The proposed integrated system architecture is depicted in below figure. As seen the driver monitoring system outputs are used as an input for the controller and the control commands are augmented with driver's commands for the vehicle control in adverse conditions. A diagnosis system constantly decides based on the risk level given by the driver monitoring system, the vehicle and the controller conditions. Using these three information channels, the diagnosis system can activate or deactivate the controllers according to the particular situation. In the following sub-sections, monitoring and controller systems are detailed. The diagnosis system structure requires several controllers and scenarios to be considered in a more extensive way. Therefore, in this case study, the augmentation of the controller and driver for controlling the vehicle and the role of the monitoring system are the focus. The system is a specific solution for accident avoidance in the case of drowsiness/sleepiness with the assist of an adaptive robust lateral controller with speed regulation as an auxiliary system.

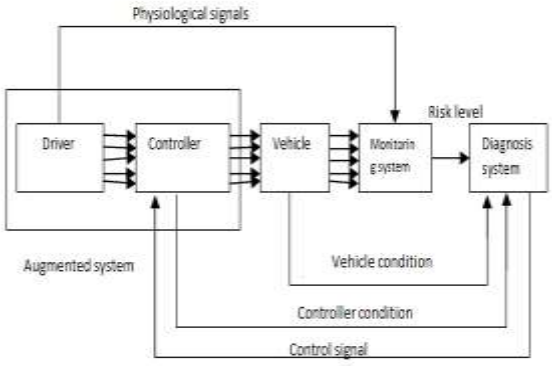

Fig. Controller based drowsiness detection system

C. Detecting The Physiological Response Of Driver

In this method the driver drowsiness is monitored by planting various sensors on the driver's body. The sensors used are EKG (Electrocardiogram), GSR (Galvanic Skin Response), and EMG (Electromyogram). The outputs received from these sensors are used in deciding the alertness of the driver. All these sensors are to be continuously attached to the body of driver. The main drawback of this system is the aging of the sensor response.

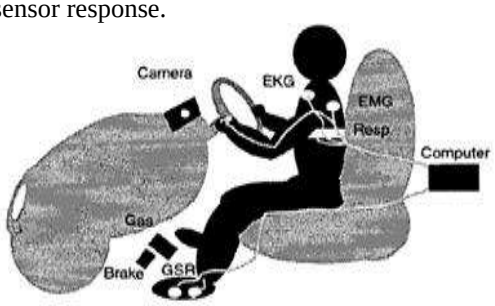

Fig. Sensors measuring the physical response

III. EYE TRACKING BASED DRIVER DROWSINESS MONITORING AND WARNING SYSTEM

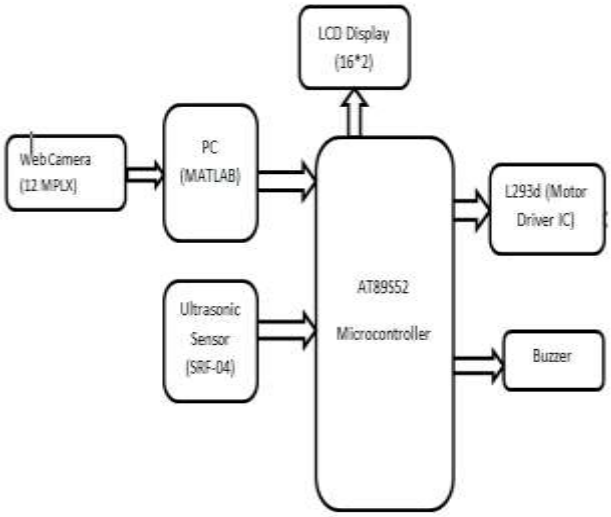

Fig. Block diagram of overall system

The above figure shows the block diagram of the overall project. The images taken from the camera are provided to the PC unit for processing. The result from the PC unit is displayed on the display screen. The ultrasonic sensor keeps monitoring the distance and along if obstacle detected it alerts the driver. Thus this is a safety system which helps in preventing accident.

IV. FUNCTIONALITY OF COMPONENTS

A. Operations

All the system and hardware components are initialized. We take the video input via camera and the GUI input data is given to the system. Eyes of the driver are continuously scanned. If found drowsy the alarm system is activated and the speed of the vehicle is gradually reduced. The driver manually stops the alarm and the same process is carried further. Along with the drowsiness detection process there is continuous

monitoring of the distance done by the Ultrasonic sensor. The ultrasonic sensor detects the obstacle and accordingly warns the driver.

B. Software Input

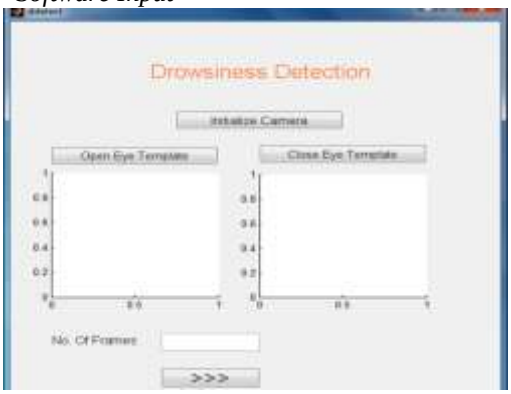

Fig. GUI used to take the input via camera

Using MATLAB graphical user interface is created. Graphical user interface enables us to create an interface between the hardware and software. It consists of various push buttons like open eye template, close eye template, initialize camera. It also consist of the edit button to edit the number of frames. With the help of handle we can move from one object to another within that GUI.

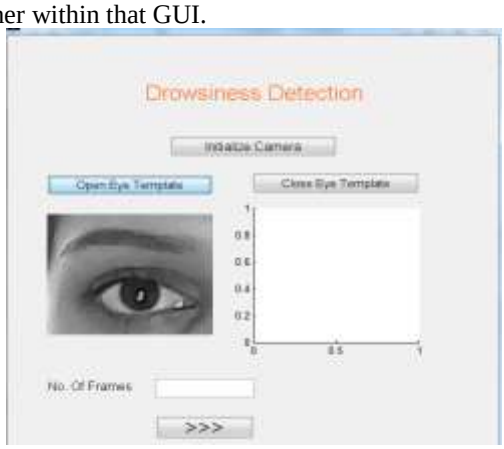

Fig. Open eye template input

Continuously eyes are scanned by the camera and video preview is taken after the camera is initialized. After clicking the pushbutton of open eye template camera takes the preview and image is cropped later to fit into the axes of open eye template.

Fig. Close eye template

Continuously eyes are scanned by the camera and video preview is taken after the camera is initialized. After clicking the pushbutton of close eye template camera takes the preview and image is cropped later to fit into the axes of close eye template.

C. Software Output

Fig. Driver is found to be drowsy

Continuous scanning of eyes is done to check whether the driver is drowsy or not. And this is decided by the open eye and close template. For a given number of iterations if consequently three frames of close eye template are found by the system, the driver is said to be drowsy. Command window in MATLAB displays the number of iterations been carried out and display 'Drowsy' if found drowsy.

D. Hardware Input

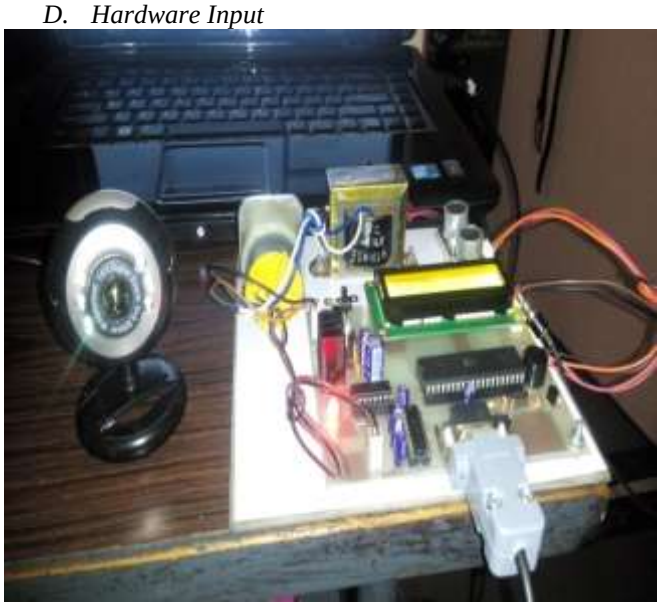

Fig. Hardware input

When the power supply is provided to the hardware the LCD, DC Motor and buzzer are powered on.

E. Hardware Outputs

Fig. No obstacle detected

If no obstacle is detected by the ultrasonic sensor LCD displays the message "No Obstacle". Hence alarm system is also not activated and DC motor continues to rotate with the same speed, i.e. its speed does not change.

Fig. Obstacle detected

If obstacle is detected by the ultrasonic sensor, LCD displays the message "Obstacle detect" as the distance at which the obstacle is detected is below the threshold value given in the program and also displays the distance of the obstacle detected. Along with the LCD display, driver is alerted in the form of alarm and the speed of DC motor is reduced gradually.

Fig. Obstacle detected at greater distance than the desired distance

As the distance at which the obstacle is detected is above the threshold value, which is given in program, LCD does not display the message "Obstacle detected" and hence alarm system is not activated. Speed of DC motor is not changed it continues to rotate at the same speed. But at what distance the obstacle is detected by the ultrasonic sensor is displayed on the LCD display.

F. Results

The results given by the system are more accurate and the output is given within 6to7 seconds and the accuracy is greater as compared to other processes.

G. Comparison Between Different Techniques

As mentioned above we have seen that many of the methods are being implemented to detect the drowsiness and the level of fatigue in the driver. The technique bears results which are very much effective. In the detecting the physiological response of driver method wherein we use ECG, EKG to detect the drowsiness of the driver in this scenario we come to know that various instruments are mounted in the vehicle as well as on the drivers body. This method tires the driver to a greater extend because the driver has to be seated in a constant position for the duration he drives the vehicle. In case if any accident is caused it therefore becomes very risky for the driver. In such cases the driver may even lose his life. In the vision based system the cameras are mounted on the dashboard which continuously keeps on scanning the face and produce the results as programmed. The system consists of two cameras: one wide angle camera focusing on the face and another narrow angle camera focusing on the eyes. The wide angles camera monitors head movement and facial expression while the narrow angle camera monitors eyelid and gaze movements. This method also produces very positive result. Thus the response produced by all the systems is not accurate therefore it is very much necessary to bring into picture such a system which will help in detecting drowsiness at faster rate and produce efficient results. This will in return help in saving the driver's life.The development of technologies for

preventing drowsiness at the wheel is a major challenge in the field of accident avoiding systems. Drowsiness prevention during driving requires a method for accurately detecting a decline in driver's alertness and a method for alerting and informing the driver. As compared to all the above methods the outputs given by the "Eye Tracking Based Driver Drowsiness Monitoring and Warning System" yields better results and time taken is also very less. The efficiency and accuracy of the model is greater as it takes very less time to give the output. The output is produced within few couple of seconds.

V. ADVANTAGES AND APPLICATIONS

A. *Advantages*

- Component establishes interface with other drivers very easily.
- Life of the driver can be saved by alerting him using the alarm system.
- Speed of the vehicle can be controlled by controlling the fuel supply of the car.
- Ultrasonic sensors are utilized for monitoring the distance and alerting the driver accordingly.
- Traffic management can be maintained by reducing accidents.
- Practically applicable.

B. *Applications*

- Can be used in vehicles to detect drowsiness.
  The drowsiness detection system can be used to detect the drowsy state of the driver. If found drowsy the alarm system gets activated and the driver is alerted. In the same way the ultrasonic sensor keeps on monitoring the distance and if the distance between the vehicle and obstacle detected is less the warning is given to the driver.
- It can be implemented in factories to keep a check on the machine operator.
  In factories such systems can be used to keep a check on the machine operator.
  This system can also be used for the safety of the machine operator.
- Can be used in railway engines for the safety of the driver.
  The railway drivers mostly have to travel long distance. This system can be used to alert the driver of the drowsy state. And the ultrasonic sensor warns them about the obstacles on the track.
- Also it can be used for military purpose.

VI. CONCLUSION

- A non-intrusive method of drowsiness detection is possible.
- Same method may be applied to detection of fatigue or other related driver performance.
- By monitoring the eyes using camera and using this new algorithm we can detect symptoms of driver fatigue early enough to avoid an accident.
- So this project will be helpful in detecting driver fatigue in advance and will gave a warning output in form of sound.
- Also an ultrasonic sensor which continuously monitors the distance helps in avoiding accidents.

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