Smart Breaking System for Automobiles: Accident Avoidance

Rahul Dhod

Academic & Consultancy Division, Centre for Development of Advanced Computing (C-DAC), A Scientific society of the Ministry of Communication & Information Technology, Government of India, Mohali, India

ABSTRACT: This paper describes a prototype model for automatic braking system based on detecting the head movement and eye blink of the driver. As most of the road accidents occur due to the reduced driver's vigilance level and fatigue because of hours of continuous driving. Thereby, in this paper we are describing an automatic emergency braking system considering head movement and eye blink as the foremost basis through which we can greatly control the ever increasing road accidents. A GSM module has also incorporated in this prototype in case of accident occur, it capable to send a SOS message to a family member in critical situations and GSM for location tracking of vehicle.

KEYWORD: Accident Avoidance, Tracking system, sensor network.

I. INTRODUCTION

Detection of driver's alertness level is not as simple; it includes monitoring of various physiological characteristics, driver operation and vehicle response. Thus it is necessary to actively monitor all these for having a secure and safe drive. While driving head movement and eye blink timing are the two things that plays an important role and can be monitored easily from avoiding accidents this paper deals with developing such system so that in case of any dangerous condition the vehicle alerts the driver and automatically applies emergency brakes to the vehicle. As it is commonly seen that when a driver falls asleep while driving then position of his head plays an important role in determining any insecure situation and can therefore alert the driver to take control of the steering. Thus if such a system could be devised that monitors the position of driver's head continuously, it can greatly help in diminishing the accidents frequency. Another factor in this regard is eye blink, normally we blink 15-20 times in a minute but when a person falls asleep then this time of blinking diminishes than the normal. Thus if we monitor the eye blink of the driver it will really prove an effective tool to reduce the road accidents. Hence these methods when combined together could prove an effective step in the direction of accident prevention.

II. PREVIOUS WORK

Many research works were carried out in the area of automatic breaking system. Some of them are briefly explained below.

Chinmaya and Raul suggested a unique of decoupling feature in frictional disk brake mechanisms, derived through kinematic analysis, enables modularised design of an Anti-lock Braking System (ABS) into a sliding mode system that specifies reference brake torque and a tracking brake actuator controller. Modelling of the brake actuation, vehicle dynamics, and control design are described for a scaled vehicle system. The overall control scheme is evaluated by hardware-in-the loop testing of the electromechanical brake system.

Chen et al [7] took up the traditional purely hydraulic braking pedal features the research object. The brake pedal control model of the regenerative braking integrated system is established by using trajectory tracking control strategy. The simulation results showed that, the model can achieve a predetermined vehicle brake pedal feel, and get the brake demand and pedal feel demand by the resolving the brake pedal state motion. The research also provides a theoretical basis for the design of regeneration brake pedal system for the electric vehicle and hybrid vehicle.

Lie and Sung [8] investigated the braking performance and safety for a bicycle riding on a straight and inclined path. The equations of motion for a wheel model as well as for the ideal synchronous braking are derived to acquire the shortest braking distance to improve the riding stability. The optimal design of the bicycle braking is obtained based on the simulation results with various bicycle geometries, ratios of brake force, and road friction.

III.   WORKING CONCEPT

Sleep drive accidents are the most severe and fatal one as the driver is in no position to take control of Any insecure condition .Thus there are more chances of colliding with any other object or Vehicle and might lead to fatal accidents. Daily newspapers are deluged with news regarding road accidents and most of them take place due to driver's in-alertness and this concept will definitely play a significant role in limiting the road accidents. The Methods used in this accident avoider system include the following two methods that are described below.

IV.   HEAD MOVEMENT DETECTION

In this paper we are describing the head movement detection through the use of an accelerometer ADXL330, which measures the tilt angle of the head and then sends an alarming signal to the driver prior to any insecure situation. Its main objective is to monitor the tilt angle of the head and then alerting the person by giving some buzzer or beep. If no action taken by the person then it will automatically apply emergency brakes to the vehicle. An accelerometer is a three -axis accelerometer that measures the head movements in three axis i.e. x, y and z. It converts the acceleration into electrical signal and can measure both static and dynamic acceleration and its output may be digital as well as analog. Here the z axis can be combined with the other remaining axes to maintain better accuracy, precision and stability through 360 degrees. The x and y axes posses the sine functions whereas z axis has cosine function. It senses the tilt angle continuously and when there is a change in the predefined sets of angles, it will send the signal to the alarm. When no response is received from the person then it applies brakes automatically to the vehicle. This can be implemented on a cap that the driver has to wear during driving and therefore it will keep tracking the head movements. In this manner it helps in avoiding the accidents.
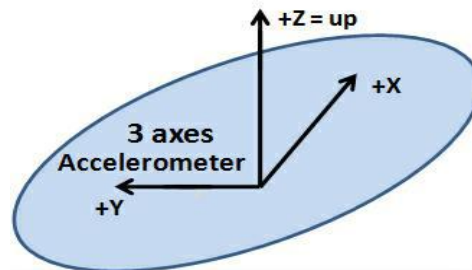

Fig: 1. Three- axes Accelerometer

In this project we use two circuits. One is transmitter and second is receiver circuit. In the transmitter circuit we use 3 Axis accelerometer base circuits and on the receiver end we use a micro-controller with LCD that gives command to the motor. In the transmitter circuit we measure the value of 3 axis accelerometer and converted into digital with the help of ADC 0809. ADC converts the data from sensor and proceeds to the microcontroller for further conversion. Microcontroller gets the hex data from the accelerometer and converted into ASCII code for LCD display. LCD display the X—Y—Z values and display the values on the LCD. At the same time microcontroller gets the data and compare inside with pre-defined variables. As we change the position of head, values are change automatically and when these change values exceed the predefined values then buzzer raises the alarm. We use the readings of accelerometer for head movement detection.

V.   EYE-BLINK DETECTION

The fatigue level of the driver can be effectively monitored by detecting the eye-blink, as the eye-blink frequency increases in case of fatigued condition than the normal and micro-sleep that lasts for 3-4 sec can serve as an indicator of any insecure condition. However, it is quiet difficult to measure it accurately. Here we are using an IR sensor that will monitor the blinking status. It has a transmitter as well as receiver that will receive the reflection from the eye when light falls on it. There is some intensity of light for every person's eye when it gets reflected from the eye and based on this concept we use the change in this intensity as it will change when the person might fall asleep. A timer is used with it to measure the time of eye blink, when the time exceeds than the normal it will give a signal to raise the alarm and in case of no response from the person it will automatically brake the vehicle. This system can be implemented on a pair

of goggles or spectacles that would more effectively sense the eye movement. Further developments in this direction can contribute to easy and reliable monitoring of the driver's eyes. If such systems are implemented in the vehicles, it will lead to safe drive and saving many lives We are giving 9V supply either using a step-down transformer or through a battery followed by a voltage regulator IC7805 supplying regulated 5V to the micro-controller and ADC. The accelerometer and eye-blink sensor are interfaced with the ADC that converts the analog signals to digital form so that they could be processed by the micro-controller. It gives the control signals to the motor in case of any changes in the head movement and eye-blink from the predefined values. A 16X2 LCD display is interfaced with the micro-controller that displays the changed values. Buzzer is interfaced with the controller that alerts the driver by giving an alarm as soon as it detects any change. The circuit diagram of the project is shown below followed by the project model.
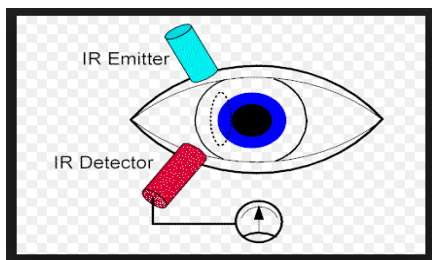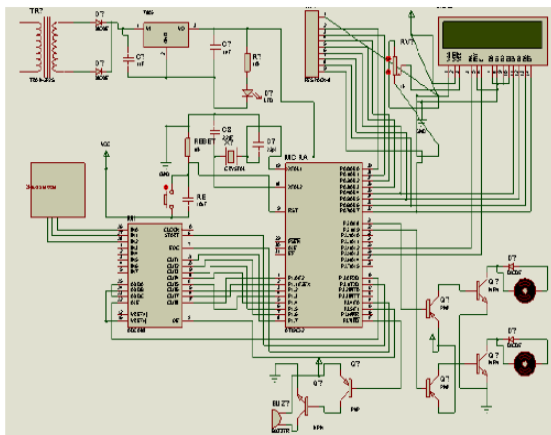

. **Fig: 2.** Eye detection using IR Sensor

Fig: 4. Project model

Fig: 3. Circuit Diagram
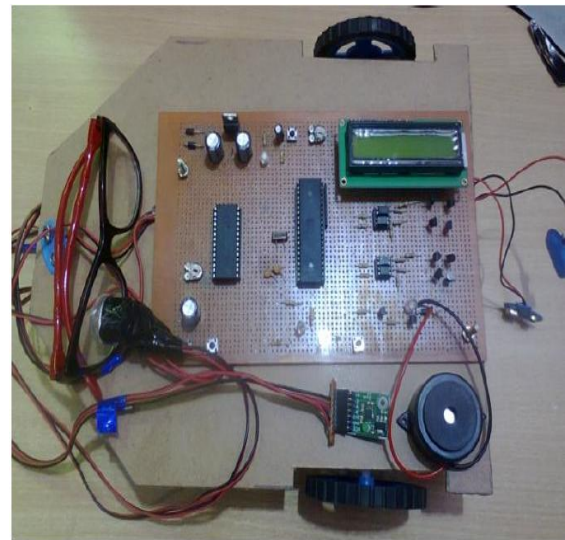
VI. COMPONENTS

IR sensor for eye-blink detection*:* Infrared light basically an electromagnetic radiation which has more wavelength than of visible light, it has frequency range from 1 to 400 THZ. Infrared used in this project is of 950nm emitting diode in GaAs technology melded in a blue gray tinted plastic package. It has peak wavelength of 950nm and high reliability. It also has good spectral matching with Si photo detectors.

Fig: 5.IR Technology

ATMEL (AT89S52): The AT89S52 belongs to 8051 family which has low power idle and power down mode, and high performance device and it works at crystal frequency from 0Hz to 33MHz and executes powerful instruction in single clock cycle. It has 8K Bytes of ISP Flash Memory. It has 256 bytes RAM and 32 I/O programmable I/O lines, Low power idle and power down modes, full duplex UART serial channel, it has also watchdog timer, power off flag, two 16 bit timer/counters.

GPS Technology: The Global Positioning System is a satellite based navigation system that can be used to track longitude and latitude. It utilizes a constellation of 24/32 active satellites orbiting the earth that transmit an accurate microwave signal. A GPS receiver requires at least three or four satellites to calculate the distance and direction as shown in Figure 3. It can calculate two dimensions, that is latitude and longitude or three dimensions that is latitude, longitude, and altitude positions.

Fig: 6. GSM module

GSM Technology: GSM stands for Global System for Mobile Communication and is an open, cellular technology used for transmitting mobile data services or voice calls. GSM modem as shown in figure 4 is a device which acts as a mobile phone and it accepts any network operator and SIMcard with its own unique phone number. This SIM900AGSM modem can be used for communication and developing embedded applications for SMS based communications, for example, to send and receive message and for voice calls. GSM systems use radio frequencies between 890-915 MHz for receiving and between 935-960 MHz for transmitting.

Fig: 7. GPS module

VII.   FUTURE SCOPE

  i.   There is possibility of using 3-D image processing technique.
 ii.   Ultrasonic detector can be used to detect any object in the path that would greatly help in avoiding collision in case if the driver is not in conscious state.
iii.   Alcohol sensor can also be used to detect if the person is drunk driving.

VIII. CONCLUSION

Eye-blink and head movement based braking system can prove a concrete step in the direction of accident prevention. It is the future of controlling the device with greater comfort and ease. Artificial intelligence and many other research and new technologies can give a new dimension to it. Further development and innovation is required in this field to make this system more promising and safe for the driver.

REFERENCES

[1] N. G. Narole, G. H. Raisoni, P. R. Bajaj, G. H. Raisoni, A Neuro-Genetic System Design for Monitoring Driver's Fatigue, IJCSNS International Journal of Computer Science and Network Security, 9(3), 2009.

[2] Qiang Ji, Zhiwei Zhu, Peilin Lan, Real-Time Non- intrusive Monitoring and Prediction of Driver Fatigue, IEEE Transactions On Vehicular Technology, 53(4), 2004.

[3] Boston University Computer Science Technical Report No.2005-12 Real Time Eye Tracking and Blink Detection with USB Cameras Michael Chau and Margrit Betke, Computer Science Department Boston University Boston, MA 02215, USA, 2005

[4] R. S. Parsai, P. R. Bajaj, Intelligent Monitoring System for Driver's Alertness (A vision based approach), 2007.

[5] S. Singh, Papanikolopoulos, "Monitoring Driver Fatigue Using Facial Analysis Techniques", IEEE Intelligent Transport System, pp. 314- 318, 1999.

[6] X. Fan, B. Yin, Y. Fun. Yawning Detection For Monitoring Driver Fatigue, 6th International Conf. on Machine Learning and Cybernetics, Hong Kong, 664-668, 2007,.

[7] Atmel Corporation "Atmel AT89s52 data sheet". Available at hyperlink:*http://www.atmel.com/images/doc1919.pdf.*

[8] Ublox 7GPS "global positioning system data sheet". Available at hyperlink: http://cdn.sparkfun.com/datasheets/Sensors/GPS/760.pdf.

[9] Simcom900 "GSM modem data sheet". Available at hyperlink:http://www.propox.com/download/docs/SIM900.pdf.