BEST: International Journal of Management, Information Technology and Engineering (BEST: IJMITE)
ISSN 2348-0513
Vol. 2, Issue 6, Jun 2014, 27-34

EMBEDDED CONTROLLER FOR SAFETY IN AUTOMOBILES

HARSHITA P, SANJANA DEVRAJ¸ S CHANDANA NAGA DEEPTHI & PRIYA B. K

Department of Electronics and Communication Engineering, Amrita School of Engineering, Bangalore, Karnataka, India

ABSTRACT

This paper proposes a real time accident prevention system by using sensor technology. The objective is to detect the driver's fatigue and drunk driving by alarming if the same pattern repeats and to control the speed near the school zone using RF module. Several patterns are identified which are linked to irresponsible driving. These detection systems can help in the prevention of deadly and costly accidents. The system may benefit from standard vehicle sensors like cameras or GPS (Global Positioning System) systems as well as non standard devices like RFID (Radio Frequency Identification) readers.

KEYWORDS: Eye Blink, Tilt, Alcoholic, Speed Control

INTRODUCTION

Present technology is increasingly shifting towards automation. Two principle components of today's industrial automations are programmable controllers and robots. In order to aid the tedious work and to serve the mankind, today there is a general tendency to develop an intelligent operation.

In past day's black box system, this system should be available in the air-craft for the purpose of investigating the accidents. For this reason, developing systems that actively monitors the driver's level of vigilance and alerting the driver of any insecure driving condition is essential for accident prevention**.** Drivers fatigue is characterized into physiological changes like sleep detection and alcohol consumption. This is identified by choosing eye blink sensor and alcohol sensor along with tilt sensor.

Safety device is embedded in vehicles to prevent the accidents. The proposed use of web camera equipped with active IR illuminators is included to acquire video images of the driver. Various visual cues typically characterizing the alertness of the driver are extracted in real time and systematically combined to infer the fatigue level of the driver. The visual cues employed characterizes the eyelid movement and head movement.

CHALLENGES

The vast emerging technology is aiding us to move forward in numerous ways. The ever increasing number of accidents all over the world can be controlled using technology. In this paper, a prototype is designed such that the physiological changes of the driver can be controlled using an alert mechanism and the accidents can be prevented in a crowded areas like school zone. The intensity of the damage occurring can be reduced to a great extent.

HARDWARE IMPLEMENTATION

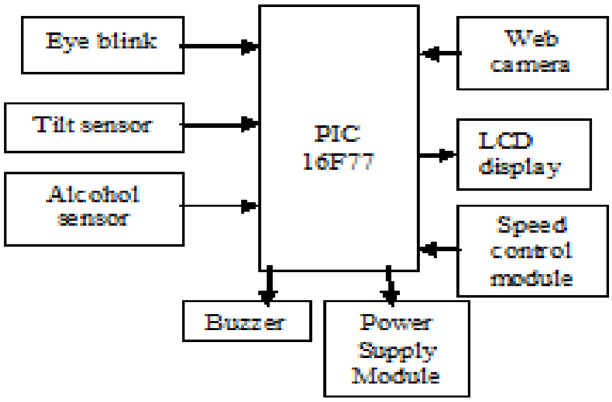

Figure 1: Functional Block Diagram

The above figure 1 represents the functional blocks used in our design. All the sensors and the speed control unit send their outputs to the microcontroller which acts as the interfacing component. An alert mechanism is enabled based on the outputs of the three sensors and the speed of the vehicle decreases based on the frequency matching of the RF module.

Eye Blink Sensor

Figure 2: Eye Blink Sensor

This Eye Blink sensor is an IR based sensor. The variation across the eye will vary as per eye blink. If the eye is closed means the output is high otherwise output is low. This is to know that the eye is closing or in opening position. This output is given to logic circuit to indicate by alarming the driver by using buzzer. This can be used for controlling accident due to unconscious through eye blink, if there is no pupil found for the certain period of pre-determined i.e. time greater than the human eye blinking time then consider an event called “blink”, for which the set of operations will be followed. Here, in this case we need to set time as 1 second or above it as “blink event” and is different from “normal eye blinking”. We need to perform testing for only blink event estimation, and not to find normal eye blinking. When the driver falls asleep, driver’s eyes will be closed. One common technique of monitoring eye blink rate is by measuring infrared (IR) light reflected from the surface of the eye. The eye is illuminated by an IR LED, which is powered by the +5V power supply and the reflected light is recorded by an IR photo diode. The IR photo diode converts this reflected light into electrical signal and given to Op-Amp. The output of an Op-Amp depends on the intensity of light received by the IR photo diode. The micro-controller drives the buzzer according to the output of Op-Amp. The digital display provides various messages to the user. When the eye is open, maximum amount of light will be reflected from the eye because our eyeball is transparent, while minimum of light will be reflected from the eye, when it is closed as skin part of eye is opaque. [2]

Tilt Sensor

The MEMS 3-axis accelerometer consists of a Mass at the centre of the sensor's chip, which is suspended by 4 Beams doped with Piezo resistive material. When the sensor is subjected to acceleration in any direction, the movement of the Mass causes the 4-Beams to deform and so change the resistance in the piezo material. This enables the sensor to detect the acceleration motion.

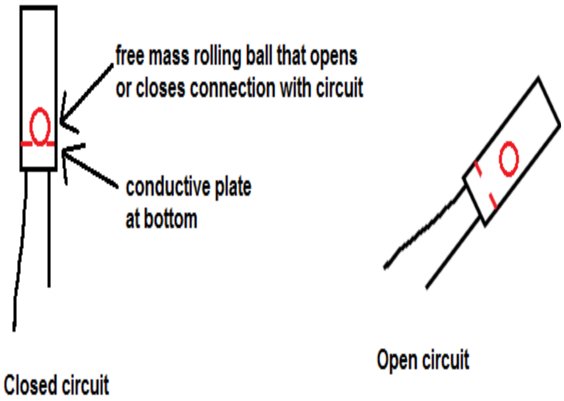

Figure 3: Tilt Sensor

The above mentioned figure 3 is a tilt sensor usually made by a cavity of some sort and a conductive free mass inside, such as a blob of mercury or rolling ball. One end of the cavity has two conductive elements (poles). When the sensor is oriented so that end is downwards, the mass rolls onto the poles and shorts them, acting as a switch throw. When this tilt sensor is tilted, the free mass rolling ball moves and forms the open circuit by not having the contact with the conductive plate at the bottom.

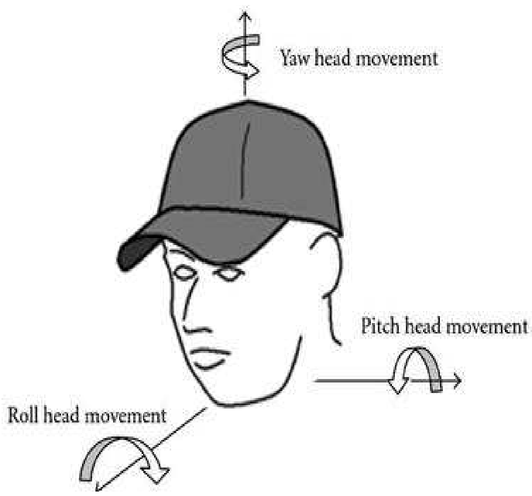

Figure 4: Possible Movements of Tilt Sensor

A tilt sensor can measure the tilting in often two axes of a reference plane. In contrast, a full motion would use at least three axes and often additional sensors. Pitch, the vertical head rotation movement (as in looking up or down) Roll, the head rotation that occurs when tilting head towards the shoulders Yaw, the horizontal head rotation movement (as in looking to left or right) as shown in figure 4. The measurement of tilt angle with reference to the earth's ground plane is to use an accelerometer.

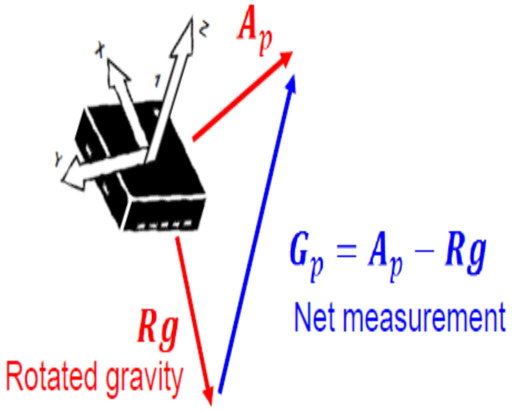

Figure 5: Vector Diagram of Tilt Sensor

The accelerometer measurement is given by G_p

$$\mathbf{G_P = A_p - Rg} \tag{1}$$

(If the accelerometer MEMS has mass m then gravitational force **is F = mRg** (2)

Where **g** represents gravity, from the equation 1, as gravity is a positive entity,

$$\boldsymbol{G_p = -A_p + Rg}$$

Neglecting acceleration A_p,

$$\boldsymbol{G_p = Rg}$$

$$G_p = \begin{pmatrix} G_{px} \\ G_{py} \\ G_{pz} \end{pmatrix} = Rg = R_y(\phi)R_x(\theta)R_z(\psi)\begin{pmatrix} 0 \\ 0 \\ -1 \end{pmatrix} = \boxed{\begin{pmatrix} \cos\theta \sin\phi \\ -\sin\theta \\ -\cos\theta \cos\phi \end{pmatrix}}$$

$$\tan\phi = \frac{-G_{px}}{G_{pz}} \qquad \tan\theta = \left(\frac{G_{py}}{G_{pz}\cos\phi - G_{px}\sin\phi}\right)$$

Thus we can find the roll and pitch angles respectively from the above equations.

Alcohol Sensor

MQ303A is semiconductor sensor for Alcohol detection. It has good sensitivity and fast response to alcohol, suitable for portable alcohol detector. Sensing element of the semiconductor sensor is a micro-ball, heater and metal electrode are inside, and the sensing element is installed in anti-explosion double 100 mesh metal case as shown in figure 6.

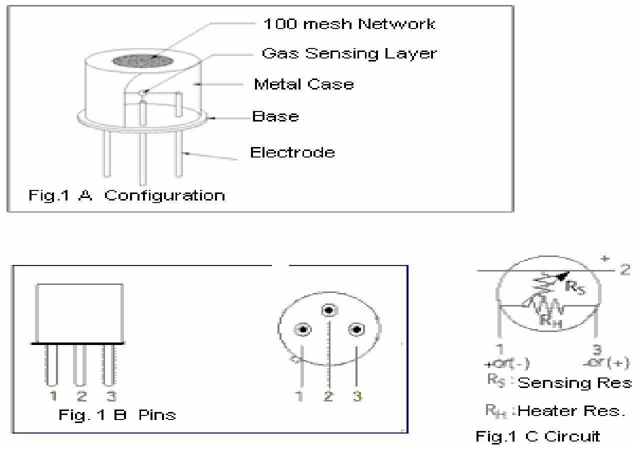

Figure 6: Alcohol Detector

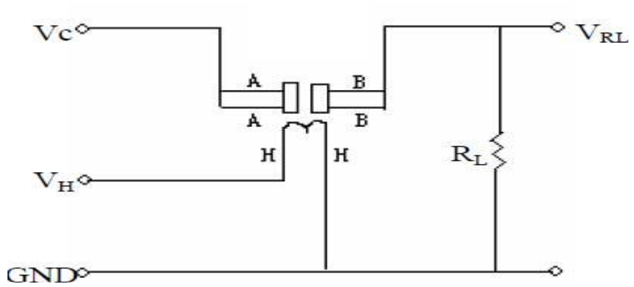

Figure 7: Test Circuit

The above figure 7 is a basic test circuit of the sensor. The sensor needs to be put 2 voltages, heater voltage（V_H） and test voltage（V_C). V_H used to supply certified working temperature to the sensor, while V_C used to detect voltage (VR_L) on load resistance（R_L）whom is in series with sensor. The sensor has light polarity, V_C need DC power. V_C V_H could use same power circuit with precondition to assure performance of sensor. In order to make the sensor with better performance, suitable R_L value is needed.

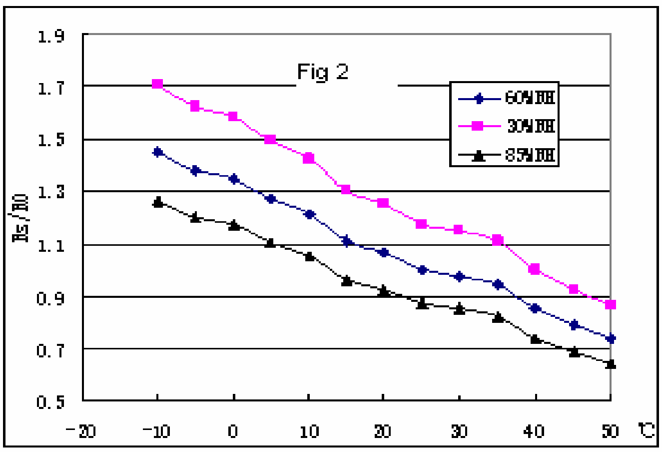

Figure 8: Influence of Temperature and Humididy

Figure 8 shows the typical temperature and humidity characteristics. Ordinate means resistance ratio of the sensor (Rs/Ro), Rs means resistance of sensor in 0.4mg/l alcohol under different temperature and humidity. Ro means resistance of the sensor in environment of 0.4mg/l alcohol, 20^{o}C/65%RH.

Speed Control Module

Speed of the vehicle is controlled automatically according to the zone where the vehicle is located signal is transmitted from sign board at a specific frequency range. The two major blocks are zone status transmitting unit and vehicle speed control and monitoring unit. The zone status monitoring unit is fixed in sign boards at different locations. This gives the zone information like school zones. The vehicle speed control can be fixed in any vehicle. The monitoring unit in the vehicle unit receives the signal transmitted from the zone status monitoring unit when frequency matches the speed of the vehicle reduces.

SOFTWARE IMPLEMENTATION

MPLAB software is the golden tool for PIC family microcontrollers. MPLAB IDE is free software which solves many of the pain points for an embedded program developer. This software is an integrated development environment (IDE), which integrated a text editor to write programs, a compiler and it will convert your source code to hex files too.

RESULTS

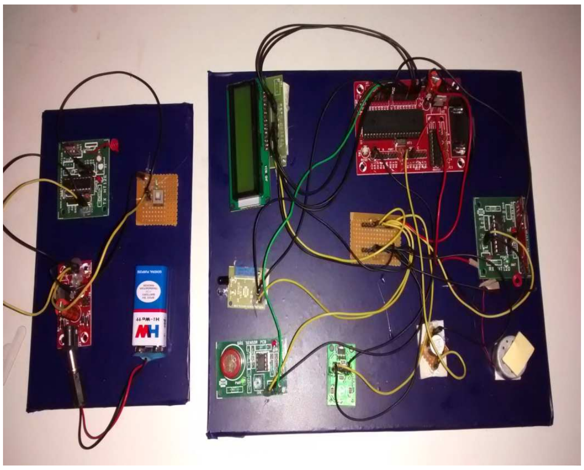

Figure7: Complete Hardware

Figure 7 shows the assembly of all units explained above. This includes transmission unit and receiving unit. Receiving unit contains all the sensors and a receiver.

CONCLUSIONS

Thus our prototype model uses different technologies like tilt, eye blink and alcoholic sensors which in turn ensures vehicle operator's safety. Hence, a system to monitor fatigue by detecting eye blinks and head movement is developed by self developed algorithms. Use of wireless camera which enables this design is to be used for recording driver's fatigue in real life applications. This design can be extended by including GSM module or GPS module which can practically help in identifying accident locations.

ACKNOWLEDGEMENTS

Our sincere thanks to Technofist pvt.ltd for their hardware support and we are grateful to the management of Amrita School of Engineering, Bangalore, for providing us with such a great opportunity in publishing this paper.

REFERENCES

1. Abdallah kaseem, ziad khairallah maalauf, ”*Vehicle Black Box System*”, 2008 - IEEE International Systems Conference.
2. Abhi R. Varma, Seema V. Arote, Chetna Bharti “*Accident Prevention Using Eye Blinking and Head Movement*”**,** International journal of computer science 2012-ETCSIT.
3. Qiang Ji, Zhiwei Zhu, and Peilin Lan, ” *Real-Time Nonintrusive Monitoring and Prediction of Driver Fatigue*”, 2004-IEEE.
4. G. Gnanavel. “*Embedded Based Complete Vehicle Protection”*, International Journal of Scientific & Technology Research, VOLUME 2, ISSUE 4, APRIL 2013.
5. Gogineni Lakshmi Swetha, Suresh Angadi. “*A Pre-emptive Susceptive Design for Drowsy Driving Detection System*”. International Journal of Engineering Trendsand Technology (IJETT) - Volume4Issue4-April201