

Accident Monitoring and Controlling on Highways using Wireless Sensors Network

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Abstract

Today, there is no such unified and advanced system to reduce the causes of accidents. The existing system to control these accidents is very inadequate and it has spineless solution. If accidents happen, then there is no help provided to the location of the accidents because exact location of accident is not known. The proposed module in the four wheelers with network of sensor like infrared sensor, alcohol sensor has been used to reduce the menace and removing impairment of bad driving. The system interpret the causes of accidents and provide equip solution over this troublesome and act as a car black box system.

Keywords: *Infrared sensor, Alcohol sensor, Car black box, reducing the menace.*

1. INTRODUCTION

Highways are the main point where huge number of accidents happened in past years. Accidents on roads cause many consequence. Accidents are caused yearlong due to various factors such as drunken driving, texting while driving, speeding distractions, and fuel outflow. Some

accidents caused due to another driver's mistake like driving on wrong lane of highways. As shown in figure 1, In 2016, December 26, four people were killed and 6 people were injured in a clash of trailers, car and tempo on Pune-Mumbai expressway near Khopoli[1]. Cause of this accident was clashing of two trailers out of which one

trailer was on wrong side. The proposed system deals with all solutions of such sort of problems. Insightful solution had been found for such problems by developing intelligent embedded systems. Automobiles are the critical systems in which life's are involved. The intention of system is to deal with accident monitoring. *See figure 1*

In proposed system different sensors are interfaced to ARM microcontroller for sensing physical quantities as well as chemical like alcohol. Eye blinking sensor deals with passenger dormant activity. Alcohol sensor prohibits driving the car

which can lead to frenzy behavior by stopping the engine. Speed limit control warns the car driver by notifying the situation of danger by automatically decreasing the speed of car. System includes messaging system using GSM module in case of accidents. Location of the car is tracked down by GPS module and notified to the family members or nearby hospitals by message. The objective of proposed system is to have impartial solution on the trending issue of accidents. System can be upgraded using temperature sensor, fuel sensor and heart rate monitoring system in future.



Fig 1 Accident occurred in December 2016

2. LITERATURE SURVEY

In [2], research on accident avoidance using eye blink research included gas sensor, alcohol sensor. Main purpose of system was the eye blinking sensor to avoid accident due to drowsy of driver. OMAP3530 processor was used. Beagle board was used for the project with Linux operating system. Camera was also used for detecting driver's activity and also alarm unit. Image processing was useful implementation in this paper.

In [3], research on accident avoidance and detection issue included use of eye blinking sensor with use of IR sensor to indicate the driver's drowsiness position. They used PIC microcontroller for developing this system with alcohol sensor interfaced. IR sensor was used for eye blink detection. Also drowsiness of driver was taken into consideration using wheel rotation of car.

In [4], research on automatic speed control and accident avoidance of vehicle using multiple sensor included smoke sensor, eye blink sensor, ultrasonic sensor, LCD display. Obstacle sensing was done using ultrasonic sensor.

In [5], research on accident avoidance and detection on highways included use of anti blocking braking system, electronic brake force system. To measure engine temperature, temperature sensor was used. To convert sensor's output conditioning was used. They used PIC microcontroller for developing this system with alcohol sensor interfaced. IR sensor was used for eye blink detection. Also drowsiness of driver was taken into consideration using wheel rotation of car.

In [6], research on accident avoidance included eye blinking sensor as well as head moment sensor. The head moment sensor used was ADXL330 which measures 3axis detection with ARM processor. LPC 2148 processor with head moment detection and Bluetooth module was used. GPS and GSM were interfaced with Bluetooth module for sending message

In [7], research on included eye blinking and Distance detection between two vehicles to avoid accidents. The sensor used was QRD1114 along with 8051 for measuring distance. This paper gave the information about future scope of the road safety system which included gas sensor,

fuel sensor etc. LPG gas sensor was used for gas sensor purpose.

In [8], research on accident avoidance and framework issue was mainly based on two wheelers. It contained accident monitoring unit which included GPS and GSM model. With detection of accident unit sends data to

accident server. Then it notifies further emergency services.

In [9], research included real time traffic accident, RFID technologies. Application software was developed for systems working. Message sent to the user after accident included location of car, number of passenger in the car before accident.

3. SYSTEM ARCHITECTURE

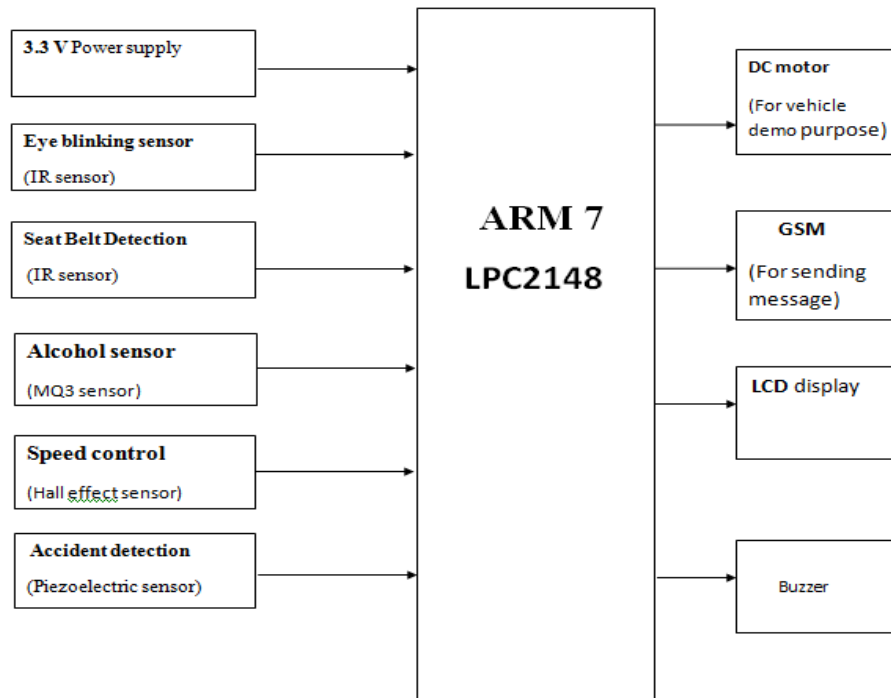


Fig2 System architecture

In system architecture LPC 2148 microcontroller for ARM7 family has been used. Distinct sensors are interfaced with microcontroller for accident monitoring and controlling. IR sensor is used for two purposes eye blinking and seat belt detection. After entering the car seat belt will be checked. If driver is wearing seat belt then lcd displays message as ok. IR sensor detects presence of seat belt. Next state will be of MQ3 sensor which is used to inspect presence of alcohol in driver's body. If alcohol value is greater than 0 ml then car won't start. Hall effect sensor is used for detecting speed of car by taking wheel rotation in to consideration. If rotation of wheel that is dc motor exceeds 90 rpm then car speed will be slowed and lcd also displays message as slow down speed. In next stage if driver is feeling sleepy then second IR sensor will detect it and buzzer will be turned. Piezoelectric sensor which is vibration sensor is used for detection of accident. When output of piezoelectric sensor is 1 then location of car at that moment is sent to controller via GPS. After this by sending AT commands GPS and GSM communicates. Message will be sent to registered mobile number using GSM module. Message contains longitude and latitude and also information about seat belt

and alcohol. Dc motor is used as a wheel of car in the system and LCD is used to display messages after various stages.

3.1 ARM Microcontroller

In ARM microcontroller two serial ports are present. This system requires two serial ports for GPS and GSM purpose respectively. Pin P0.1 and P0.2 are used for GPS module. Pin P0.8 and P0.9 are used for GSM module. Alcohol sensor is interfaced to pin P0.10. Pin P0.15 is used for seat belt detection using infrared sensor. For second infrared sensor which is for purpose of eye blink detection is interfaced at pin P0.16. Hall effect sensor is interfaced at P0.29 pin. DC motor is interfaced at P0.12 pin. P0.28 pin is used for piezoelectric sensor. P0.21 and P0.22 are RS and EN pins of LCD respectively. Data pins of LCD are from P1.16 to P1.19. Buzzer is interfaced at pin P0.7.

3.2 Infrared Sensor

It has Infrared transmitter and infrared receiver. Object can be anything which has certain shape and size, the IR LED transmits the IR signal on to the object and the signal is reflected back from the surface of the object. The reflected signal is received by an IR receiver. If driver is sleepy then light

will be reflected back from eyes of driver and then buzzer will start ringing. Similarly when driver is not wearing seat belt then car won't start. If driver removes seat belt in midway then also car will stop. IR sensor operates on 5V DC voltage. It has supply current of 3mA with viewing angle of 95 degrees. **See figure 3**

3.3 Alcohol Sensor

Alcohol sensor analyses breath and indicates presence of alcohol. It indicates level of alcohol present in body.

When methanol is reacted with silicon dioxide heat is generated, this is working

principle of this sensor. Sensor contains a tube which produces heat and it is made up of aluminum oxide and tin dioxide. When ethanol in breath is reacted with SnO₂ electrode heat is more. The number of alcohols more current will flow produced in the sensor. IC number for alcohol sensor is MQ3. It operates on 5V supply. It operates in temperature range of 10 to 70 degree Celsius.

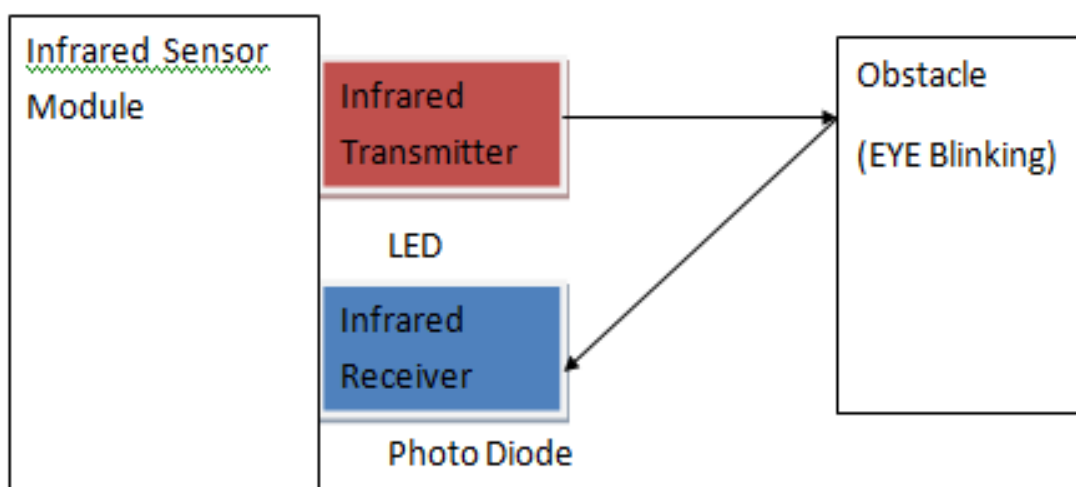
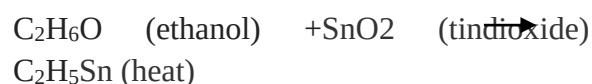


Fig 3 Operating principle of infrared sensor

3.4 Piezoelectric Sensor

Piezoelectric sensor is a pressure sensor. When accident occurs piezoelectric sensor experiences pressure due to another object striking on the car. 1 Mega ohm resistance is present as a load in this sensor so that if pressure is of large intensity still this sensor does not get damaged. Piezoelectric sensor sends electrical signal to the controller. This sensor operates on 5V DC supply. Weight of sensor is 6 gram. It operates in 3 to 30 degree Celsius temperature range. Maximum current of sensor is 15mA.

3.5 Hall effect Sensor

Hall effect sensor is used for intention to detect the car speed. This sensor is used on the wheels of car. When magnet of wheel passes by sensor it's voltage varies. It sends rectangular pulses to microcontroller. As shown in figure below, as the magnets passes by the sensor, its voltage varies. It operates on 5V supply. IC number of sensor used is ACS 712 20A. It has output current of 5mA. **See figure 5**

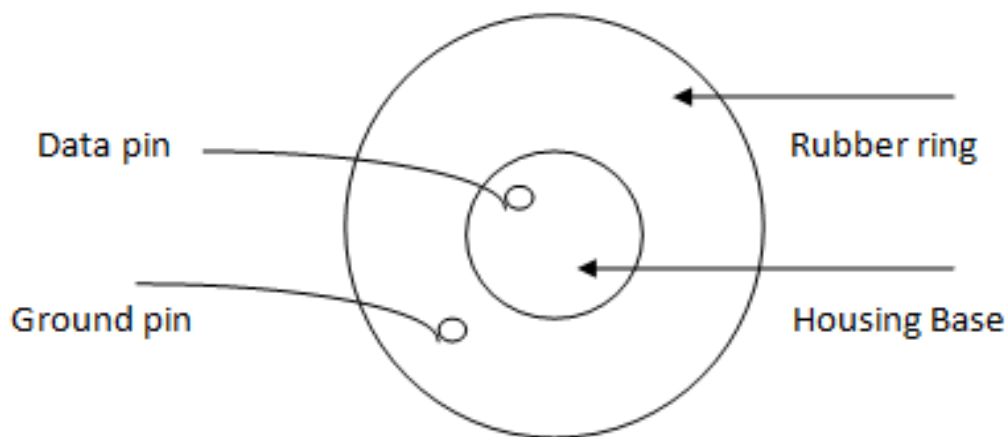


Fig4. Structure of Piezoelectric Sensor

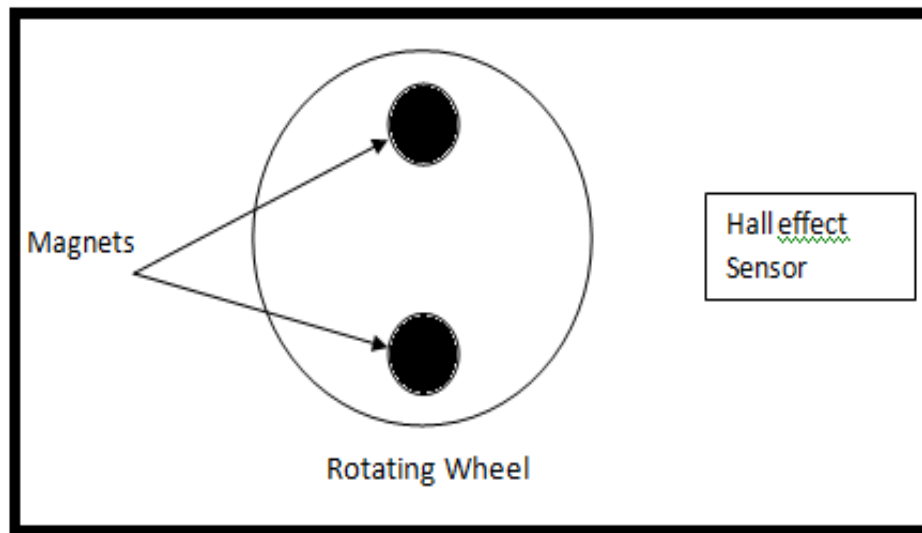


Fig 5. Operating principle of Hall effect sensor

3.6 Global Positioning System and Global System for Mobile Module

This pair of module is used in co ordinance with piezoelectric sensor. When sensor detects crash of car, GPS module senses the coordinates of location where the accident has occurred. GSM module will send the coordinates to registered mobile number. AT commands have been used for communication through GPS and GSM. GPS operates on 3.3.V supply. While GSM operates on 5V supply.

3.7 Direct Current Motor and Liquid Crystal Display

Motor is used for purpose of showing wheels of car. Speed of motor varies as voltage from various sensor varies. LCD displays the messages of various stages 16*2 LCD is used. Motor used is DC motor has 12 gram weight with 500 rpm. It operates on 12V supply. It has 6mm shaft diameter internal hole.

4. SIMULATION RESULTS

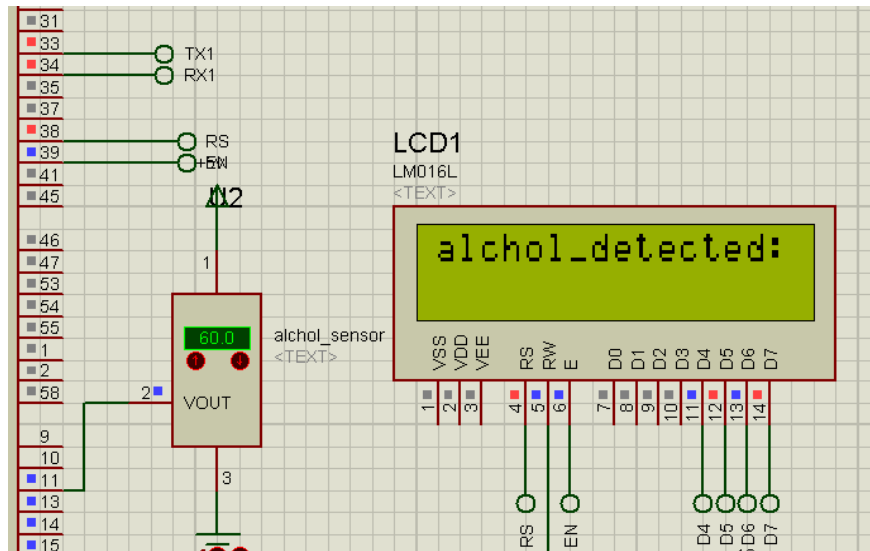


Fig 6. Simulation of alcohol sensor.

Alcohol consuming threshold value is set to 60. Hence when resistor pot value is equal to or greater than 60, LCD shows message of alcohol has detected.

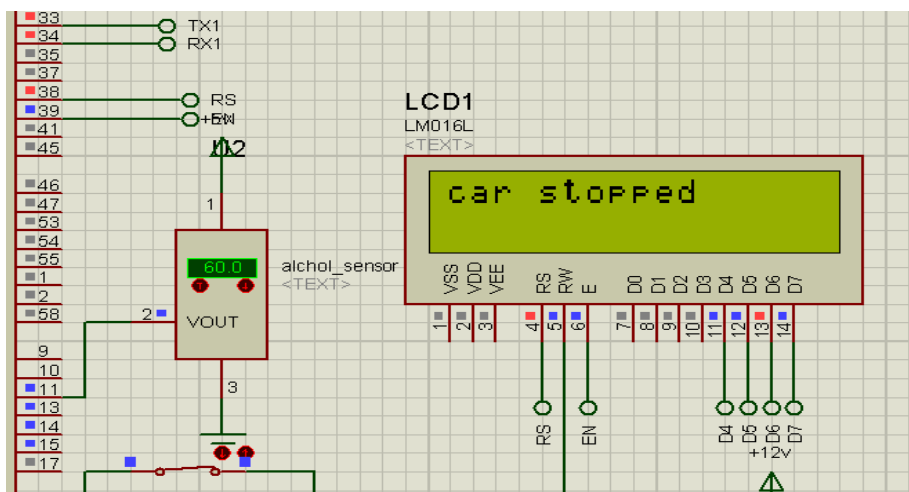


Fig 7. Simulation of Infra Red sensor

Switch for infrared sensor for eye blinking detection is pressed. This means that driver is in sleepy condition then buzzer rings. In

the figure LCD shows the message as car stopped.

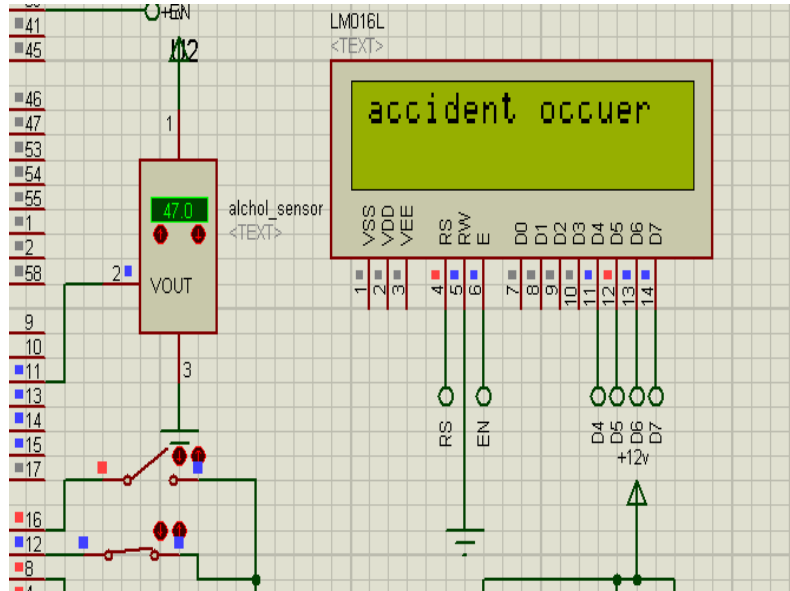


Fig 8 Simulation of piezoelectric Sensor

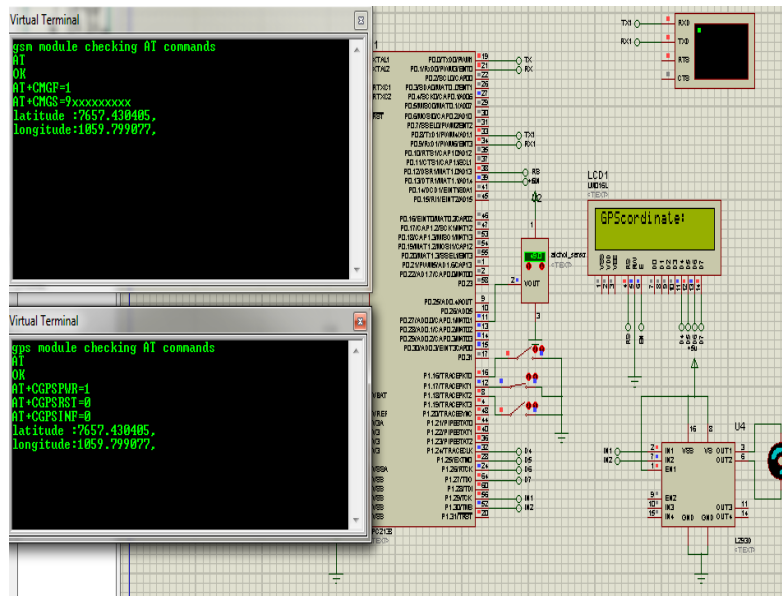


Fig 9 Simulation of GPS and GSM is activated

As shown in figure 8, piezoelectric switch is pressed i.e. accidents has occurred. GPS tracks the location and send this location through GSM. This communication is done

by AT commands. In figure 9, virtual terminal shows the location sent to registered mobile number.

5. DEMONSTRATION RESULTS

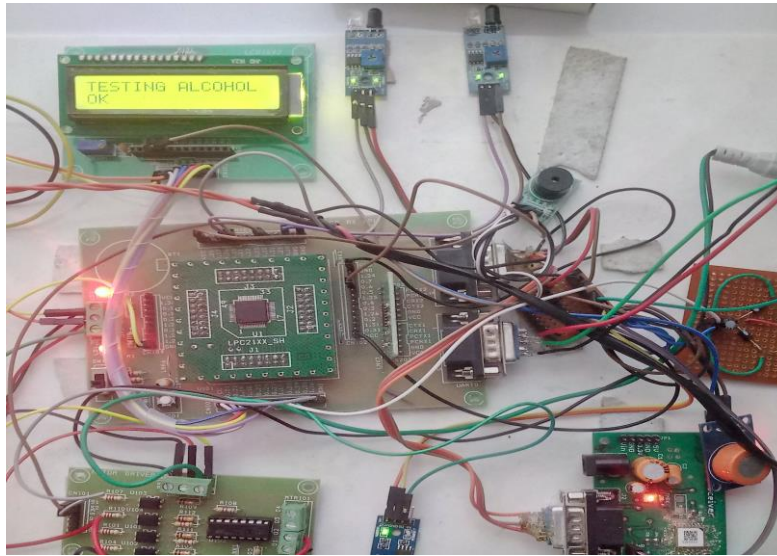


Fig 10. Result of testing alcohol.

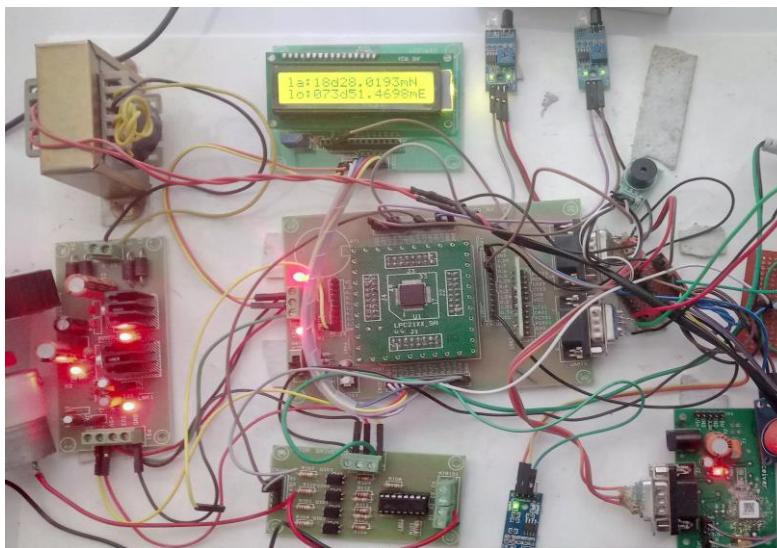


Fig 11 Result of accident occurrence condition.

MQ3 Sensor is activated after driver enters car. If alcohol is tested then car won't start. In fig LCD shows the message of testing alcohol. Alcohol is not found then it displays ok message. **See Figure 10.**

When occurred accident is detected by piezoelectric sensor then GPS and GSM module is activated. In figure GPS coordinates are displayed on the LCD screen. Using this coordinates we can find out location of accident.

Table I

State no.	Activated Sensor	Output
1	IR (Seat belt)	“Wear seat belt” Wearing seat belt- Ok Not wearing -Test failed car won't start
2	Alcohol	“Testing alcohol” If alcohol absent- Ok If alcohol present- Test failed car won't start
3	DC motor	DC motor starts if state 1 and state 2 shows message as ok.
4	IR(eye blinking)	If driver sleeping. Buzzer rings. “Blink detected” “Don't sleep”
5	Hall effect sensor	If speed of car is greater than 90 Car stops “Slow down the speed”

6	Piezoelectric	If accident happens "Collision Detected"
7	GPS	If state 6output=1 "Find coordinates" "Latitude" "Longitude"
8	GSM	If state 5 output=1 "AT+ CMGF=1" "LAT= value, LON=value" "Location sent"

When driver enters car state 1 and state 2 are checked. In state 1, if seat belt is detected then car starts. Else LCD displays message as wear seat belt. In state 2, MQ3 sensor check presence of alcohol. If alcohol is found driver is prohibited from driving. State 3 is for car(DC motor) starting that is if alcohol is not found and seat belt is detected car starts. State 4 includes eye blinking sensor. If sensor output is 1 then buzzer rings and LCD shows message as don't sleep. State 5 contains working of halleffect sensor. If speed of car is greater than 90 then car speed is automatically slowed down and LCD also shows message as slow down speed. State 5 has accident detection task. Piezoelectric sensor experiences large force if accident happens.

It sends signal to controller and after this GPS location at the moment of collision are sent as message via GSM to registered mobile number.

CONCLUSION

Low cost and small scale integrated system to avoid large menace of accidents. System acts as black box for automobiles. Getting location of accident quickly after accident has occurred and providing medical care will be helpful for driver. Further it can be modified by providing by messaging to nearest hospitals also.

REFERENCES

- 1) 27 December news post on website www.firstpost.com.

- 2) D. B. Rane, Gaikwad Pooja et al 2015 "Accident Avoidance Using Eye Blink Detection", International Journal of Informative and Furistic Research Vol 2, Issue 6.
- 3) B. Praveenkumar, K. Mahendran , 2013-2014 "Prevention of Accident Due To Drowsy By Using Eye Blink", International Journal of Innovative Research in Science, Engineering and Technology. Vol. 3, Issue 5.
- 4) S Nagakishore Bhavanam , Vasujadevi M, 2013-2014 "Automatic Speed Control and Accident Avoidance Of vehicle using Multi Sensors" , International Conference on Innovations in Electronics and Communication Engineering.
- 5) S.P. Bhumkar, V.V. Deotare, R.V.Babar , 2011-2012 "Accident Avoidance And Detection on Highways," International Journal of Engineering Trends and Technology- Volume3 ,Issue2.
- 6) Abhi Verma , Seema Arote et al 2012 "Accident Prevention using Eye Blink and Head Movement " International Journal of Computer Applications.
- 7) Pragyaditya Das, S pragadeesh 2015 "Implementing a drowsiness detection and vehicle detection in parallel" International Journal Of Scientific Technology And Research vol 4, Issue 12.
- 8) Amit Meena, Srikrishna Iyer et al 2014, "Automatic accident detection and reporting frame work for two wheelers", in Advanced communication control and technologies conference.
- 9) Hossam M. Sherif , M. Amer Shedid et al 2014, Real Time traffic accident detection System Using wireless Sensor network", in Soft Computing and pattern recognition 6th international conference.