

An Advanced Fatigue, Vehicle Monitoring and Information Processing System for Accident Management Support

Abhishek Kumar, Akshneel Sharma, Arun Kumar, Dhiraj Kumar Yadav, Prema V

Department of Electrical & Electronics Engineering, SVCE, Bengaluru, India

Abstract: *Speeding and drunken drive are the basic reasons for vehicle accident. Apart from this mechanical failure of engine and fatigue during long drive is also the cause of accident. Many lives could have been saved if emergency service could get accident information and reach in time and if drunken drivers are prevented from driving. Nowadays, GPS has become an integral part of a vehicle system. Microcontroller sends the alert message through the GSM MODEM including the location to police control room or a rescue team. So the police can immediately trace the location through the GPS MODEM, after receiving the information. Then after confirming the location necessary action will be taken. The detection is maintained by the sensors used in appropriate places. The power supply is given by the source battery that is charged by the solar cell and a backup power is provided by the piezoelectric plates fixed at accelerator, clutch and brake.*

Keywords: *Fatigue; GSM MODEM; GPS MODEM; Piezoelectric; Accelerator; Solar Cell*

I. INTRODUCTION

The Vehicle Safety Technology (VST) in the automobile industry refers to special technology (Advanced-Driver Assistance System) that is developed to ensure the safety of automobiles and passengers. This includes car to computer communication, GPS tracking features etc. The Rapid growth of technology and infrastructure has made our lives easier. The advent of technology has also increased the traffic hazards and the road accidents taking place frequently which causes huge loss of life and property because of the poor emergency facilities. Main causes behind these road accidents include: lack of training institutes, unskilled drivers, poor road conditions, use of cell phone during driving, over loading and poor governmental plans in this regard. Road accidents and traffic congestion are the major problems. Hence, the value of human life is being ignored. They involve high human suffering and monetary costs in terms of untimely deaths, injuries and loss of potential income. There are so many new techniques such as Antilock Breaking System (ABS), Adaptive Cruise Control (ACC), and Anti-Collision System (ACS) to

avoid accidents and in spite of all this, such large number of accidents takes place. The frequency of traffic collisions in India is amongst the highest in the world. A National Crime Records Bureau (NCRB) report revealed that every year, more than 135,000 traffic collision related deaths occur in India. Also due to the delay in reaching of the ambulance to the accident location and the traffic congestion in between accident location and hospital increases the chances of death of the victim.

II. SYSTEM DESIGN

There is a need of introducing a system to reduce the loss of life due to accidents and the time taken by the ambulance to reach the hospital. To overcome the drawback of existing system we will implement the new system in which there is an automatic detection of accident through sensors provided in the vehicle.

A. Prevention System

The prevention system involves, switching off automobile if the driver has consumed the alcohol the buzzer is initiated and the engine of the vehicle does not start. On a long drive in the case of truck or the busses that cover long distance undergo mechanical failure that leads to overheating of the engine. Generally a normal person can drive only for few hours. If the driver drives the vehicle beyond the specified limit of driving the driver can fall asleep and hence can lose the control over the vehicle. For this the eye blink sensor is used in order to monitor the driver eye blink pattern. If there is any change in that the buzzer is initiated and the fuel injection system is cut off by using the relay. The obstacle sensor detects the obstacle coming on the way of the vehicle while it is moving on road.

B. Detection System

The detection part involves, when a vehicle faces accident, immediately MEMS sensor will detect the signal and then Microcontroller sends the alert message through the GSM modem including the location to predefined numbers that can be reserved for a rescue team. The rescue team will arrives at the accident place and takes the microcontroller to analyze the parameters of accident automobile.

C. Vehicle Unit

For implementation of this, vehicle unit should be installed in every vehicle. It consists of alcohol sensor, MEMS sensor, temperature sensor, obstacle sensor, GPS & GSM Module and the eye blink sensor. The alcohol sensor MQ-2 is placed at the dashboard or the steering of the vehicle where it can easily detect the alcohol content if the driver has consumed the alcohol. The LM-35 temperature sensor is the one which will detect the temperature of engine. If the temperature of the engine goes beyond the specified range the buzzer is initiated and the vehicle slowly stops. Obstacle sensors are placed at the front bumper. The function of the obstacle sensor is that it will detect the on road obstacles and suitably giving warning signals to the driver. Eye blink sensor are the sensor that will monitor the drivers eye blink pattern of making sure that if the drivers fall asleep the buzzer is turned on and the fuel injection system is disconnected making sure that the vehicle does not accelerate further. This information consists of the location of accident detected by GPS module installed in vehicle. The GPS system finds out current position of vehicle (latitude and longitude) which is the location of accident spot and gives that data to GSM module. This information to the control unit is sent by GSM module.

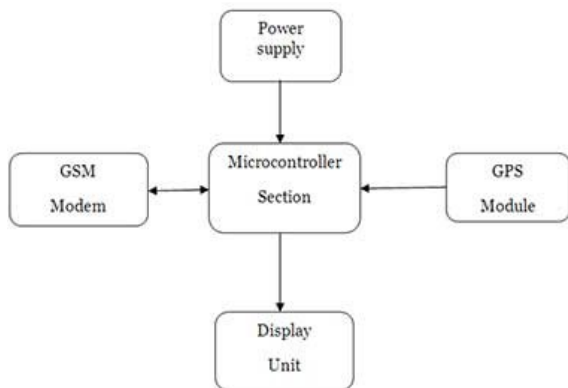


Fig 1. Block Diagram Of Detection System

D. Control Unit

Control unit is the brain of our system. Practically, the control unit will contain all the information about the hospital location and the contact number of all the hospitals in order to send an ambulance to the accident spot. The system calculates the nearest distance from the accident spot to the nearest hospital location through a Google API. It receives the message through another GSM module about accident location from the GPS and GSM module installed in its vehicle unit and responds. This also consist the microcontroller that ensures the proper signal is initiated and displayed on the LCD Screen as and when required.

E. Medical Response Unit

Control unit sends the ambulance to the accident location. Ambulance serves the victim from the accident location.

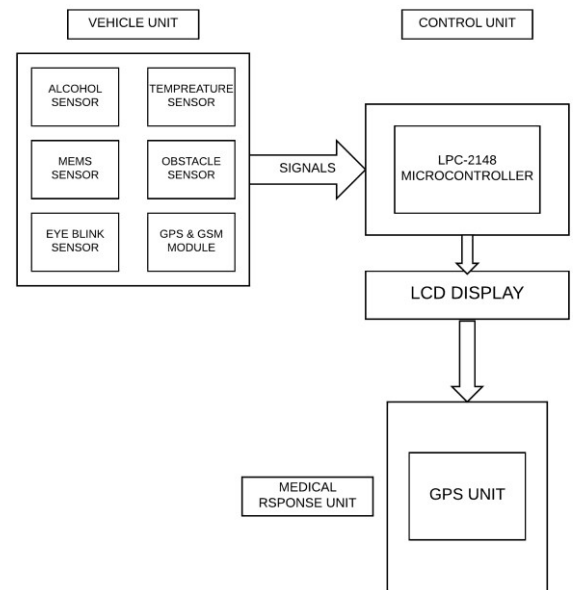


Fig 2. Block Diagram Of The Proposed System

F. Power Supply Unit

The Power supply unit is the most important part of the system since for every equipment installed requires some certain amount of power to operate effectively and making sure that it gives the required output. The power supply is given by the battery that provides the required amount of the power to the system. The vehicle consists of clutch, brake and accelerator that are continuously used by the driver. The clutch, brake and the accelerator are fixed with a piezoelectric plate. Whenever the brake, clutch or accelerator is used a small amount of pressure is applied on this and hence it converts the mechanical pressure to the electricity that can be stored in the battery.

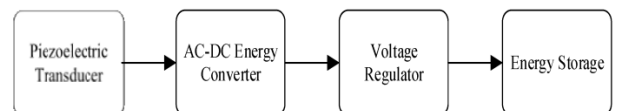


Fig 3. Block Diagram Of Peizoelectric Power Generation

In case, due to some mechanical damage, the piezoelectric plate does not work effectively the solar power can be used to charge the battery. This also ensures that the power that is utilized by the vehicle's battery unit for other purpose is not made in use and hence the energy is saved in the battery.

The MQ-2 gas sensor is sensitive to LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke.

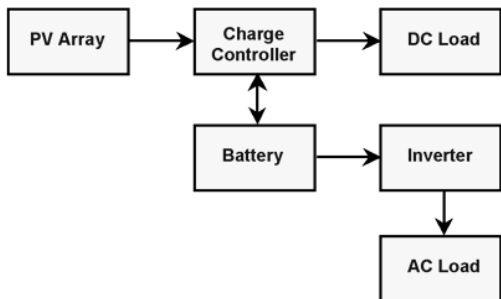


Fig 4. Solar Energy Conversion Block Diagram

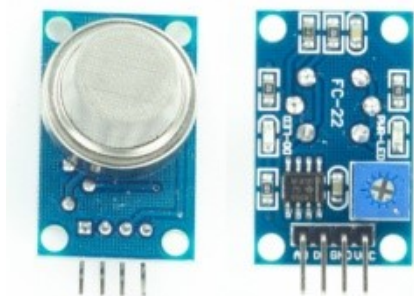


Fig 5. MQ-2 Alcohol Sensor

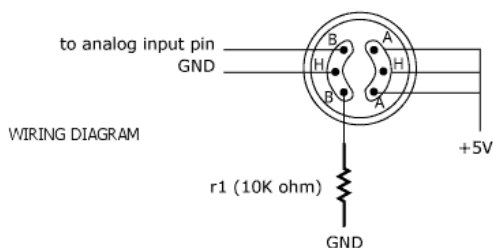


Fig 6. Wiring Diagram

Output of the sensor is directly proportional to alcohol content. When Ethanol molecules in the air meet the electrode i.e. between alumina and tin dioxide in sensor, ethanol burns into acetic acid producing more current hence alcohol increases current also increases.

G. Obstacle Sensor

Infrared Obstacle Sensor Module has built in IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to detect presence of any obstacle in front of the sensor module. The module has on board potentiometer that lets user adjust detection range. The sensor has very good and stable response even in ambient light or in complete darkness.



Fig 7. IR Sensor

H. Eyeblink Sensor

This Eye Blink sensor is IR based. 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 to know the eye is closing or opening position. This output is given to logic circuit to indicate the alarm.

I. MEMS Sensor

The ADXL330 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs, all on a single monolithic IC. The product measures acceleration with a minimum full-scale range of. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

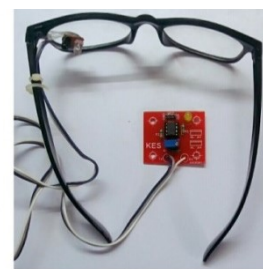


Fig 8. Eye blink Sensor

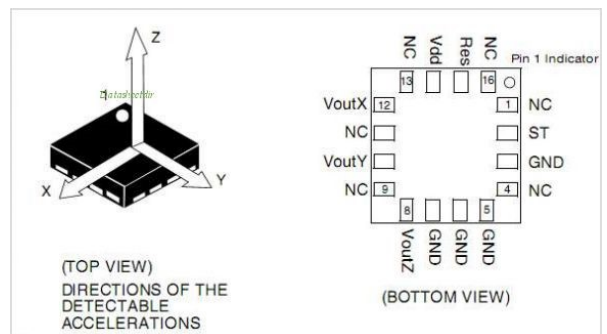


Fig 9. MEMS Sensor

J. LM-35 Temperature Sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies.

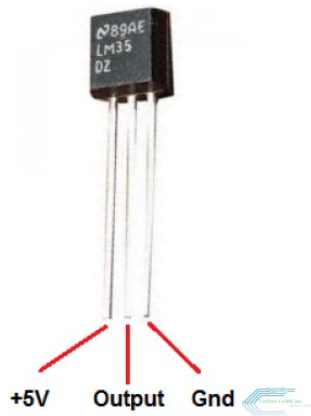


Fig 10. LM 35 Temperature Sensor

K. GSM

GSM (Global System for Mobile communications) is the technology that underpins most of the world's mobile phone networks. The GSM platform is a hugely successful wireless technology and an unprecedented story of global achievement and cooperation. GSM has become the world's fastest growing communications technology of all time and the leading global mobile standard, spanning 218 countries. GSM is an open, digital cellular technology used for transmitting mobile voice and data services. GSM operates in the 900MHz and 1.8GHz bands GSM supports data transfer speeds of up to 9.6 kbps, allowing the transmission of basic data services such as SMS.

L. GPS

GPS (Global Positioning System) technology is used to find the location of any object or vehicle to monitor a child continuously using satellite signals. Three satellite signals are necessary to locate the receiver in 3D space and fourth satellite is used for time accuracy. GPS will give the information of parameters like longitude, latitude and attitude. With the help of these parameters one can easily locate the position of any object. In this GPS technology, the communication takes place between GPS transceiver and GPS satellite.

III. RESULTS

The project has an active market for people who travel long distances at a time. This system could be beneficial to a range of users from truckers that travel daily to a family that travels a long distance twice a year. This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. It provide alarm, engine will be stop and message with location sent to owner. Obstacle Detecting Sensor is used to detect objects and obstacles in front of sensor in a narrow angle useful in robotics applications. Instead of alarm we can use Automatic Braking System which will reduce the speed of the car. It provides only alarm. This Eye Blink sensor is IR based. 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 to know

the eye is closing or opening position. If the driver closes eye for more than 3 seconds, it provide alarm, engine will be stop and message with location sent to owner. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It's operating range -55 to $+150^{\circ}\text{C}$ temperature range. When engine temperature goes to threshold it produces alarm and engine get stopped.

IV. CONCLUSION

An automatic accident prevention and reporting system is designed and implemented using technologies like to prevent accident, GPS modem for finding the location of vehicle in terms of latitude and longitude, as well as GSM for sending message on mobile at the receiver end. As we conclude our paper here along with the entire stimulus, we are still willing to upgrade the application of enhanced technology for the electronic equipment usage efficiency. The snapshot indicates the messages alerts when our accident alert system is tested at two different locations near to one another. Hence, there is a small variation in the coordinates, the initial value of latitudes and longitudes are same but the fractional value changes with small difference.

REFERENCES

A. IEEE Papers

- [1] Syedul Amin, Md., Bhuiyan, M.A.S., Reaz, M.B.I. and Nasir, S.S. (2013) GPS and Map Matching Based Vehicle Accident Detection System. 2013 IEEE Student Conference on Research and Development (SCORED), Putrajaya, 16-17 December 2013.
- [2] Wang Wei, Fang Hanbo, —Traffic accident automatic detection and remote alarm device, Proceedings of IEEE International Conference on Electric Information and Control Engineering, pages: 910-913, 2011.
- [3] K.Athavan; S.Jagadeeshwaran, G.Balasubraminan, N.Dinesh, G.Abhilash, G.Gokul —Automatic ambulance rescue System, Proceedings of 22nd IEEE International Conference on Tools with Artificial Intelligence, pages:190-195, 2012.

B. International Journals/ Periodicals

- [1] Thompson, C., Whit, J., Dougherty, B., Abnigh, A. and Schmidt, D.C. (2010) Using Smart Phone to Detect Car Accidents and Provide Situational Awareness Emergency Responses. The 3rd International ICT Conference on Mobile Wireless Middleware Operating Systems and Applications.
- [2] Amnesh Goel, Sukanya Ray, Nidhi Chandra, —Intelligent Traffic Light System to Prioritized Emergency Purpose Vehicles based on Wireless Sensor Network I, published in International Journal of Computer Applications, Volume 40– No.12, February 2012 .
- [3] Mr.S.Iyyappan and Mr.V.Nandagopal, Accident Detection and Ambulance Rescue with Intelligent Traffic Light System, published in International Journal of Advanced Technology and Engineering Research, 2013.
- [4] Megalingam, R.K., Nair, R.N. and Pakhya, S.M. (2010) Wireless Vehicular Accident Detection and Reporting System. International Conference on Mechanical and Electrical Technology (ICMET).