



Vehicle Accident Spotting and Monitoring by Utilizing MEMS Accelerometer and GPS Tracing

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Abstract:

The fast development from claiming engineering has made our lives easier. The coming innovations also expanded those traffic dangers and the street mishaps occur habitually which makes enormous reduction from huge lives due to poor emergency services and facilities. Proposed work will give acceptable ultimate answer for this weakness of existed systems. As stated by this undertaking when a vehicle meets for a mishap or accident, instantly a Micro-Electro-Mechanical System (MEMS) vibration sensor will identify the signal and sends it will to ARM controller. ARM controller will direct to Global Positioning System (GPS) to find the area and coordinates from claiming accident location. Furthermore by utilizing Global System for Mobile Communication (GSM), microcontroller sends the caution message including geographic allotment coordinates of rescue vehicle to nearby ambulance, hospital, police, and relative of the victim person. In this way the salvage cooperation ambulance in the rescue team of hospital will track accident area promptly by using geological area coordinates on Google earth provision or alternately whatever viable geographic area discoverer requisition. After adjusting the area accident spot the rescue vehicle unit will begins its salvage operation. This framework also controls the traffic signals in the way about rescue vehicle so that it will enable rescue vehicle to arrive at clinic in least period.

Keywords: Accident; Accelerometer; Ambulance; Micro-Electro-Mechanical System; GPS; GSM.

I. INTRODUCTION

The population of the planet is been increasing, with China India also being those two greater part of densely populated nations. Road movements also been getting an ever increasing so effecting amount of congested routes due to higher populace and expanded benefits of the business exercises bring about more vehicles for transportation activities [1]-[3]. This expanded vehicle prompts large portions of road accidents and mishaps. Clinched alongside way mishap because of absence of emergency services people lose their lives. Apart from that, vehicles might be passed though the different types of accidents which may occur due to manmade reasons such as mistakes during driving, crossings of traffic signals and rules, drink and driving or natural issues of roads, hills and so on. Front end collision of cars and side end collision cars are the common accident nature due to many reasons. Accident avoid an estates that the arrangements and moves made to keep away or stop a misfortune before it happens. Accidents can be delegated as an unintended and unforeseen occasions giving expanded danger of harm, sick wellbeing, passing and loss of property due to harm to conditions. India's accident-death rate as per CIA world factbook is around 7 for every 1000. In light of this, 8.4 million individuals expire their lives in each year in India which comes to 22,500 every day around [4]. Nowadays, advanced technologies in vehicular systems are adopted including steering locks, accident protections of travelling persons in the car by means of air bags situated in the cars. The automobile world is shortsighted towards the broad utilization of broadcast communications frameworks inside vehicle. Vehicles are in present days are suited with modern communication gadgets having capabilities of accident safety provisions for drivers and passengers within the car [5]-[6]. In previous days, monitoring of transportation vehicles were done

on the basis of monitoring module suited in the vehicle [7]. A master control unit only wills the data by means of speed and places visited by the transportation vehicles. Traffic monitoring and surveillance system was designed by [8] by using and adopting the IP network in 2014. Such system is applicable only for the urban areas where the Internet Network is available and fails in the remote areas. Accidents over the road are un-planned mishap which may occur at any place and locations. To save the lives within the vehicle, efficient system is always needed to spot out the accident location, it must send out the areas of accidents to hospital and ambulance rescue teams along with hospital, police and relatives of the car driver or victims. GSM and GPS based system was presented in [9] are sending out only the accident information to the relatives but not send the actual geographical information of the mishap area. The principle point of proposed work is to identify and discover the accident site, and give a smooth stream to rescue ambulance to reach hospital in time in emergency. In proposed framework, the unit introduced in vehicle will automatically informs to pre-programmed numbers of the rescue team of ambulance. In this reported work, MEMS vibration sensor and GPS following framework are utilized for mishap discovery. At the point when mishap happens, this framework sends short message to police, ambulance, adjacent healing facility and relative of patient by means of GSM modem. Message will give longitude and latitude values of accident geographical area so that location coordinates of accident can be determined.

II. SYSTEM DESIGN AND PARTICULARS

When accident arises, short messages containing related information is sent to the ambulance, hospital, police, and relative of the victim person. So the rescue team in the ambulance can immediately trace the location by putting

geographical location coordinates in Google earth application or any other GPS viewer application. After confirming the location of accident spot, the ambulance unit will start its rescue operation. If the person meets with a small accident or if there is no serious threat to anyone's life, then the alert message can be terminated by the driver by a switch provided in order to avoid wasting the valuable time of the hospital team. The proposed system comprises of four primary units including vehicle unit, ambulance unit, main server with laptop and the node circuit (traffic junction unit) which coordinates with each other and ensures that the emergency vehicle/ambulance reaches the hospital with no time slack.

A. Vehicale and Control Unit

Vehicle unit is the key part of proposed system and situated in the vehicle itself. ARM LPC-2138 controller is the heart of the proposed system. For detection of accidents and related vibrations, MEMS-Accelerometer sensor is adopted in the vehicle. When vehicle is sucked with any accident strike, MEMS-accelerometer sensor will detect the vibrations and this vibration intensity can be distinguished against the type of accident. Block diagram of vehicle unit is shown in fig.1. If vibrations are major then accident is happened, and this analog vibrational input is supplied to ARM controller. Other parameters related to accidental vehicle including engine temperature, speed and fuel levels are also monitored. Accident place and related coordinates can be easily detected by means of GPS system which is present over the vehicle unit itself. GPS transmitter gives the latitude, longitude, date, time etc parameters. All of this information is transmitted to the

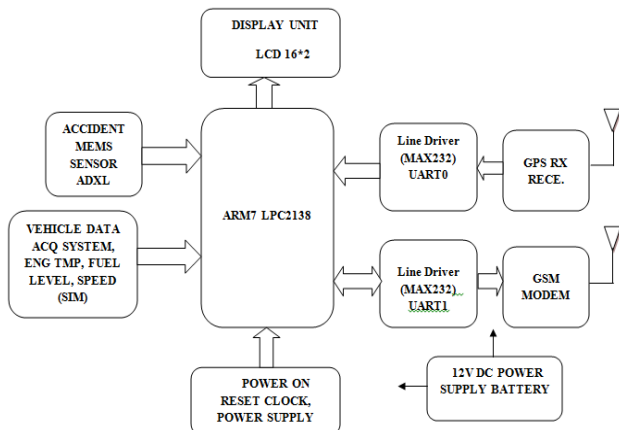


Figure.1. Block diagram of vehicle unit.

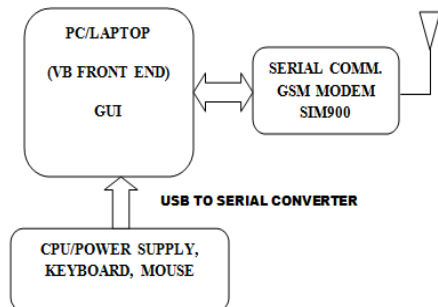


Figure.2. Block diagram of server and control unit.

ambulance, police, hospital and relatives of patients by using GSM modem with the help of main server or laptop unit which may be placed in the vehicle or out of the vehicle. Block diagram of server and control unit is shown in fig. 2. An accelerometer MEMS is a sort of sensor which gives an analog information while moving in X, Y, Z bearing or might be X, Y course just relies on upon the kind of the sensor. At event of tilt these sensors toward that path then the information at that

comparing pin will change in the analog form. Control unit consist of data base of all the contact numbers and details of geographical areas. All the messages are routed by using control unit by means of GSM technology.

B. Ambulance Unit

When ambulance and hospital unit receives the accidental information, then the ambulance and rescue team will serve this message by sending the ambulance towards the accident area. Geographical details of accident are can be accessed by means of GPS system suited in the ambulance rescue vehicle. Block diagram of ambulance unit is shown in fig. 3. Serving ambulance is also routed by using shortest path and low density traffic regions so that ambulance can reach with very small time to save the lives of victims in the accidents. Circuit diagram of the prosed system is shown in fig. 4. Consisting the vehicle unit, sensors present over the vehicle unit and ambulance unit.

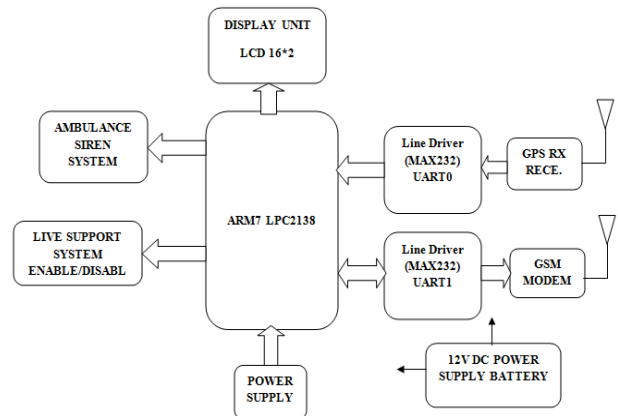


Figure. 3. Block diagram of ambulance unit.

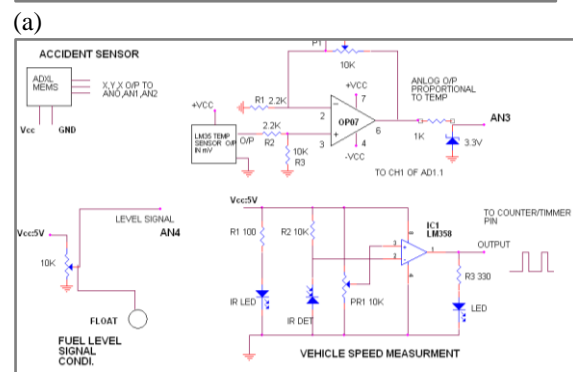
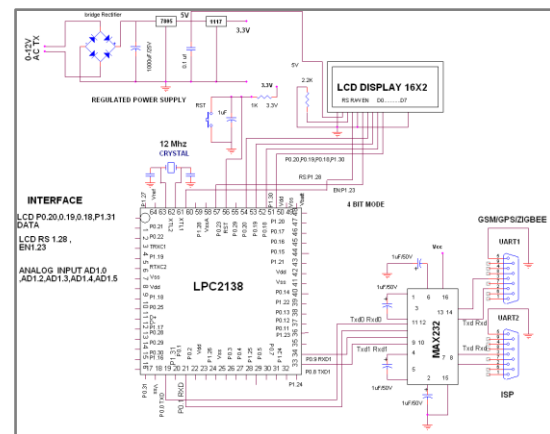


Figure.4. Circuit diagrams of prosed system with: (a) Vehicle and ambulance unit, (b) Vehicle engine parameters detection.

C. GSM and GPS Modems Used in Vehicle and Ambulance Unit

In proposed system, GSM 800/900 modem with model SIM 900A is used. GSM modem is interfaced with ARM by using inbuilt UART port of ARM controller as shown in fig.5.

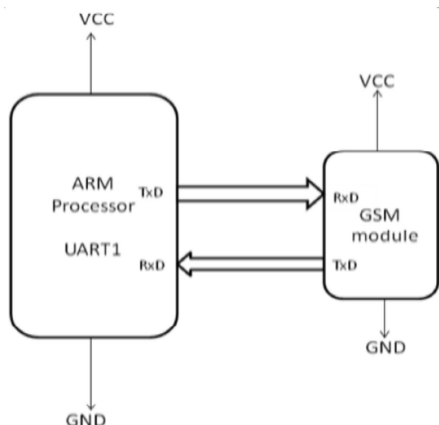


Figure.5.GSM modem interfacing.

GPS modem of GY-NEO6MV2 is used having L1 Band SPS GPS capabilities. It supports 12 channel accessing with 154dB-m of tracking sensitivity. GPS modem interface with ARM is shown in fig.6.

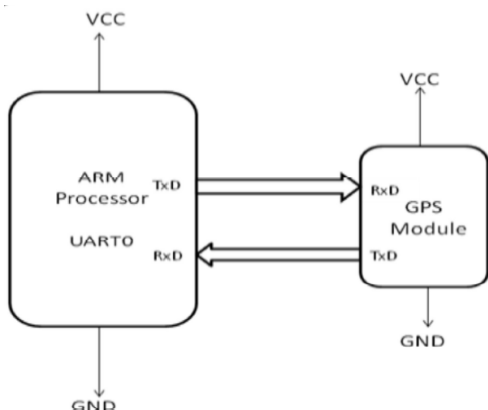


Figure. 6. GPS modem interfacing.

D. Node Circuit Unit Interfacing

The node circuit unit consist of computer database and GSM modem interacting capabilities. When accident message is received from the control station, it will acknowledge the ambulance and police station offices and rout out the necessary data of longitude, latitude, speed of the vehicle along with smallest possible path for reaching at accidental area.

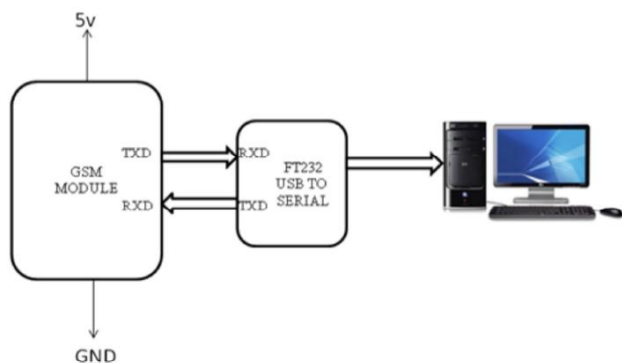


Figure.7. Node circuit unit interfacing

III. SYSTEM OPERATION

When accident is occurred, MEMS vibration sensor will be activated by means of amount of vibrations received from the

accident. Density of vibrations can be in analog form so that signal conditioning circuitry is adopted for vibration sensor which is situated at front-back end and sides of vehicle.

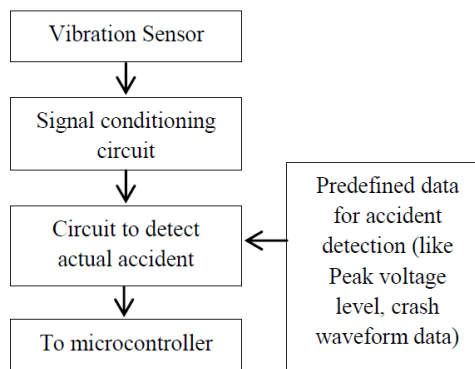


Figure. 8.Vibration sensor parameter.

Signal conditioning behind the MEMS sensor is shown in fig. 8. MEMS are used to determine the amount of shocks and vibrations during the accident. Error voltage thresholds are defined for detection and consideration of accident. Output of MEMS accelerometer is shown in fig. 9. High voltage variations can be marked as an occurrence of accident and then this information can be routed by using GSM module to the control station with all the related geographical details by means of GPS modem. Algorithm of the operation after occurrence of an accident is shown in fig. 10.

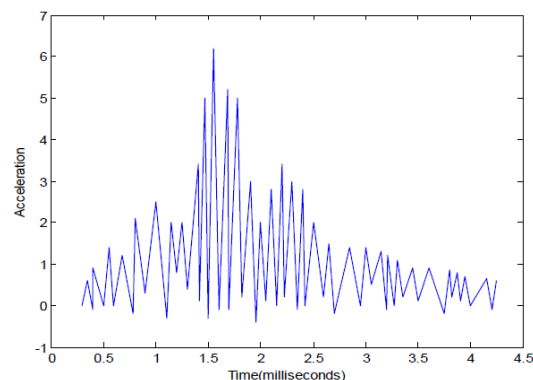


Figure. 9.MEMS Accelerometer sensor output.

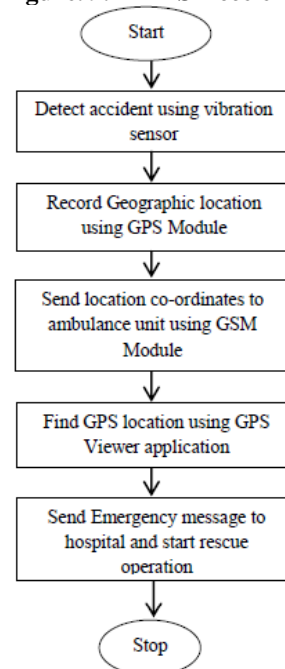


Figure. 9.Flowchart of the operation after detection of an accident.



Figure.11. Accident detection and location over the LCD display.



Figure. 12. Vehicle engine parameters

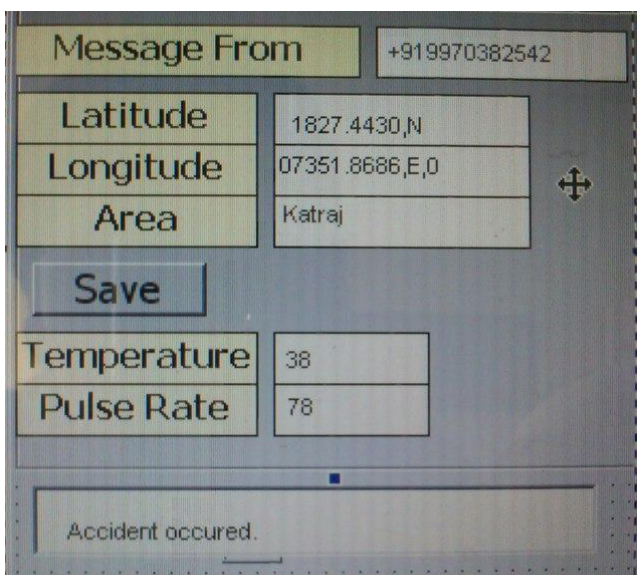


Figure. 13. Accident data at control unit of server section.

As mentioned in the flowchart, operation of proposed system is summarized in fig.12 and 13. Accident data at the server section will allow to send the messages to execute the ambulance rescue operations timely.

Complete project setup including vehicle unit and ambulance unit is shown in fig. 14.

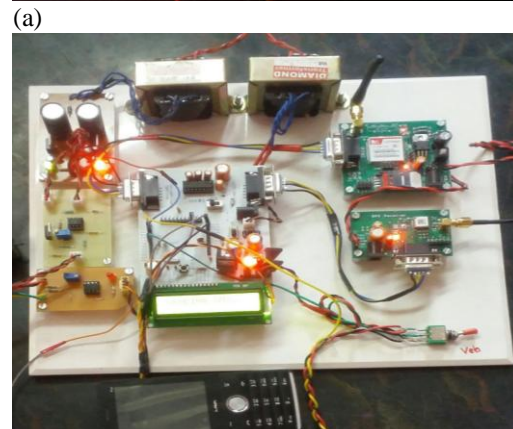
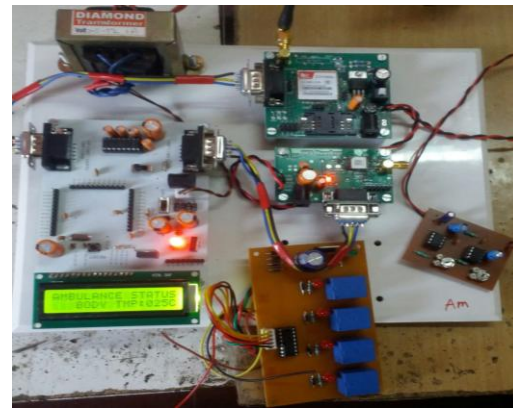


Figure.16. Photograph of modeled project for : (a) Vehicle unit, (b) Ambulance unit.

IV. CONCLUSION

Vehicle accident spotting and monitoring by utilizing MEMS accelerometer sensors and GPS tracing as been proposed. Presented system will recognize the accidents automatically and will provide an acceptable route to ambulance vehicles so that rescue team could arrive at their end in timely to save the human lives stacked with an accident. This type of system can be viably actualized to a whole city alternately nations with huge population number like India to achieve superior outcomes to reduce the death rate caused by accidents.

V. REFERENCES

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