

Smart Alert System For Vehicles

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Abstract: 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 take place frequently which causes huge loss of life and property because of the poor emergency facilities. Road accidents are one of the major causes of mortality around the world and over 1,300,000 people are killed annually in the road accidents. Most of fatal accidents occur on the roads outside the city. Some of the casualties are killed in the crash moment and the others after the accident, mostly due to late arrival of rescue groups. The late arrival of rescue groups is mostly because of the lack of rapid and timely notice from accident. The aim of our work is to find the vehicle accident location by means of sending a message using a system which is placed inside of vehicle system. So in this work we are using the arduino microcontroller ATMEGA 2560 for cost effective and also for easy understanding. Here we used embedded C programming for better accuracy and GPS and GSM modules which helps to trace the vehicle anywhere on the globe. The exact location of the vehicle is sent to our remote devices (mobile phones) using GSM modem. Proposed system contains single-board embedded system that is equipped with GPS and ZigBee, along with microcontroller that is installed in the SAS vehicle.

Keywords: GSM, GPS, zigbee transceiver with atmega2560

I. INTRODUCTION

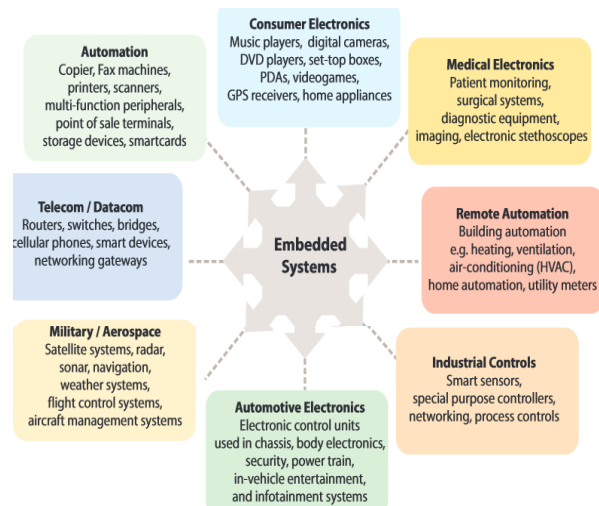
Today, it is very difficult to find the location of an accident and to dispatch the first responders on time. It's more difficult for the lives of victims until any one inform about the accident to hospitals or police or family.

To avoid this problem, different technologies like GSM/CDMA and Global positioning systems are used. The SAS based accident identification module contains a Micro Electro Mechanical System(MEMS) like vibrating sensor, human thermal detection sensor, LCD, buzzer, zigbee transceiver, GSM module and a GPS module connected to the processor unit. At the moment of accident, the vibration sensor or thermal sensor detects the accident and gives the information to the microcontroller, which will display the information on the nearby vehicles, switch on the buzzer unit through the zigbee transceiver and to the police and owner/parents through GSM network. Here the system also provide the user to track the vehicle location, when he/she required. Here the position of the vehicle is also send to the mobile in terms of latitude and longitude with the help of GPS.

1.1.EMBEDDED SYSTEMS

An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. 98 percent of all microprocessors are manufactured as components of embedded systems.

Embedded systems are commonly found in consumer, cooking, industrial, automotive, medical, commercial and military applications. Telecommunications systems employ numerous embedded systems from telephone switches for the network to cell phones at the end-user. Computer networking uses dedicated routers and network bridges to route data. Consumer electronics include personal digital assistants (PDAs), mp3 players, mobile phones, videogame consoles, digital cameras, DVD players, GPS receivers, and printers. Household appliances, such as microwave ovens, washing machines and dishwashers, include embedded systems to provide flexibility, efficiency and features. Advanced HVAC systems use networked thermostats to more accurately and efficiently control temperature that can change by time of day and season. Home automation uses wired- and wireless-networking that can be used to control lights, climate, security, audio/visual, surveillance, etc., all of which use embedded devices for sensing and controlling.



Embedded systems are designed to do some specific task, rather than be a general-purpose computer for multiple tasks. Some also have real-time performance constraints that must be met, for reasons such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs.

1.2 ROAD ACCIDENTS

“The world’s first road traffic death involving a motor vehicle is alleged to have occurred on 31 August 1869. Irish scientist Mary Ward died when she fell out of her cousins’ steam car and was run over by it”.

A traffic collision, also known as a motor vehicle collision (MVC), traffic accident, motor vehicle accident, car accident, automobile accident, road traffic collision, road traffic accident, wreck, car crash, or car smash occurs when a vehicle collides with another vehicle, pedestrian, animal, road debris, or other stationary obstruction, such as a tree or utility pole. Traffic collisions may result in injury, death and property damage. Worldwide, motor vehicle collisions lead to death and disability as well as financial costs to both society and the individuals involved. Road injuries resulted in 1.4 million deaths in 2013, up from 1.1 million deaths in 1990. About 68,000 of these occurred in children less than five years old. Almost all high-income countries have decreasing death rates, while the majority of low-income countries having increasing death rates due to traffic collisions. Middle-income countries have the highest rate with 20 deaths per 100,000 inhabitants, 80% of all road fatalities by only 52% of all vehicles. While the death rate in Africa is the highest (24.1 per 100,000 inhabitants), the lowest rate is to be found in Europe (10.3).

A study suggested, 57% of crashes were due solely to driver factors, 27% to combined roadway and driver factors, 6% to combined vehicle and driver factors, 3% solely to roadway factors, 3% to combined roadway, driver, and vehicle factors, 2% solely to vehicle factors, and 1% to combined roadway and vehicle factors. Reducing the severity of injury in crashes is more important than reducing incidence and ranking incidence by broad categories of causes is misleading regarding severe injury reduction.

1.3.OBJECTIVE

- ✚ Its eliminates the time taken for the first aid victims, in reaching the severe accident occurred places.
- ✚ To alert the nearby vehicles through the ZIGBEE TRANSCEIVER, away from the line of sight.
- ✚ Easy Identification of the crashed vehicles in the places like hill stations with fog with the help of GPS LOCATION accessing services.
- ✚ Removes the false alert message service through the GSM .

II. RELATED WORK

The ARM7(LPC2148) microcontrollers are based on a 32/16 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/2/4/6/8 are ideal for applications where miniaturization is a key requirement, such as access control and point -of-sale.

A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, SSP to I2Cs and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

2.1 ANALYSIS

The main aim of is to design an ARM based GSM and GPS accident detection and tracking system. In this project LPC 2148 processor is used. When an accident occurs, MEMS gets disturbed and sends output signal to the processor LPC2148 so that the location is identified using GPS. If any fire accident occurs the fire sensor detects the fire and inform to the processor which will send the details to parents/police/ambulance through GSM network. The also provides with alcoholic sensor which will detects the drivers alcoholic percentage and control the ignition of the vehicle.

As the ARM processor requires 3.3 volts of supply, so a step down transformer of 230/12V is used to get the required AC output. To convert that AC supply to DC supply is done by using rectifier. DC output consists of ripples, to remove those ripples we use filter capacitors. To get output voltages of +5v & +12v we are using voltage regulators 7805 & 7812. Finally 3.3v is given to the ARM processor for functioning. ARM processor consists of two modes of operation i.e; program mode and run mode. Program mode is used for dumping of the program into ARM processor from any external device such as computer. Run mode is used for the execution of program. For the purpose of accident detection we use run mode of operation. When an accident occurs disturbance is created in MEMS which indicates a change in an angle of X-Co-Ordinate gives an analog signal output. This analog signal is converted into digital signal by using internal ADC of and hence the digital signal is given to ARM processor.

We make use of three pins of MEMS namely X-Co-Ordinate pin(1),read pin(2),write pin(3). X-Coordinate pin is used for the indication of change in angle; read pin gives the information or data to the ARM processor. When an ARM processor reads the signal from MEMS it indicates that an accident has been occurred in order to locate the spot of accident we use GPS, output of GSM and GPS is given to MAX -232 .MAX-232 is a level converter which changes RS-232 to TTL and vice-versa. Because the LPC 2148 understands TTL format. When accident occurs GPS is activated and it gives the values of location in terms of Latitude and Longitude.

For example:

Accident occurred at location of
Latitude=1641.4095
Longitude=1725.3602

The same above values are sent to the mobiles using GSM for which the mobile numbers are dumped in the program. At the same time those values are displayed on LCD Display. Immediately after the accident detection, the air bag is released. Release of air bag is shown in your project by glowing LED. Hence by using MEMS,GSM and GPS accident location is detected and the information is sent to the mobile as well as LCD Display.

2.2.DRAWBACKS

To further increase the usage of automatic accident detection and notification systems, this system can be used to indirectly detect accidents through sensors, such as accelerometers. In future we can interface different sensors with this paper, such as alcohol detector, drowsiness detector, heart rate detector, etc. In terms of these we can really prevent accident and save life. Security sensors to identify theft can also be added. It can be reprogrammed to switch off vehicle and track the vehicle in theft.

III. PROPOSED WORK

Vehicles are one of the important sources of transportation. Number of death incidents occurs during night and in hill stations as well as a places with fog which has been recently increased. Many cases are due to driver habits and unawareness, while the people are sleeping in the vehicles or when the vehicles driven in the accidental zones. When these happen in the places where the medical team can't reach at time, alert the vehicles which approaching the accident occurred place by a text message. Its done with the help of zigbee protocol.

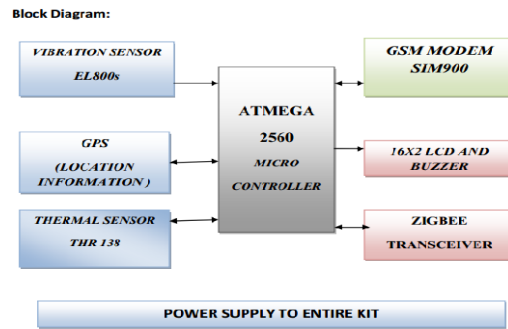


Fig: B LOCK DIAGRAM for real time module

3.1 ZIGBEE TRANSCEIVER

Zig Bee is a specification for a suite of high level Communication protocol using small, low-power digital radios based on an IEEE 802.11a standard for personal area networks. Zig Bee operates in the industrial, scientific and medical (ISM) radio bands free band Data transmission rates vary from 20 to 250 kilobits/second. This enough to transmit the key content from clove to computer. Zig Bee is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. Low power-usage allows longer life with smaller batteries. Mesh networking provides high reliability and more extensive range. The technology is intended to be simpler and less expensive than other WPANs such as Bluetooth.



Features of the Zigbee:

- ✚ TX Peak Current: 40 mA
- ✚ RX Current: 40 mA (@3.3 V)
- ✚ Power-down Current: < 1 μ A
- ✚ Indoor/Urban: up to 133 ft (40 m) Outdoor line-of-sight: up to 400 ft (120 m)
- ✚ Transmit Power: 2 mW (3 dBm)
- ✚ Receiver Sensitivity: -96 dBm Dimensions: 24mm x 28mm x 9mm (0.94in x 1.1in x 0.3in)3.24g (0.14oz).

3.2 GSM MODULE

The Arduino GSM Shield allows an Arduino board to connect to the internet, make/receive voice calls and send/receive SMS messages. The shield uses a radio modem M10 by Quectel. It is possible to communicate with the board using AT commands. The GSM library has a large number of methods for communication with the shield.

The shield uses digital pins 2 and 3 for software serial communication with the M10. Pin 2 is connected to the M10's TX pin and pin 3 to its RX pin. See these notes for working with an Arduino Mega, Mega ADK, or Leonardo. The modem's PWRKEY pin is connected to Arduino pin 7. The M10 is a Quad-band GSM/GPRS modem that works at frequencies GSM850MHz, GSM900MHz, DCS1800MHz and PCS1900MHz. It supports TCP/UDP and HTTP protocols through a GPRS connection. GPRS data downlink and uplink transfer speed maximum is 85.6 kbps.

3.2 GPS MODULE

A GPS navigation device is a device that accurately calculates location by receiving information from GPS satellites. Initially it was used by the United States military, but now most receivers are in automobile and smart phones.

The GPS is a satellite –based navigation system made up of a network of a minimum of 24, but currently 30, satellites placed into orbit by the U.S. Department of Defence.

GPS devices may have capabilities such as:

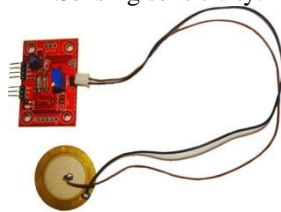
- 1)Maps, including street maps, displayed in human readable format via text or in a graphical format,
- 2)Turn-by-turn navigation directions to a human in charge of a vehicle or vessel via text or speech,
- 3)Directions fed directly to a autonomous vehicle such as a robotic probe,

- 4)Traffic congestion maps and suggested alternative directions,
- 5)Information on nearby amenities such as restaurants, fueling stations and tourist attractions.

GPS devices are also used by private investigators to give more information to their clients. They will plant their own GPS devices to learn about their target. Moreover, some rental car services use the same technique to prevent their customers from going out of their targeted area. They charge additional fees for those who violate their rules. They get this information from the car's GPS devices.

3.4 VIBRATION SENSOR:

- ✓ Working voltage: 12VDC
- ✓ Operating current: 10mA(Max)
- ✓ Stand by current (When at rest): 0.3mA(Max)
- ✓ Output mode: high/low voltage signal level(alternative)
- ✓ Sensing sensitivity: Adjustable



3.5 THERMAL SENSOR

Its trigger when the vibration output is high and its provide by the microcontroller . Once the output of this sensor exceed the threshold level its output is high say(1). Then the microcontroller provides trigger to the GPS module and then perform the process.



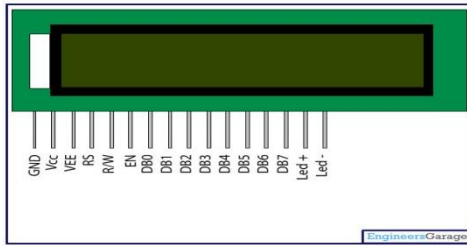
3.6 Microcontroller

Due to the requirement of the 3 receiver and transmitter pins(i.e. Rx and Tx). The ATMEL series as well as the PIC microcontrollers can't be used. In this situation the arduino controller used ATMEGA 2560 which has about 100 more pins, with the four Rx and Tx pins . Therefore usage of this lower end process, the cost of the project be reduced.



3.7 LCD Display

The 16*2 Character LCD display is used to display the text message that received.Initially the LCD will display there is “no alert”. When the vehicle enters the zone of accident detected, it will display an Alert message as “EMERGENCY<GPS location>” in a two linesof the display.This Display uses three Control pins and 8 Data pins from the microcontroller. The port to be assigned for the purpose of the data lines is P1.



3.8 Buzzer

The Buzzer is used to alert the people who near to the vehicle. Whenever the meter reaches threshold level it's the microcontroller inside the car, the microcontroller will send a signal for buzzer outside the car.



IV. OPERATION.

Initially, the SAS kit were active. Once the accident were occurred, its checks for the vibration sensor output if its beyond the threshold level it will be high and again look for the thermal detection if its output too high then makes the controller to access the GPS location and transmits it to the mobile phones with the help of GSM module.

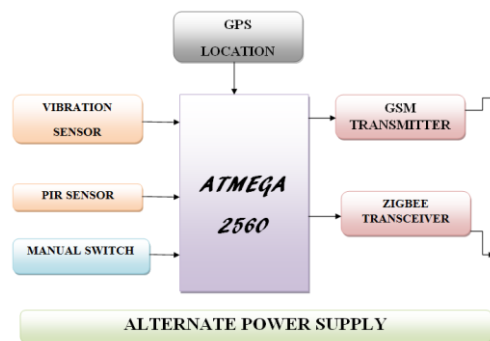


Fig: BLOCK DIAGRAM for Transmitter side

Through the Zigbee Transceiver it can send the nearby vehicles which presents within the 1.2 miles around 254 nodes can get the ALERT message says " accident occurred within the region"An alternate power supply given to kit in order to avoid the problem of battery failures in vehicles. And therefore, their lives been safe by them.Their programs are verified with the help of the arduino software and simulation done with the help of protheus.

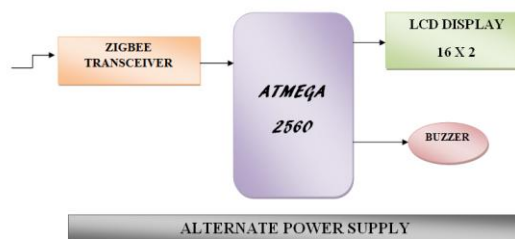


Fig: BLOCK DIAGRAM for RECEIVER side

4.1 Zigbee and GPS simulation:

Zigbee and GPS simulation were done with the help of *protheus software* for the interfacing and working checkout. Coding done through the *arduino software*.

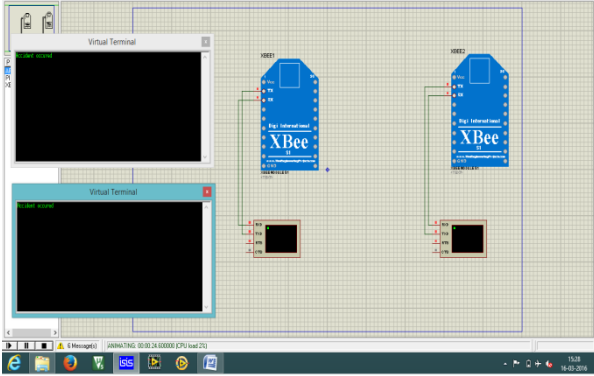


Fig: zigbee module simulation with protheus

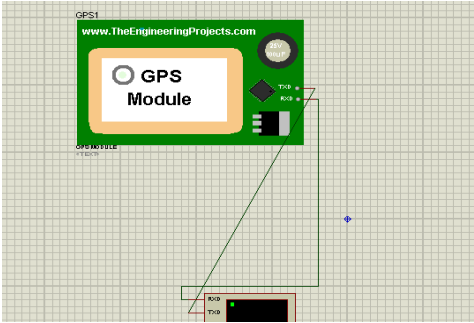


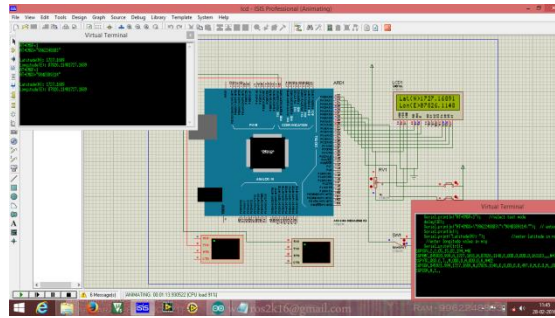
Fig: GPS module simulation with protheus

V. CONCLUSION

The main objective of this project is to detect the vehicle accident and transmit the location of the accident with the information of victim and type of accident to the medical help centre and police control room. So medical help centre and police control room will get the exact location by the geographical co-ordinates transmitted via message with the help of map.

```
sketch_feb25a.g  
delay(100);  
Serial.println("AT+CHGR=1");  
delay(10);  
Serial.println("AT+CHGS=7200516502\1\9962248803\'");  
Serial.println();  
Serial.print("Latitude(N): ");  
Serial.println(Latitude);  
Serial.print("Longitude(E): ");  
Serial.println(Longitude);  
Serial.write(a);  
temp=0;  
i=0;  
j=0;  
k=0;  
delay(20000);  
}  
void serialEvent()  
{ while (Serial.available())  
{ char inChar = (char)Serial.read();  
str[i]= inChar;  
i++;  
if (i < 7)  
{ if(str[i-1] != test[1-1])  
{ i=0;  
}  
}  
if(i >=60) {  
temp=1;  
}  
}  
}
```

And with the help of zigbee transceiver we can transmit the alert message to nearby vehicles around 1.2miles those who are all not in line of sight. So, it can increases the rate of survival. As there is a scope for improvement and as a future implementation we can add a wireless webcam for capturing the images which will help in providing driver`s assistance.



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