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Accident Alert and Vehicle Tracking System using GPS and GSM

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ABSTRACT

Nowadays, road accidents are very high. On time medical aid can help in saving lives. Integrated engineering is a latest trend to solve problems. To be able to design a product using an integrated technology will be beneficial to any engineering problems and a huge contribution to the community. An important indicator of survival rates after an accident is the time between the accident and when emergency medical personnel are dispatched to the accident location. By eliminating the time between when an accident occurs and when the first responders are dispatched to the scene decreases mortality rate and can save lives. One approach to eliminating the delay between accident occurrence and first responder dispatch is to use in vehicle automatic accident detection and notification systems. Also tracking a vehicle in case of any theft has become a tough job. This system aims to alert the near and dear ones of the person in the vehicle about the accident to provide immediate medical aid. In this System when a vehicle meets with an accident immediately Impact sensor, Piezoelectric Sensor Transducer, Micro electro mechanical system (mems) will detects the signal and sends it to Arduino (Atmega328P). Immediately microcontroller sends the signal to GPS module to give the exact value of the geographical coordinates which contains the value of longitude, latitude and altitude. After that the microcontroller sends the alert message through the GSM module to the near and dear ones. Also in case of any theft our project facilitates the owner to get his vehicle's position in terms of Latitude and Longitude and a link directing to the google maps when the owner sends a SMS to the SIM used in the system.

Keywords: Accident alert, Vehicle tracking, Piezoelectric sensor transducer, MEMS, SMS, GSM, GPS.

1. Introduction

The motor vehicle population is growing at a faster rate than the economic and population growth. Accidents and the death rate due to road accidents .Most of the accident deaths that happens are due to the lack of immediate medical assistance, on the roads like express highways. A facility for providing immediate medical assistance to the accident area can reduce the fatality to a greater extends. Thus comes the idea of an alert system that senses the accident and its seriousness to alert the medical center, to the passenger's near and dear ones for providing ambulance or medical aid to the accident area.

The proposed system will check whether an accident has occurred and identify the seriousness of the injury to the accident victim/driver. Once the decision of serious accident has taken, the system will alert the victim's dear ones via short message service and they could inform the rescue team so that the rescue team can rush to the spot immediately without any delay as the correct location will be communicated by the mobile phone of the accident victim.

In the past few years, accident detection and warning systems have been extensively studied. Research work in this field has proposed a telematics model, one of the systems is designed to capture the location of the vehicle through a GPS receiver, send the location information to the owner's mobile phone number via SMS, and then send it to the telematics operator server via GPRS. Another prototype where a system for Vehicle Monitoring Controlling and Tracking has developed by using Android Application. The Details regarding Tracking are updated in Android App which user has to install in his device. In one of the research work prototype architecture is also proposed to improve the survival chances of passengers in traffic accidents. The system uses the functions provided by

car-to-car communication technology to provide automatic detection, reporting and assistance for passengers in traffic accidents. Here a low cost alert system is proposed to provide immediate medical aid to the accident victims by alerting the victim's near and dear one's with the exact place of accident through SMS. This system also has a feature of tracking a vehicle location in case of any theft.

2. Embedded Block Units

2.1 The Main Control Module

In this design, we chose a microcontroller board called Arduino uno which is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. ATmega328P microcontroller is the high-performance 8-bit Pico power ,Automatic Voltage Regulator(AVR),RISC-based microcontroller combines 32 KB ISP Flash memory with read-while-write capabilities, 1024B EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented Two-Wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The Arduino uno board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits [1]. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. The Arduino Uno has a number of facilities for communicating with a computer, another Arduino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows serial communication on any of the Uno's digital pins.

2.2 GPS Modem

Exact location on earth can be known GPS latitude, longitude information. The Global Positioning System (GPS) [3] is a space based radio navigation system consisting of a constellation of satellites and a network of ground stations used for monitoring and control. GPS is operated and maintained by the Department of Defense (DOD). The GPS is a constellation of satellites in orbit around the Earth which transmit their positions in space as well as the precise time. It is the receiver that collects data from the satellites and computes its location anywhere in the world based on information it gets from the satellites. The heart of the GPS modem in the system is NEO-6M GPS chip from u-blox. It can track up to 22 satellites on 50 channels a level of sensitivity i.e. -161 dB tracking, while consuming only 45mA supply current. One of the best features the chip provides is Power Save Mode (PSM). It

allows a reduction in system power consumption by selectively switching parts of the receiver ON and OFF. This dramatically reduces power consumption of the module to just 11mA making it suitable for power sensitive applications like GPS wristwatch. This includes pins required for communication with a microcontroller over UART. The module supports baud rate from 4800bps to 230400bps with default baud of 9600.

2.3 GSM Modem

A GSM modem is a device which can be either a mobile phone or a modem device which can be used to make a computer or any other processor communicate over a network. A GSM modem requires a SIM card to be operated and operates over a network range subscribed by the network operator. It can be connected to a computer through serial, USB or Bluetooth connection. The GSM modem has wide range of applications in transaction terminals, supply chain management, security applications, weather stations and GPRS mode remote data logging.

The GSM modem used in the System is SIM900A which is a complete Dual-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications allowing you to benefit from small dimensions and cost-effective solutions. Featuring an industry-standard interface, the SIM900A delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900A can fit especially for slim and compact demand of design.

3. System Features and their Working

3.1 Architecture of the Proposed System

The proposed system consist of accident detection and alert system, vehicle tracking system. The accident detection system will constantly monitor the vehicle and detect whether the vehicle is in normal driving posture or has fallen down or any impact has taken place on the vehicle. When the vehicle accident is detected by means of different sensors interfaced the system then immediately inform the location of the accident to the contact numbers mentioned in the program which is dumped in the microcontroller (Atmega 328P) by making use of the GPS module interfaced in the system. If in case there occurs any theft the owner will sends an SMS to the SIM used in the system any message having a word Track in it for example, Track my Vehicle then the system in return sends an alerting message consisting vehicle's location to the owner. The high level architecture of the system is as shown in the Figure 1 and 2.

3.2 Accident Detection and Alerting System

This system consists of two main parts. The first part detects whether the vehicle has fallen down or met with any impact or any fire accident has taken place. This module consist of three sensors namely, Piezoelectric sensor transducer, MEMS, Smoke sensor. Once the vehicle accident is detected the information is send to the second part of the system. The second part consists of an Arduino uno, GSM module, GPS module. When any of the three sensors gets activated based on the level of impact then the micro-controller Atmega in the Arduino fetches the location from the GPS receiver and sends the corresponding information to the contact number mentioned in the code which is dumbed in the Arduino i.e., to near and dear one's via SMS.

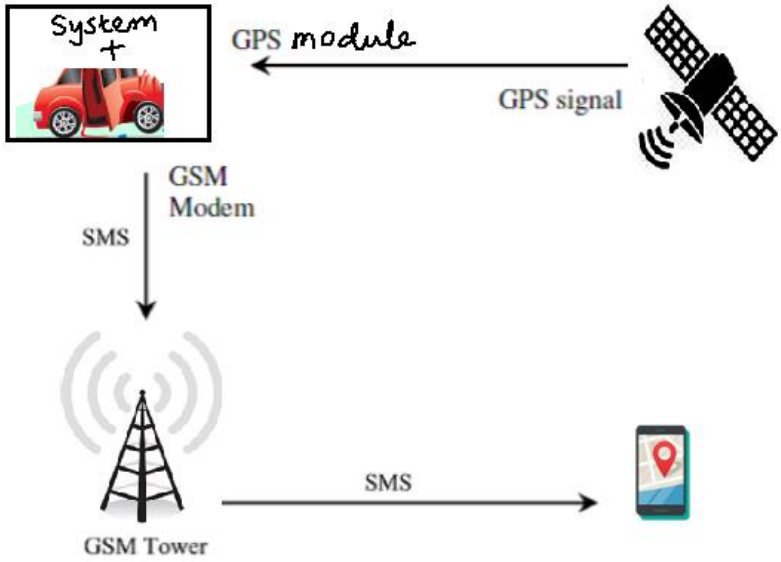

Fig.1. High level architecture of Accident detection

and alerting system

3.3 Vehicle Tracking in case of Theft

This system consists of two ends. The user end and the Vehicle end.

The working process is when vehicle got theft then the use has to send an SMS to the mobile number that is used inside the GSM module of the system, the message can be anything having a substring “Track” for example, Track Vehicle, Track my vehicle etc.

Then the micro-controller reader the input from the GSM module and fetches the location details via GPS module and aging sends the location details to the user mobile number via SMS

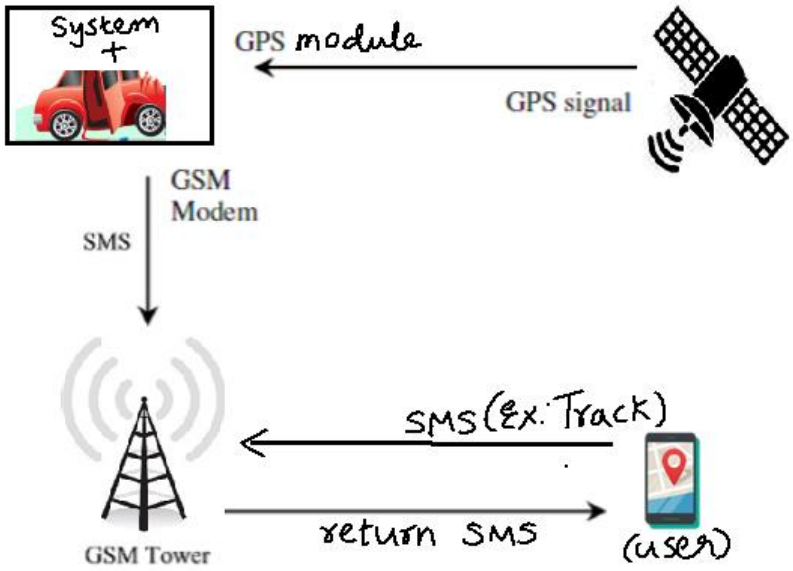

Fig.2. High level architecture of Vehicle Track

in case of Theft

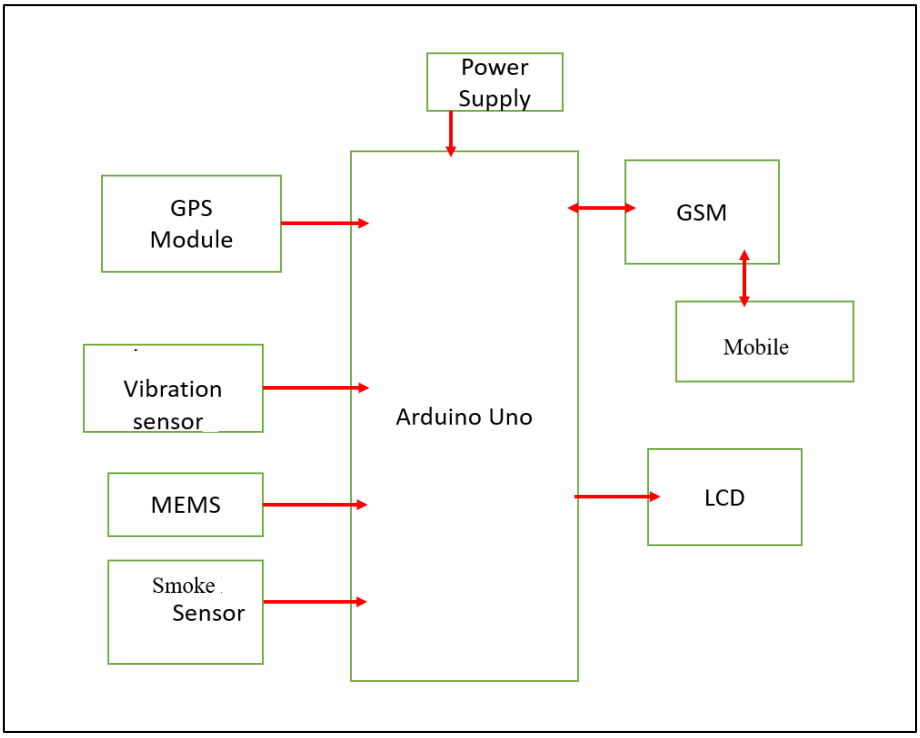

Fig.3. Block Diagram of the System

4. Algorithm for Different Processes in the System

The flowchart describing the operation of the proposed system is as shown in the figure 4.

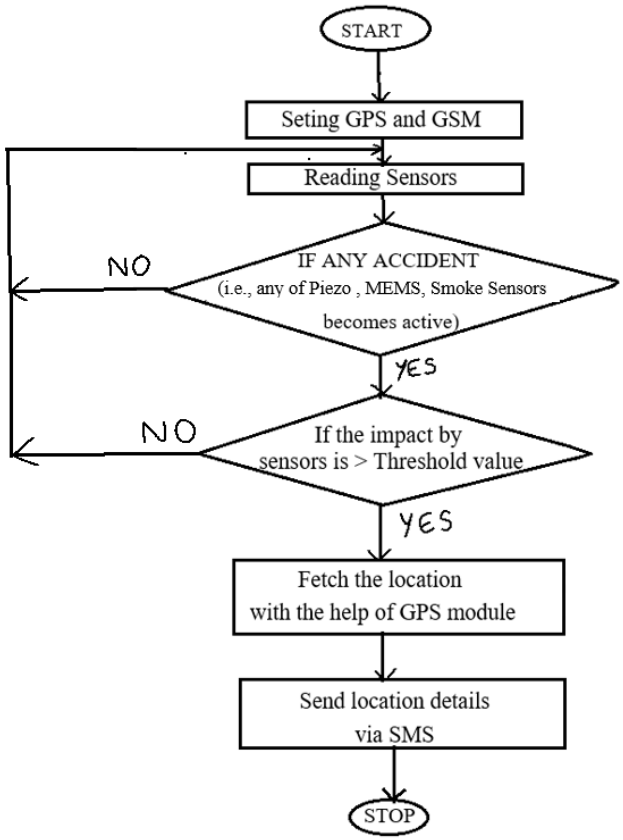

Fig.4. Flow chart of the Accident Detection and Alert System

The flowchart describing the operation of the proposed system is as shown in the figure 5.

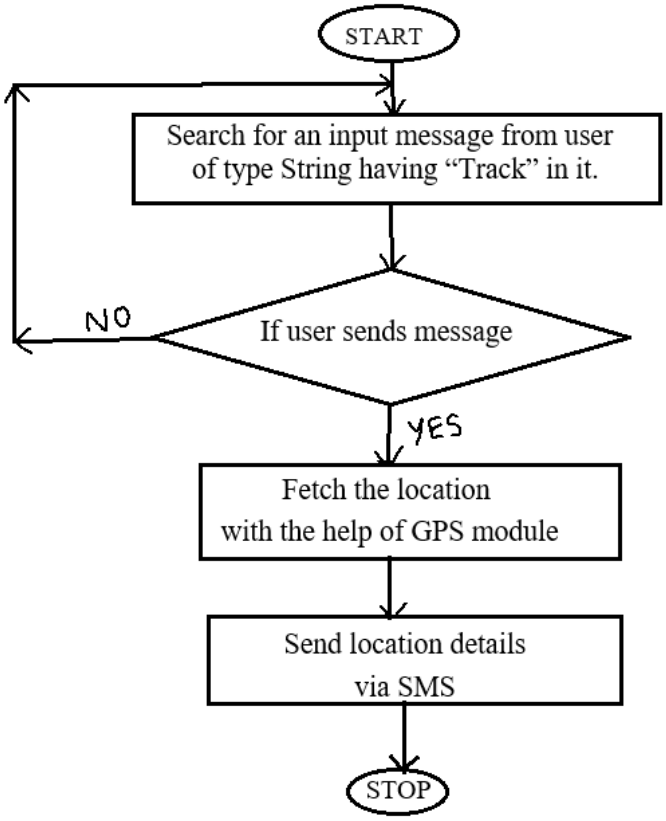

Fig.5. Flow chart of the Accident Detection and Alert System

5. Debugging and Results

A. After interfacing sensors, GSM, GPS module the system is dumped in with a program with the help of Arduino IDE (1.8.12) after debugging successfully

Fig.6. Executing program using Arduino IDE (1.8.12)

B. Message alert when accident occurred

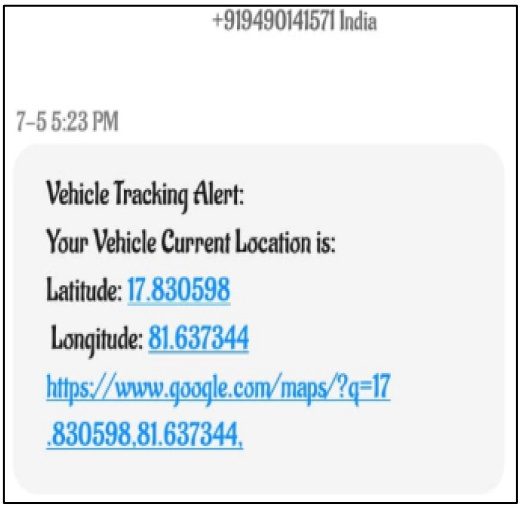

Fig.7. SMS to mobile in case of accident

C. Return Message in case of Theft

The system is programmed to send continuously the location details until the owner reaches the car and press reset on the system so that even though the thief changes his location the owner can get his vehicle's location. The return message is depicted in figure 8.

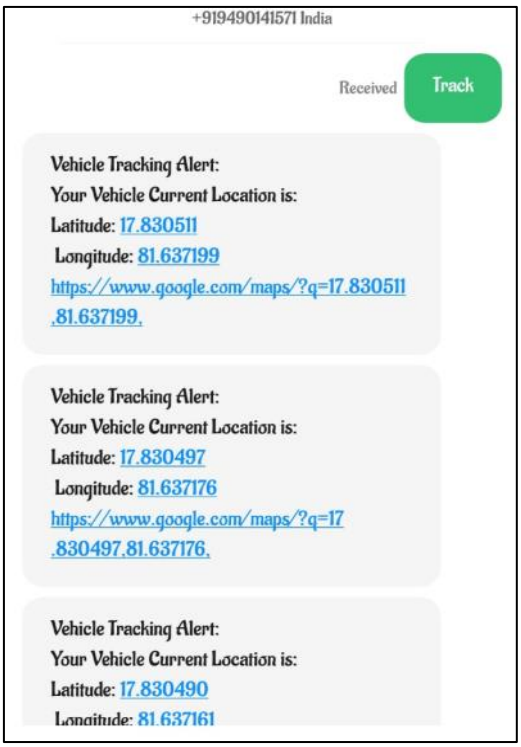

Fig.8. SMS to mobile in case of theft

6. Conclusion and Future Work

Every human life is precious and worth saving. Life should not end on road waiting for help in a crash. This projects shouts out for help where we are unable to shout for help. The system can detect the accident and then alert

the victim's near and dear ones to provide medical aid to accident victim. Piezoelectric Sensor Transducer sensor, fire sensor and MEMS are used to determine whether an accident had occurred also gives the owner with the feature of tracking his vehicle in case of theft. The communications between the system and the responder or owner is done by GSM. We have observed the performance of accident detection and alerting via SMSs using GPS,GSM and sensors It helps not only in finding the location of vehicle but also it is helpful in saving the lives of victims by finding where an accident has happened.

In Future we can interface different sensors with this module, such as Alcohol Sensor , we can Make the Engine off when the Driver is Drunk .Our system can be reprogrammed to off the vehicle's Engine in case of theft. We can use the EEPROM to store the previous Navigated positions and we can navigate up to N number of locations by increasing its memory. We can use this System to assist the traffic. By keeping the kits in the all the vehicles and by knowing the locations of all the vehicles. Accident detection and alert systems are highly relevant in these days and this project aims at developing a low cost solution for the same for the benefit of the society.

Declarations

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Competing Interests Statement

The authors declare no competing financial, professional and personal interests.

Consent for publication

Authors declare that they consented for the publication of this research work.

Availability of data and material

Authors are willing to share data and material according to the relevant needs.

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