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Vehicle Accident Automatic Detection and Remote Alarm Device

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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 accident take place frequently which causes huge loss of life and property because of the poor emergency facilities. Our project will provide an optimum solution to this draw back. An accelerometer can be used in a car alarm application so that dangerous driving can be detected. It can be used as a crash or rollover detector of the vehicle during and after a crash. With signals from an accelerometer, a severe accident can be recognized. According to this project when a vehicle meets with an accident immediately Vibration sensor will detect the signal or if a car rolls over, and Micro electro mechanical system (MEMS) sensor will detects the signal and sends it to ARM controller. 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 conforming the location necessary action will be taken. 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 medical rescue team. This paper is useful in detecting the accident precisely by means of both vibration sensor and Micro electro Mechanical system (MEMS) or accelerometer. 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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1. INTRODUCTION

The high demand of automobiles has also increased the traffic hazards and the road accidents. This is because of the lack of best emergency facilities available in our country. An automatic alarm device for vehicle accident is introduced in this paper. This design is a system which can detect accidents in significantly less time and sends the basic information to first aid center within a few seconds covering geographical coordinates, the time and angle in which a vehicle accident had occurred. This alert message is sent to the rescue team in a short time, which will help in saving the valuable lives. A Switch is also provided in order to terminate the sending of a message in rare case where there is no casualty, this can save the precious time of the medical rescue team. When the accident occurs the alert message is sent automatically to the rescue team and to the police station. The message is sent through the GSM module and the location of the accident is detected with the help of the GPS module. The accident can be detected precisely with the

help of both Micro electro mechanical system (MEMS) sensor and vibration sensor. The Angle of the rolls over of the car can also be known by the message through the MEMS sensor. This application provides the optimum solution to poor emergency facilities provided to the roads accidents in the most feasible way [7].

2. BLOCK DIAGRAM

2.1 Block diagram description

From the Figure 1 the system consists of different modules which are interfaced to the ARM (32 bit) controller. The input power is step down to 12v DC from 230v AC power line by the power supply unit. The main module is the ARM controller which provides high speed processing of the data because of the pipelining technique and its ability to be used as a 16 bit controller called Thumb. The main advantage of using this controller is its better performance with high code density. Whenever the accident occurs the vibrations are sensed by the vibration sensor and these signals are given to the controller through the amplifying circuit. If incase there is an rolls over of the car the angle of the rolls over is detected by the Micro electro mechanical system(MEMS) sensor and it is given as the input to the controller for further processing. As and when the input is received by the controller, the buzzer (alarm) is ON and the message is sent to the rescue team with the help of the GSM module. The rescue team reaches the site of the accident with the help of the location given in the message. The location or the geographical coordinates where the vehicle is present are detected by the GPS module.

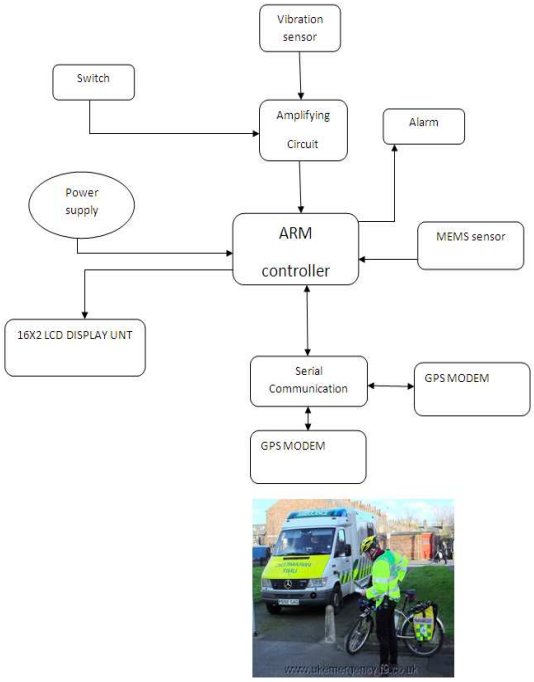

Figure 1. Block diagram of Vehicle Accident Automatic Detection and Remote Alarm Device

An LCD display is provided to get the display of the tasks carried out. In some conditions where there are no casualties or when there is no need of the medical facility to the person, then the messaging can be terminated with the help of the switch provided in order to avoid wasting the valuable time of the medical rescue team. The GSM and GPS modules are interfaced to the ARM controller using serial communication. All the components are interfaced precisely so that the accident detection and alert message sending are fully automated, so that the warning time is reduced significantly.

2.2 Flow Chart

The Flow Chart of the system is shown in the figure 2. It shows the system is initialized on power ON. When the system is detected to be abnormal, it is confirmed that the accident has occurred. The vibration/acceleration of the vehicle is detected to confirm the cause of the accident. As soon as the accident is detected the buzzer (alarm) is ON. The switch is scanned first; if it is a minor accident then the switch is

ON so that messaging is terminated. If it is a major accident, the switch remains OFF and the message is sent automatically to the rescue team after the location is detected by the GPS.

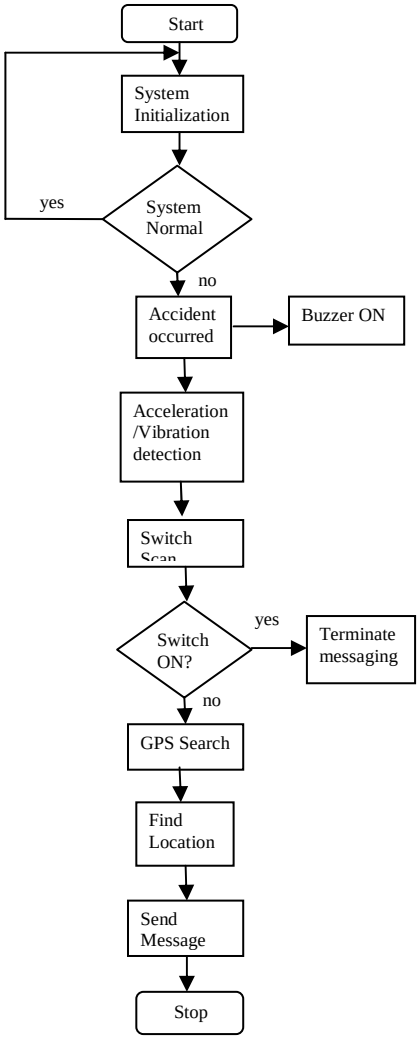

Figure 2. Flow chart of Vehicle Accident Automatic Detection And Remote Alarm Device

3. HARDWARE IMPLIMENTATION

From the figure 3 the design structure consists of a control unit ARM7 LPC2148, accident detection module includes three-axis accelerometer sensor MMA7660FFC, user interface module includes LCD, and a message sending module. When the collision occurs the vibration sensor detects the collision automatically. When the vehicle rolls over the roll angle is given by the Z –axis of the accelerometer sensor. The alert signal is sent when the roll angle is greater the set reference value.

3.1 Control Unit

The LPC2148 microcontroller is 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. It is cost effective and reliable. Pipelining is employed in order to simultaneously operate all parts of processing and memory systems [11].

The CPU has two types of instruction sets Arm (32-bit) which gives maximum performance and Thumb (16-bit) which gives maximum code density. The major advantage of ARM is its ability to manipulate 32-bit integers with a single instruction. The main advantage of Thumb is its ability to switch back to ARM which gives high speed to operate fast interrupts and other algorithms. This provides better performance than 16-bit architecture, and better code density than a 32-bit architecture.

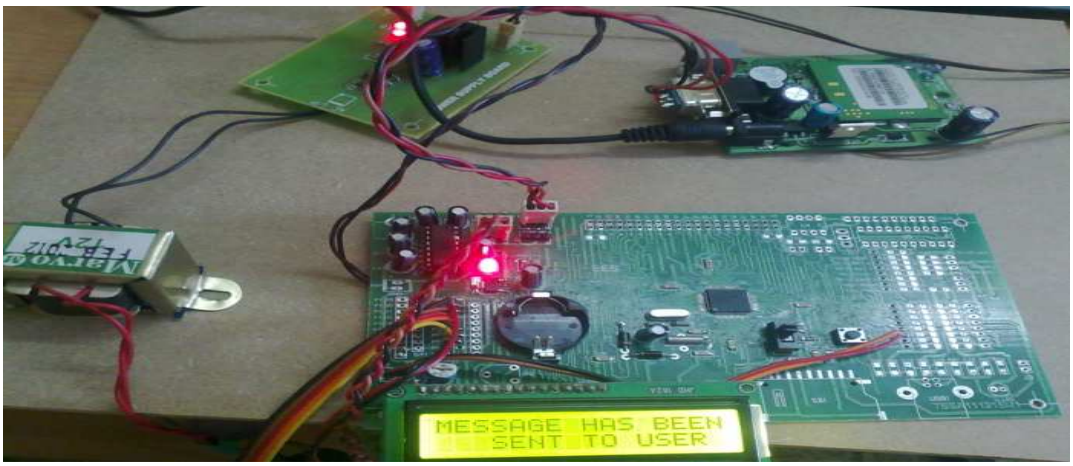

Figure 3. Hardware implementation of Vehicle Accident Automatic Detection And Remote Alarm Device

3.2 GPS Module

The Global Positioning System (GPS) is a satellite based navigation system that sends and receives radio signals. A GPS receiver acquires these signals and provides the user with information. Using GPS technology, one can determine location, velocity and time, 24 hours a day, in any weather conditions anywhere in the world for free. GPS was formally known as the NAVSTAR (Navigation Satellite Timing and Ranging). Global Positioning System was originally developed for military. Because of its popular navigation capabilities and because GPS technology can be accessed using small, inexpensive equipment, the government made the system available for civilian use. The USA owns GPS technology and the Department of Defense maintains it. The basis of the GPS technology is a set of 24 satellites that are continuously orbiting the earth. These satellites are equipped with atomic clocks and send out radio signals as to the exact time and their location. These radio signals from the satellites are picked up by the GPS receiver. Once the GPS receiver locks on to four or more of these satellites, it can triangulate its location from the known positions of the satellites. It is a high performance, low power satellite based model. It is a cost effective and portable system which accurately detects the location [13].

3.3 GSM Module

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA. It operates at either the 900 MHz or 1,800 MHz frequency band. It supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS (Short Message Service).

The message sending module is SIM300, it is a Tri-band GSM/GPRS that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz. SIM300 provides GPRS multi-slot class 10/ class 8 (optional) capability and supports the GPRS coding schemes. The SIM300 provides RF antenna interface with two alternatives: antenna connector and antenna pad. The antenna connector is MM9329-2700. And customer's antenna can be soldered to the antenna pad. The SIM300 is designed with power saving technique, the current consumption to as low as 2.5mA in SLEEP mode. The SIM300 is integrated with the TCP/IP protocol, Extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for data transfer applications. Both GPS and GSM are interfaced to the control unit using serial communication protocol [10].

3.4 Accident Detection Module

It consists of a three-axis accelerometer sensor MMA7660FFC with sensitivity +/- 1.5g, with digital output. It is interfaced to the control unit by I2C (Inter Integrated circuit) protocol. It is low cost and has high shocks survivability (10,000 g). It has low current consumption (0.4 microamp) and low power consumption analog voltage (2.4v-3.6v) and line-digital voltage (1.71v-3.6v)> It has an auto sleep / wake feature for low power consumption. Tilt orientation detection can be done accurately.

4. RESULTS AND COMPARISIONS

This paper gives a diffent way of approaching the problem. The accident location can be located easily and the detection of accident is precise unlike the prior approaches, where detection of accident is done by either of the two sensors. In this approach the accident is detected by both the vibration and microelectro mechanical sensor and there is an alternative way provided to stop the whole process of meassaging through a switch. Where as the other approaches provide only one way of detecting the accident. Hence this paper has an edge over the other earlier approaches.

5. CONCLUSION

With the advent of science and technology in every walk of life the importance of vehicle safety has increased and the main priority is being given to reduce the alarming time when an accident occur, so that the wounded lives can be attended in lesser time by the rescue team. This paper provides the design which has the advantages of low cost, portability, small size and easy expansibility. The platform of the system is ARM along with MEMS, Vibration sensor, GPS and GSM, interfacing which shortens the alarm time to a large extent and locate the site of accident accurately. This system can overcome the problems of lack of automated system for accident location detection. Consequently, the time for searching the location is reduced and the person can be treated as soon as possible which will save many lives. This system will have broad application prospects as it integrates the positioning systems and the network of medical based services. The accident can be detected by both vibration sensor and MEMS sensor which will give the accurate information. The controller will process the data, as soon as input is received by the controller the alarm is ON and message is sent through the GSM module. The geographical coordinates and the time of the site of the accident is detected by the GPS module. An alternate condition is given by pressing a switch, in order to interrupt the flow of sending the message in case of no casualty; this will help to save time of medical rescue team and unnecessary alarming which creates havoc in such unusual conditions. The accident location automatic detection will help us to provide security to the vehicles and to the lives of the people. The high priority is given to the lives of the people. Hence, this paper provides a feasible solution to traffic hazards and it gives security to vehicle and reduces loss of valuable lives and property.

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