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Vehicle Accident Detection and Messaging System Using GPS and GSM

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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. Our project will provide an optimum solution to this draw back. An accelerometer and force sensor 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 Force sensor will detect the crash signal or if a car rolls over, and accelerometer will detects the signal and sends it to AVR 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.**

***Index Terms*— ADXL 335 Accelerometer, Accident Detection, FSR, GSM, GPS.**

I. INTRODUCTION

Transportation has great importance in our daily life and its development has made many of our chores much easy. But it can cause disaster to us and even can kill us through accidents. During 2008, Road Traffic Injuries ranked fourth among the leading causes of death in the world. Nearly 1.3 million people die every year on the world's roads and 20 to 50 million people suffer non-fatal injuries, with many sustaining a disability as a result of their injury. Road traffic injuries are the leading cause of death among young people aged 15-29 years and cost countries 1-3% of the gross domestic product (GDP). If no action is taken, road traffic crashes are predicted to result in the deaths of around 1.9 million People annually by 2020. [1] Thus accident detection system using GPS and GSM has gained attention. This system automatically informs about the accident to the pre-programmed numbers OR to the mobile numbers registered.

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II. PREVIOUS RESEARCH

At present criteria, we cannot detect where the accident has occurred and hence no information related to it leading to the death of an individual. The research work is going on for tracking the position of the vehicle even in dark clumsy areas where there is no network for receiving the signals. In this project GPS is used for tracking the position of the vehicle, GSM is used for sending the message and the AVR controller is used for saving the mobile number in the memory and sends the message to it when an accident has been detected. Hence with this project implementation we can detect the position of the vehicle where the accident has occurred so that we can provide the first aid as early as possible.

III. EQUIPMENTS USED

A. GPS Module

The Global Positioning System (GPS) is a multi--functional system, which has high-precision, all-weather, and global radio navigation and positioning, timing functions. It used satellite network formed by 24 satellite transmit positioning signal to Earth, constantly firing. A GPS receiver anywhere on the Earth, as long as three or more satellite signals received, after calculating, you can report the location, time and state of motion of a GPS receiver.

Figure 1:GPS module

B. GSM Module

GSM is a digital mobile telephone system that is widely used in most of the 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). GSM digitizes and compresses data, then sends it down a channel with two other

streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. GSM is the de facto wireless telephone standard in Europe. GSM has over one billion users worldwide and is available in 190 countries. Since many GSM network operators have roaming agreements with foreign operators, users can often continue to use their mobile phones when they travel to other countries

Figure 2:GSM module

C. AVR Micro Controller

The microcontroller unit (MCU) is the heart of the system. It receives data from the GPS, processes all data and detects the accident from the processed data. The location of the accident is also send by the MCU. AVR (ATMEGA 328) proposed for the system. The Large amounts of RAM for buffering, Enhanced Flash program memory and low power consumption make it ideal for the proposed system.

The high-performance Atmel Pico Power 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB 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 2-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. [2]

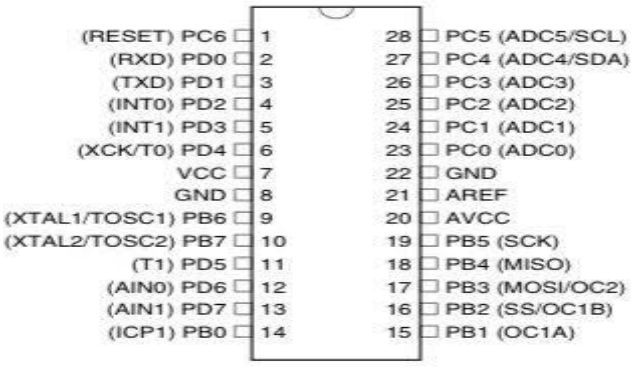

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Figure 3:ATMEGA 328

D. FORCE SENSING RESISTOR (FSR)

Here FSRs are used to detect the vibrations or crash. FSRs are two-wire devices with a resistance that depends on applied force, pressure, squeezing or weight. The standard 402 sensor is a round sensor 18.28 mm diameter. They are simple to use and low-cost. FSRs are basically a resistor that changes its resistive value depending on how much it is pressed. These sensors are fairly low cost and easy to use. [3]

Figure 4: FSR Sensor

E. ADXL 335 ACCELEROMETER

The ADXL 335 is a small, thin low power, complex 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with minimum full range of ± 3g. It can measure the static acceleration of gravity in tilt sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. The user selects the bandwidth of the accelerometer using C_x, C_y, C_z capacitors at the X_{out} , Y_{out} , Z_{out} pins. Bandwidths can be selected to suit the applications range. [4]

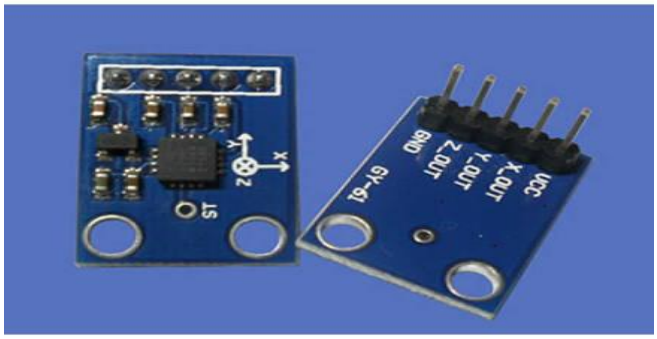

Figure 5:ADXL 335 Accelerometer

IV. PROPOSED METHODOLOGY

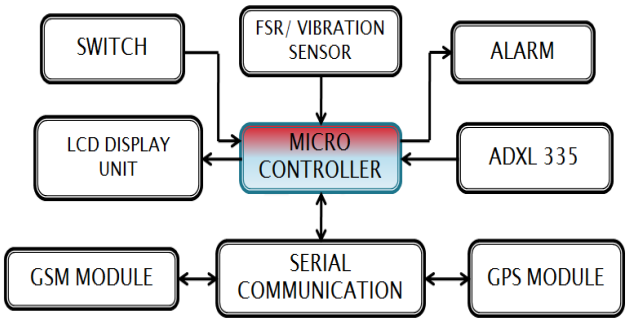

Figure 6:Block Diagram

The working of the entire project is described in following two steps

STEP I:Detection of Signals from vibration sensors

Whenever the accident (crash) occurs or tilting of car takes place, as shown in figure 8 and figure 9. The figure shows the ADXL accelerometer tilted (highlighted with red circle in the figure 8) and the FSR applied with the force (highlighted with red circle in the figure 9). Hence the FSR

or/and accelerometer gets activated. The signals from these sensors are sent to the MCU. The sensors are calibrated in such a way that if the i/p signal value (here pressure and tilting angle) exceeds certain predefined value, the MCU sends the signal to the GSM module. The LCD display provided displays the value of the force and the lower limit of the force value. The LCD display also shows the value of the tilting angle.

STEP II: Detection of location and sending those locations via GSM message

The GPS module keeps on continuously recording the location co-ordinates. Whenever the accident occurs the MCU detects whether the signals i/p value are within the limited value provided while the MCU is being programmed. If the values (pressure OR tilt angle) are greater than the given value, it indicates that the accident has occurred. A switch is provided so that if the driver is in safe conditions he can press the switch and terminate the message to be sent to the control room. A specific delay of 10 to 20 seconds is provided, if the switch is not pressed within the given time, the MCU sends the detected co-ordinates through the GSM module in the form of SMS service. MCU is also programmed in such a way that mobile numbers of one or two relatives or friends of the driver is added to the list of persons to whom the SMS should be delivered. The message is sent to the registered mobile numbers. Co-ordinates of the place are sent in the form of Latitude and Longitude.

V. RESULTS

Figure 7: When the car is in normal condition (pressure sensor without any pressure applied and accelerometer without any tilt)

In the above image, the pressure sensor and the accelerometer are in normal position which indicate that the car is in normal condition without any accident hence the LCD display only shows the X and Y co-ordinates and the pressure value which is zero (when no damage occurs).

Figure 8: When the car takes a tilt(accelerometer is tilted beyond the prescribed safe limit)

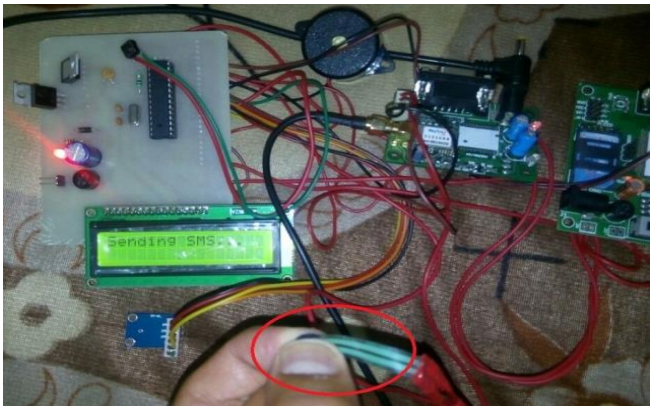

Figure 9: When the car experiences vibrations due to crash, and FSR senses the vibration (FSR is pressed due)

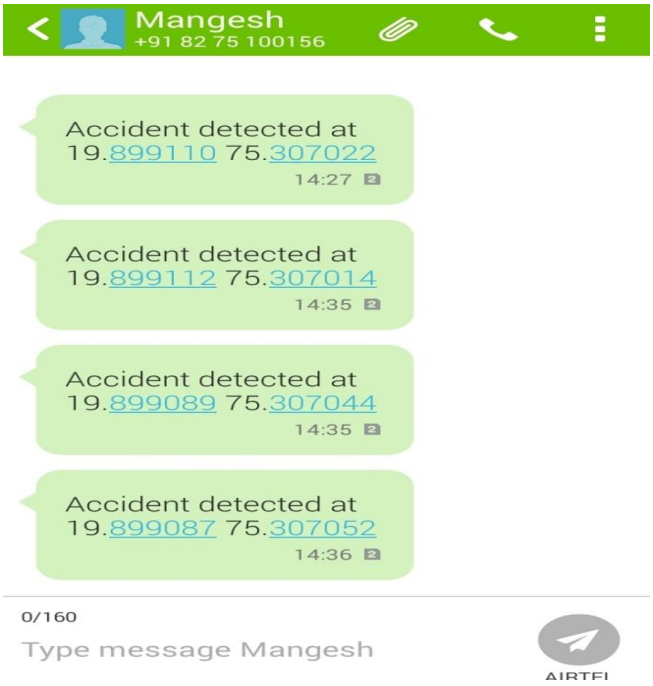

Figure 10:Text message received through GSM

In Figure 2 and figure 3, the tilt sensor and FSR are tested. When ADXL 335 is tilted or pressure is applied on FSR, the GSM module sends the message to the registered mobile number.

Figure 4 shows the text messages received when the accident occurred. Clearly it is seen that the text message consists of the coordinates in the form of Latitude and Longitude.

The entire circuitry along with the MCU can be placed inside the air bag provided in the car. This will facilitate the protection of the main circuitry till the worst possible condition or severe accident conditions.

VI. FUTURE SCOPE

The system can be improved by including a face recognition algorithm focusing on eyes of the driver, and continuously monitor consciousness of the driver. The designed system is implemented in a modelled vehicle; the same can be interfaced to a real-time vehicle to gather real-time data. The system can be made crash proof by providing casing to the sensors so that the impact is less when an accident occurs. The material used to protect the car battery can be made use of for the casing.

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