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EVENT DATA RECORDER IN AUTOMOBILE

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Abstract *Nowadays accidents are increasing. Many new vehicles are being added on the road each day. This also increases the amount of accident. The vehicles are fitted with airbags, anti-lock breaking system and many such things. But in order to do any research or development, there is a need for the knowledge of the real cause of an accident. The accident may occur due to the mistake of others or due to driver itself. The presently available features which are in corporated into vehicles are GPS tracking and mapping. The IEEE has also introduced some standards in this regard. The system proposed is like a black box, implemented inside a vehicle. The proposal of the IEEE association is audio and video logging and engine parameters such as the temperature, brake conditions, sharp turn, torque of the vehicle etc. This is analogous to a black box but such costly devices cannot be incurporated into a car as such systems will cost more than the car itself. Moreover there is no alert system. So an initiative to design a data logger as an emergency alert system was made. This initiative was made because of delayed medical help and relief. It also decreases the cost so as to make it affordable to vehicle of all ranges. The accident is sensed physical collision and when such an accident occurs an alert message is sent to a pre-stored mobile number. The exact position of the vehicle at the time of an accident can be located using the GPS module. So medical help to those people can be provided as soon as possible*

Key Words: Automobile, Safety, Emergency alert

1. INTRODUCTION

Road accidents are so common in everyday life and it costs us so much in terms of money and vehicular hardware, but a much more value is given to the humans involved in the accident. In a world where an automobile is not anymore a luxury but a necessity, overcrowding of these vehicles is one of the causes of accidents. But through a deeper evaluation, it could be found that most of the accidents happen due to driver faults, vehicular faults and adverse road or climatic conditions. In the past, there have been many studies about road accidents and methods to avoid them. Innovative concepts such as blink sensor technology, drunken driver technology, steering wheel grip technique etc. has been proposed and implemented. But despite of all these efforts, accidents keeps happening.

Instead of concentrating directly on avoiding the accidents, an event data recorder is installed in the automobile which records all the vehicular data at the time, before and after the crash. This vehicular data can be retrieved from a vehicle after a crash, which can be studied and analysed later

Event data recorder has various practical applications. It can be used to deduce the pattern of accidents at a particular situation and prevent it from happening again by taking necessary precautions. Event data recorders are very helpful for insurance companies because study of crash parameters helps them to allow or deny the claim for the accidents as the event data recorder holds the proof. And it is useful for the police, as they can find out what really caused the accident.

2. HARDWARE IMPLEMENTATION

The following hardware and circuit sections are used to design and implement this project.

2.1 INERTIAL MEASUREMENT UNIT

An inertial measurement unit (IMU) is an electronic device that measures and reports a body's specific force, angular rate, and sometimes the magnetic field surrounding the body, using a combination of accelerometers and gyroscopes, sometimes also magnetometers. IMUs are typically used to maneuver aircraft, including unmanned aerial vehicles (UAVs), among many others, and spacecraft, including satellites. Recent developments allow for the production of IMU-enabled GPS devices. An IMU allows a GPS receiver to work when GPS-signals are unavailable, such as in tunnels, inside buildings, or when electronic interference is present.

A. Accelerometer

An accelerometer is a device that measures proper acceleration; proper acceleration is not the same as coordinate acceleration (rate of change of velocity). Accelerometers in free fall (falling toward the center of the Earth at a rate of about 9.81 m/s2) will measure zero. An accelerometer measures proper acceleration, which is the acceleration it experiences relative to freefall and is the acceleration felt by people and objects. An accelerometer at rest relative to the Earth's surface will indicate approximately 1 g upwards, because any point on the Earth's surface is accelerating upwards relative to the local inertial frame (the frame of a freely falling object near the surface). To obtain the acceleration due to motion with respect to the Earth, this "gravity offset" must be subtracted and corrections made for effects caused by the Earth's rotation relative to the inertial frame.

B. Gyroscope

A gyroscope is a spinning wheel or disc in which the axis of rotation is free to assume any orientation by itself. When rotating, the orientation of this axis is unaffected

by tilting or rotation of the mounting, according to the conservation of angular momentum. Because of this, gyroscopes are useful for measuring or maintaining orientation. Gyro sensors, also known as angular rate sensors or angular velocity sensors, are devices that sense angular velocity. They are used to sense rotational motions in a body and also to sense changes in their orientation. Gyroscope sensors are used to read and sense the orientation of a vehicle in three axis. It is with the help of this sensor, the orientation and position data of the vehicle is recorded. These data are stored in to a flash memory, which can then be recreated for further use.

2.2 THE ARDUINO MICROCONTROLLER

The Arduino is a programmable 8-bit microcontroller that is capable of manipulating a series of periphery devices based on the program or with a program that uses serial data from another periphery device. For example a thermistor could be connected up to the Arduino and the Arduino in turn connected up to a small piston device. Based on the temperature values coming in from the thermistor the Arduino could open or close a window in response. Other examples of periphery devices include LCDs and GPS units which is the device featured in this report.

2.3 LCD DISPLAY

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. LCD consists of two glass panels, with the liquid crystal material sandwitched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed. Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. The LCDs are the simple seven-segment displays, having a limited amount of numeric data.

2.4 GPS MODULE

A GPS receiver shows where it is. It may also show how fast it is moving, which direction it is going, how high it is, and maybe how fast it is going up or down. Many GPS receivers have information about places. GPSs for automobiles have travel data like road maps, hotels, restaurants, and service stations. A GPS unit takes radio signals from satellites in space in orbit around the Earth. There are about 30 satellites 20,200 kilometres (12,600 mi) above the Earth. (Each circle is 26,600 kilometres (16,500 mi) radius due to the Earth's radius).

Far from the North Pole and South Pole, a GPS unit can receive signals from 6 to 12 satellites at once. Each satellite contains an atomic clock which is carefully set by NORAD several times every day. The radio signals contain very good time and position of the satellite, including its ephemeris. The GPS receiver subtracts the current time from the time the signal was sent. The difference is how long ago the signal was sent. The time difference multiplied by the speed of light is the distance to the satellite. The GPS unit uses trigonometry to calculate where it is from each satellite's position and distance. A GPS receiver can calculate its position many times in one second. A GPS receiver calculates its speed and direction by using its change in position and change in time.

2.5 GSM MODULE

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. They consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification

2.6 FLASH MEMORY

Flash memory refers to a particular type of electronically Erasable Programmable Read-Only Memory (EEPROM). It is a computer memory chip that maintains stored information without requiring a power source

3. BLOCK DIAGRAM AND WORKING

The block diagram description is given below.

- During an accident, there is a sudden increase in acceleration.
- The accelerometer sensor detects the collision when the acceleration suddenly goes beyond a particular value.
- The microcontroller processes the output from accelerometer and displays a collision message on the LCD display.
- The GPS unit allocates the location of accident.
- An alert message containing the location of accident is sent to a pre-stored emergency number using GSM unit.
- The event during the crash and the orientation of the vehicle are recorded and stored in a Flash memory.
- The data during the crash event can then be retrieved from the flash memory and crash event can be visually recreated.

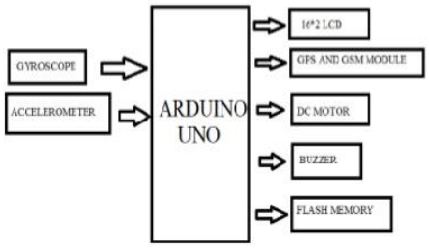

Fig -1: Block Diagram

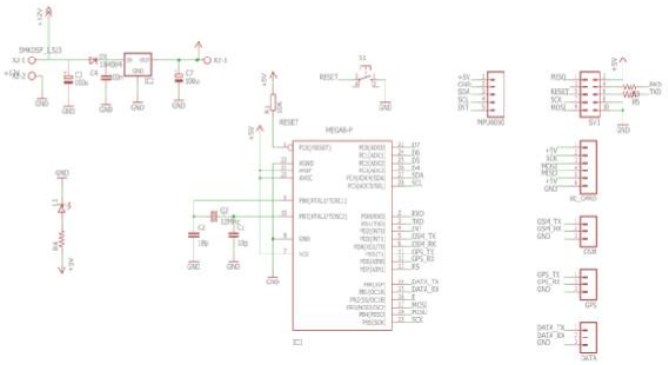

Fig -2: Circuit Diagram

The circuit diagram of the device is as shown in figure 2. The microcontroller used is AtMega8. It is provided with a 5V dc supply which is provided by 12V dc battery and then limiting it to 5V by a voltage regulator. The microcontroller is also provided with a 12MHz crystal frequency to synchronise its working. Supply is also given to GSM unit. From the diagram, it can be seen that the different ports of microcontroller are used for the connections to external peripheries. Pins of Port D is connected to the GSM and GPS unit. Port C is used for the control to the LCD as well as the MPU 6050 (accelerometer and gyroscope unit). The RS pin of the LCD is connected to a port D pin. The pins of Port B is used to connect to the SD card. The MPU 6050 communicates with the Arduino through the I2C protocol. The MPU 6050 is connected to Arduino as shown in the diagram. The MPU 6050 module has a 5V pin which is connected to the Arduinos 5V pin. The GND of the Arduino is connected to the GND of the MPU 6050. The MPU 6050 detects the collision and microcontroller processes this data. The GPS then sends the location to a pre-stored mobile number via GPS unit. The orientation of the vehicle is continuously stored in a flash memory which can be later processed for analysis using programming language called Processing.

4. CONCLUSIONS

The project successfully implemented the embedded system which gave good results and expected functioning. The data can be retrieved as required with great ease. Event Data Recorders can provide useful information that can be used to support crash reconstruction research. This data also has the potential to augment data in crash databases, by providing information especially relating to system performances. This is also very helpful as emergency medical services can be provided.

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