Sensor Based Hardware Implementation of Vehicle Accident Detection System

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Abstract—In present time Road accident deaths are increasing considerably. The main factor behind that they did not get medical help immediately. If the Victim will get hospital service immediate, his life can be saved. Now the question arises why they don't get medical help immediate. The answer of this question is "No one gets aware of the person who had gone through the Road Accident". To resolve this problem a system is needed that will send the Accident Alert or Accident location to the hospital or their family members. In the project shock sensor and Accelerometer sensor with Arduino UNO has been used to sense the Accident condition. GSM Module sends the message to their family members as soon as the Accident takes place with the location of the Accident place with the help of GPS Module. This can help family members to arrive at the accident site and provide medical support to the Victim on time. In this way, the present work can save the valuable life of people and can help in decreasing the death rate that takes place due to road accidents.
Keywords— Road Accidents, Medical Assistance, GSM, Arduino, Shock Sensor, Accelerometer Sensor.

I. INTRODUCTION

As the Countries are developing day by day. Population is also increasing and thus demand of Vehicles increasing constantly. Now a days almost every home at least one vehicle in their home. Vehicles have great importance in our daily life. Vehicles are used to carry goods, to travel from one place to another, to keep in touch with our friends and family members and sometimes to enjoy the travelling.

As everything in this world has some pros and cons. Vehicles also have some cons and one of the majors is road accident. Too many road accidents have been reported every day. In most of the cases people in the vehicle lost their life as they do not get the medical help immediately [1]. Peoples who are present there, do not inform the hospital to avoid any police case. Sometimes the accident took place in an isolate area where people are not present to inform ambulance. However, many lives could have been saved if the emergency service could get the crash information in time [2].

Recent technology is used in vehicles have inbuilt system to sense the accident and to report that. But such systems are costly and not all vehicles have such technology. Only luxury vehicles have such facility.

Hence an IOT based Vehicle Accident Detection System (VADS) is introduced and explained here which will spot the accident through its sensors and after some time delay it will immediately automatically report to family members or emergency services with the location. If in the given time delay driver does not want that message should be send to emergency services as the accident may be the minor accident. Then driver has to press the given button to stop the sending of message.

In this way the Victims will get the medical assistance immediately and their valuable life can be saved.

II. METHODOLOGY

Vehicle Accident Detection System describes a system of networked and controllable devices that works together to detect the accident and send alert message to emergency services. In this system there are seven main parts: Arduino, GSM Module, GPS Module, Accelerometer Sensor, Vibration Sensor, LCD and Buck Converter. Firstly, power will be provided to the Buck Converter, it steps down voltage to 5V and given to the arduino with a VIN pin. GSM Module, GPS Module, Vibration Sensor, Accelerometer Sensor and LCD are also connected with an arduino to provide or take information from microcontroller [3,4]. Accelerometer Sensor and Vibration Sensor detects accident of the vehicle and sends information to the Arduino. Timer of 15 seconds will run in LCD and if in that time delay driver is able to press the button that is given in this system. It means accident is a minor accident and message will not be sent to the emergency services otherwise Arduino will communicate with the GPS Module to spot the coordinates of the accident location and with the help of GSM Module, it sends the accident site to the emergency services. In arduino we upload the program code then it performs some logical and mathematical operation to control the GSM Module [5].

III. COMPONENTS USED

- **Arduino Uno:**

In arduino board family, Arduino UNO is the board that comes to first when beginning with the arduino coding. The Arduino UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family. You can tinker with your UNO without worrying too much about doing something wrong, worst-case scenario you can replace the chip for a few dollars and start over again. Arduino UNO is a microcontroller board based on the **ATmega328P**. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by a USB cable or a barrel connector that accepts voltages between 7 and 20 volts, such as a rectangular 9-volt battery.

Fig 1: Arduino Uno

- **GPS Module:**

GPS receiver module gives output in standard (National Marine Electronics Association) NMEA string format. It provides output serially on Tx pin with default 9600 Baud rate. This NMEA string output from GPS receiver contains different parameters separated by commas like longitude, latitude, altitude, time etc. Each string starts with '$' and ends with carriage return/line feed sequence.
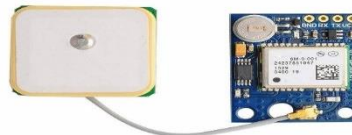
- **GSM Module:**

A GSM modem or GSM module is a device that uses GSM mobile telephone technology to provide a wireless data link to a network. GSM modems are used in mobile telephones and other equipment that communicates with mobile telephone networks. A GSM module uses mobile network towers to send and receive data, it is a handy technology that allows for seamless communication on the go.

Fig 3: GSM Module

- **Accelerometer Sensor:**

An accelerometer sensor is a tool that measures the acceleration of any body or object in its instantaneous rest frame. It is not a coordinate acceleration. Accelerometer sensors are used in many ways, such as in many electronic devices, smartphones, and wearable devices, etc. Accelerometer sensors are easy to apply to all subjects, without

much emphasis on sensor placement. These sensors are used to monitor vital signals, even for the problematic cases surrounding cardiac arrest.
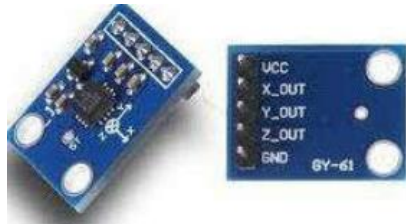

Fig 4: Accelerometer (ADXL335)

- **Vibration Sensor:**

Vibration sensor is also called a piezoelectric sensor. These sensors are flexible devices which are used for measuring various processes. This sensor uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. This sensor is also used for deciding fragrances within the air by immediately measuring capacitance as well as quality.

Fig 5: Vibration Sensor

- **LCD 16*2:**

An electronic device that is used to display data and the message is known as LCD 16×2. As the name suggests, it includes 16 Columns & 2 Rows so it can display 32 characters (16×2=32) in total & every character will be made with 5×8 (40) Pixel Dots. So, the total pixels within this LCD can be calculated as 32 x 40 otherwise 1280 pixels. 16 X2 displays mostly depend on multi-segment LEDs. There are different types of displays available in the market with different combinations such as 8×2, 8×1, 16×1, and 10×2, however, the LCD 16×2 is broadly used in devices, DIY circuits, electronic projects due to less cost, programmable friendly & simple to access.

*Fig 6: LCD 16*2*

- **Buck Converter:**

A buck converter or step-down converter is a DC-to-DC converter which steps down voltage (while stepping up current) from its input (supply) to its output (load). It is a class of switched-mode power supply. Switching converters (such as buck converters) provide much greater power efficiency as DC-to-DC converters than linear regulators, which are simpler circuits that lower voltages by dissipating power as heat, but do not step up output current.
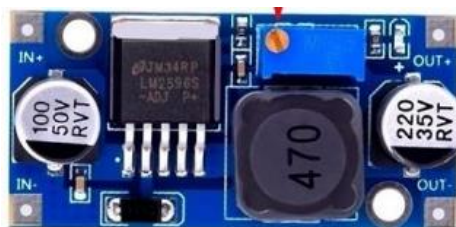

Fig 7: Buck Converter

IV.   SYSTEM ARCHITECTURE

In this System, the external disturbances are detected like high vibration in vehicle or tile in the vehicle above specified values in any direction. When it is detected, a function is called to find the current location of the Victim with the help of GPS in the Location Detection Module. The location data obtained from the GPS is sent to the emergency services through the GSM module to request help [6].
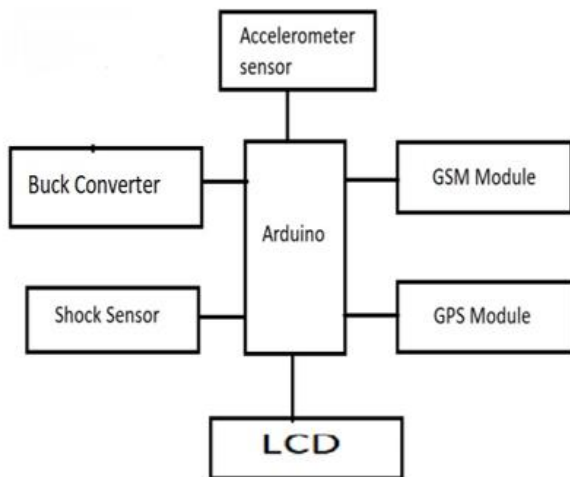
Fig 8: Block Diagram of VADS

Fig 9: Hardware Model

V. ALGORITHM

1. Start
2. First of all, the system is powered with the proper amount of power supply
3. Initialize the system successfully.
4. System will check connectivity and response of GPS and GSM modules.
5. System will observe for any accident via Vibration sensor and Accelerometer sensor.
6. If the accident occurs, then it will check the state of button available.
7. If the button is pressed then the system will reset and emergency message will not be sent.
8. If the button is not pressed in a given time delay, then an alert message will be sent to emergency services with exact location of accident site [7].
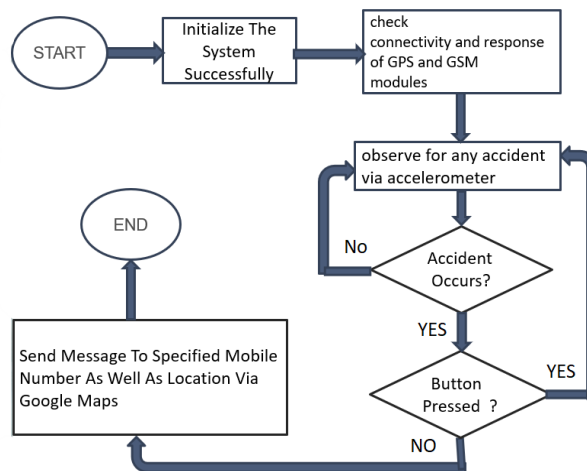

Fig 10: Flow Chart of VADS

VI. RESULTS

The result of this project is a system that provides help to the road accident victims in time those who are not in a condition to ask help for them. The system is capable of sending message to the family members in a faster way.
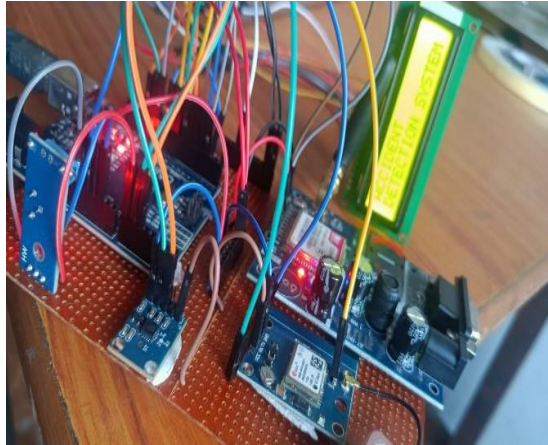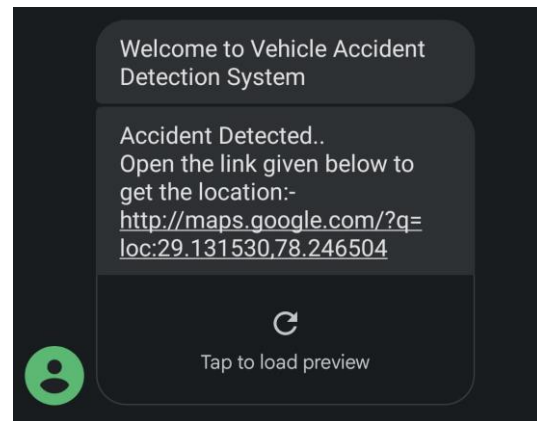
Fig 11: Interfacing LCD with Arduino and Sensors   *Fig 12: Message Notification on Mobile Phone*

VII.   FUTURE ENHANCEMENT

Now emergency messages are sent to family members. In these emergency messages can be sent to the nearest hospital from the accident site. So that emergency services could reach the accident site in time and can provide help to the road accident victim to save his/her life.

VIII.   CONCLUSION

A vehicle accident detection system is a crucial technology that can significantly improve road safety and reduce the severity of accidents. By utilizing various sensors and advanced algorithms, these systems can quickly identify and analyse potential accidents, providing timely alerts or triggering necessary actions to prevent or mitigate the impact. After development of Vehicle Accident Detection System system in future if accident of person is happened, he would not have to depend on other people for help.

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