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VEHICLE ACCIDENT ALERT SYSTEM BUILT USING ARDUINO, AN ADXL335 ACCELEROMETER, GPS, AND A GSM MODULE

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Annotation: In this article we have learned about How to interface GPS module with Computer, how to build a Arduino GPS Clock and how to Track vehicle using GSM and GPS. Here in this project, we are going to build an Arduino based vehicle accident alert system using GPS, GSM and accelerometer. Accelerometer detects the sudden change in the axes of vehicle and GSM module sends the alert message on your Mobile Phone with the location of the accident. Location of accident is sent in the form of Google Map link, derived from the latitude and longitude from GPS module. The Message also contains the speed of vehicle in knots.

Key words: Alert system, arduino Uno, vehicle accident, accelerometer, commands, location, message, programming.

Every day around the world, a large percentage of people die from traffic accident injuries. An influential indicator of survival rates after detecting the accident is the time between the occurrence of the accident and the arrival of emergency responders to the scene. Reductions in this time, in turn, may affect the numbers of fatalities, and this is achieved through using automatic traffic accident detection and notification systems which are either built-in the modern vehicles or available in the roads. In this system, it detects whether accident occurs or not using accelerometer and it notifies to some numbers through call and then they check using SMS where location will be traced. In addition to that whether any smoke or gas leakage also it detects and notifies through SMS.

Components Required:

- Arduino Uno
- GSM Module (SIM800L)
- GPS Module (NEO-7M)
- Accelerometer (ADXL345)
- 16x2 LCD
- Power Supply
- Connecting Wires
- 10 K-POT
- Breadboard or PCB
- Power supply 12v 1amp
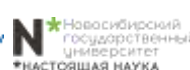
GPS Module and Its Working:

GPS stands for Global Positioning System and used to detect the Latitude and Longitude of any location on the Earth, with exact UTC time (Universal Time Coordinated). GPS module is used to track the location of accident in our project. This device receives the coordinates from the satellite for each and every second, with time and date. We have previously extracted **$GPGGA** string in Vehicle Tracking System to find the Latitude and Longitude Coordinates.

Fig.1. **GPS NEO-7M Module**

GPS module sends the data related to tracking position in real time, and it sends so many data in NMEA format (see the screenshot below). NMEA format consists several sentences, in which we only need one sentence. This sentence starts from **$GPGGA** and contains the coordinates, time and other useful information. This **GPGGA** is referred to **Global Positioning System Fix Data**. Know more about NMEA sentences and reading GPS data here.

GSM Module:

The SIM800L is a complete Quad-band GSM/GPRS Module which can be embedded easily used by customer or hobbyist. SIM800L GSM Module provides an industry-standard interface. SIM800L delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data with low power consumption. It is easily available in the market.

- SIM800L designed by using single-chip processor integrating AMR926EJ-S core
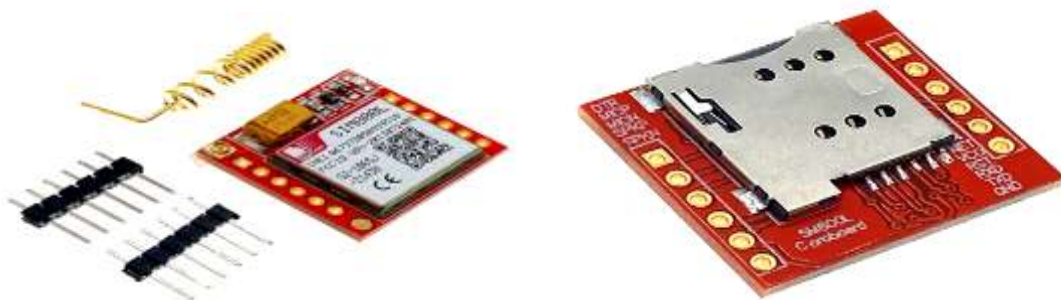- Quad - band GSM/GPRS module in small size.
- GPRS Enabled

Fig.2. **GSM SIM800L Module**

AT Command:

AT means ATTENTION. This command is used to control GSM module. There are some commands for calling and messaging that we have used in many of our previous GSM projects with Arduino. For testing GSM Module, we used AT command. After receiving AT Command GSM Module respond with OK. It means GSM module is working fine. Below are **some AT commands** we used here in this project:

```
ATE0 for echo off

AT+CNMI=2,2,0,0,0 <ENTER>        Auto opened message Receiving.  (
No need to open message)

ATD<Mobile Number>; <ENTER>      making a call (ATD+919610126059;
\r\n)

AT+CMGF=1 <ENTER>                Selecting Text mode

AT+CMGS=" Mobile Number" <ENTER> Assigning recipient's mobile num
ber

>>Now we can write our message

>>After writing message

Ctrl+Z send message command (26 in decimal).

ENTER=0x0d in HEX
```

(To learn more about GSM module, Check our various GSM projects with various microcontrollers here)

Accelerometer:

Pin Description of accelerometer:

1. Vcc   5-volt supply should connect at this pin.
2. X-OUT   This pin gives an Analog output in x direction
3. Y-OUT   This pin gives an Analog Output in y direction
4. Z-OUT   This pin gives an Analog Output in z direction
5. GND   Ground
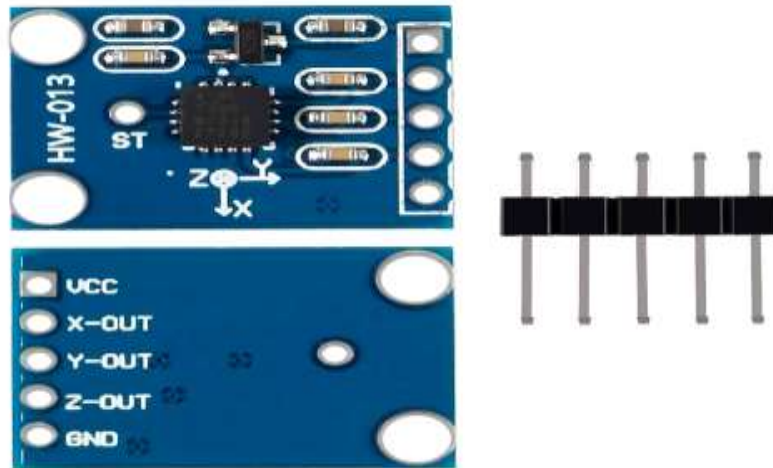6. ST   This pin used for set sensitivity of sensor

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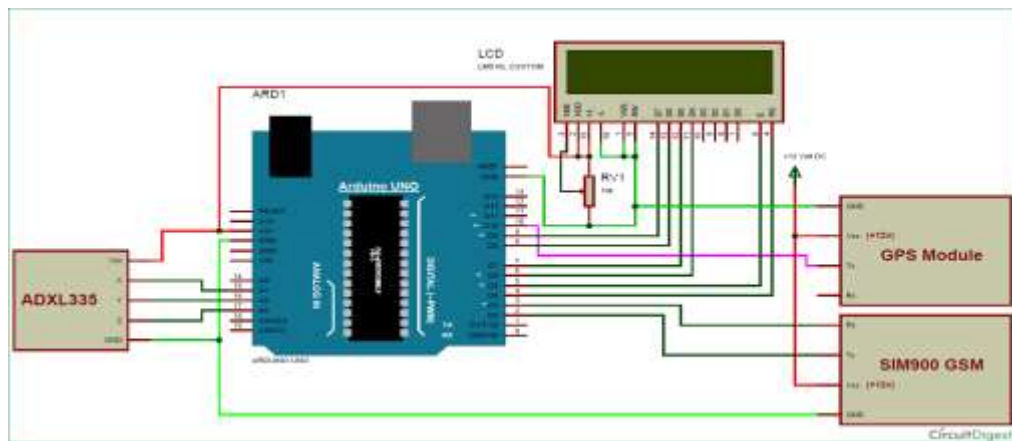PROBLEMS AND SOLUTIONS FOR OBTAINING RENEWABLE ENERGY-2023"

Fig.3 **ADXL335**

Also check our other projects using Accelerometer: Ping Pong Game using Arduino and Accelerometer Based Hand Gesture Controlled Robot.

Circuit Explanation:

Circuit Connections of this **Vehicle Accident Alert System Project** is simple. Here TX pin of **GPS module** is directly connected to digital pin number 10 of Arduino. By using Software Serial Library here, we have allowed serial communication on pin 10 and 11, and made them Rx and TX respectively and left the Rx pin of GPS Module open. By default, pin 0 and 1 of Arduino are used for serial communication but by using the Software Serial library, we can allow serial communication on other digital pins of the Arduino. 12 Volt supply is used to power the GPS Module.

GSM module's TX and Rx pins of are directly connected to pin D2 and D3 of Arduino. For GSM interfacing, here we have also used software serial library. GSM module is also powered by 12v supply. An **optional LCD's** data pins D4, D5, D6, and D7 are connected to pin number 6, 7, 8, and 9 of Arduino. Command pin RS and EN of LCD are connected with pin number 4 and 5 of Arduino and RW pin is directly connected with ground. A Potentiometer is also used for setting contrast or brightness of LCD.

An **Accelerometer** is added in this system for detecting an accident and its x, y, and z-axis ADC output pins are directly connected to Arduino ADC pin A1, A2, and A3.

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Working Explanation:

In this project, Arduino is used for controlling whole the process with a **GPS Receiver and GSM module**. GPS Receiver is used for detecting coordinates of the vehicle, GSM module is used for sending the alert SMS with the coordinates and the link to Google Map. **Accelerometer namely ADXL335** is used for detecting accident or sudden change in any axis. And an optional 16x2 LCD is also used for displaying status messages or coordinates. **We have used GPS Module SIM28ML and GSM Module SIM900A.**
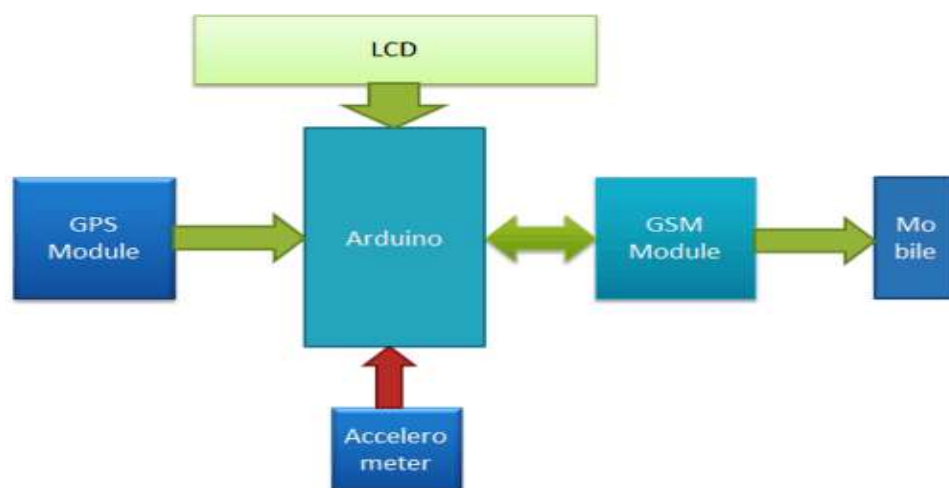
When we are ready with our hardware after programming, we can install it in our vehicle and power it up. Now whenever there is an accident, the car gets tilt and accelerometer changes his axis values. These values read by Arduino and checks if any change occurs in any axis. If any change occurs, then Arduino reads coordinates by extracting $GPGGA String from GPS module data (GPS working explained above) and send SMS to the predefined number to the police or ambulance or family member with the location coordinates of accident place. The message also contains a Google Map link to the accident location, so that location can be easily tracked. When we receive the message then we only need to click the link and we will redirect to the Google map and then we can see the exact location of the vehicle. **Speed of Vehicle, in knots** (1.852 KPH), is also sent in the SMS and displayed on the LCD panel.

References:

1. Koppel, S., Charlton, J, Fildes, B. & Fitzharris, M., How Important is Vehicle Safety in the New Vehicle Purchase Process?, Accident Analysis and Prevention, 40(3), pp. 994-1004, 2008.

2. Sadoi, Y. (2000). Malaysia: Skill formation in the auto parts industry. Retrieved on 14 April, 2015 from: http://iias.asia/iiasn/23/regions/23SEA5.html

3. Transport and Research Laboratory, UK International Federation of Red Cross and Red Crescent Societies, World Disasters Report (1998)

4. Peden Metal. World report on road traffic injury prevention. Geneva, World Health Organization, 2004.

5. AutomatedCollision notification (ACN) Field operational test (FOT) Evaluation report", https://trid.trb.org/view.aspx?id=719095.