Accident Alert System Using Arduino

THIS MINI PROJECT WORK IS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF

BACHELOR OF TECHNOLOGY
IN
ELECTRONICS & COMMUNICATION ENGINEERING

SUBMITTED BY

Name	Univ. Roll No.
MONISH ROY	10800319081
AABID ALI	10800319082
MUKESH KUMAR SAW	10800319083
ANKAN DAN	10800319089

UNDER THE GUIDANCE OF

Dr. RUPAM DAS
Assistant Professor

DEPARTMENT OF ECE
ASANSOL ENGINEERING COLLEGE
AFFILIATED TO
MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF ECE
ASANSOL ENGINEERING COLLEGE
Vivekananda Sarani, Kanyapur, Asansol, West Bengal – 713305

Certificate of Recommendation

I hereby recommend that the preliminary thesis report entitled, "**Accident Alert System Using Arduino**" carried out under my supervision by the group of students listed below may be accepted in partial fulfilment of the requirement for the degree of "Bachelor of Technology in ECE Engineering" of Asansol Engineering College under MAKAUT.

Name	**Univ. Roll No.**
MONISH ROY	10800319081
AABID ALI	10800319082
MUKESH KUMAR SAW	10800319083
ANKAN DAN	10800319089

Countersigned:

……

(Pof (Dr) Arunava De)
Head of the Department
ECE Engineering,
Asansol Engineering College,

……

(Dr. Rupam Das)
U.G. Project Coordinator
Dept. of ECE Engineering,
Asansol Engineering College,
Asansol-713305

Asansol-713305

DEPARTMENT OF ECE ENGINEERING
ASANSOL ENGINEERING COLLEGE
Vivekananda Sarani, Kanyapur, Asansol, West Bengal – 713305

Certificate of Approval

The forgoing mini project document is hereby approved as creditable study of an engineering subject carried out and presented in a manner satisfactory to warrant its acceptance as prerequisite to the degree for which it has been submitted. It is understood that by this approval the undersigned does not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the thesis only for the purpose for which it is submitted.

……

(Dr. Rupam Das)
Mini Project Supervisor

Acknowledgement

It is my great privilege to express my profound and sincere gratitude to our Mini Project Supervisor, Dr. Rupam Das for providing me a very cooperative and precious guidance at every stage of the present project work being carried out under his/her supervision. His valuable advice and instructions in carrying out the present study has been a very rewarding and pleasurable experience that has greatly benefited me throughout the course of work.

We were also profound to get help from Mr. Manas Datta , who helped us a lot to get our project done.

We would like to convey my sincere gratitude towards Pof (Dr) Arunava De, Head of the Department of ECE, Asansol Engineering College for providing us the requisite support for time completion of our work. We would also like pay my heartiest thanks and gratitude to all the teachers of the Department of ECE, Asansol Engineering College for various suggestions being provided in attaining success in our work.

I would like to express my earnest thanks to my other colleagues along with all technical staffs of the Department of ECE, Asansol Engineering College for their valuable assistance being provided during my project work.

Finally, I would like to express my deep sense of gratitude to my parents for their constant motivation and support throughout my work.

(MONISH ROY) ……

(AABID ALI) ……

(MUKESH KUMAR SAW) ……

(ANKAN DAN) ……

CONTENTS

Page no.

1. ABSTRACT

A majority of car crash is affected by careless driving that causes extensive economic and social costs, as well as injuries and fatalities. Thus, the research of precise crash detection systems is very significant issues in automotive safety. A lot of crash detection algorithms have been developed, but the coverage of these algorithms has been limited to few scenarios. Road scenes and situations need to be considered in order to expand the scope of a collision detection system to include a variety of collision modes. The proposed algorithm effectively handles the x, y, and z axes of the sensor, while considering time and suggests a method suitable for various real worlds.The performance of the suggested algorithm was evaluated under various scenarios and it adjusted crash detection events depending on the real scenario. The proposed algorithm is expected to efficiently manage the space and lifespan of the storage device.

2.INTRODUCTION

Vehicle crashes cause injuries and deaths to road users as well as enormous economic and social costs, and more than 50% of vehicle crashes are caused by careless driving. In order to ensure driving safety, in recent years, all countries have researched car crash avoidance technology. According to statistics, if you can give the driver an additional 0.5 second reaction time in a dangerous situation, you can reduce collision by 45%, so modern cars are equipped with all kinds of measurement and alarm systems to keep driving safety. Vehicle crash detection can be detected in a variety of ways, but g-sensors (accelerometer) are usually used. This method is commonly used because it is cheap and possible to easily determine the amount of change in the values of x, y, z. Today, being able to support humans in their daily work by developing autonomous systems is one of the biggest challenges of modern computer science. One example is an autonomous driving system that helps reduce fatalities from traffic accidents. A variety of new sensors have been used in the past few years for tasks such as recognition, navigation and manipulation of objects. A plenty of technology has been aimed to research the crash detection in vehicle. Collision probability data generated from Monte Carlo simulation taking driver behavior and vehicle dynamics into account, tracking algorithm using interactive multi- model particle filter, and threat assessment algorithm to estimate collision

probability. In another method, two models are considered: a model in which the follower maintains a safe distance and a model in which the follower maintains a safe time. Analyze distance delays and time delays caused by major vehicles' impact on followers.There is also a way to develop new challenging benchmarks for stereo, optical flow, visual odometer/SLAM and 3D object detection tasks using autonomous driving platforms. The motion sensor method uses a complex motion

processor to provide very accurate data and, if used near the engine, can also filter out vibrations. They used automotive sensors to reduce vibration and made readings very accurate. Algorithms that use data fusion between acceleration, deceleration, and tilt angles have a great success rate. No false positives or failed crashes were recorded in the test results. Collision detection is a very important feature for motorcycle occupants and is used by the E-call system, which can reduce the time between an accident and emergency service arrival by 50%.

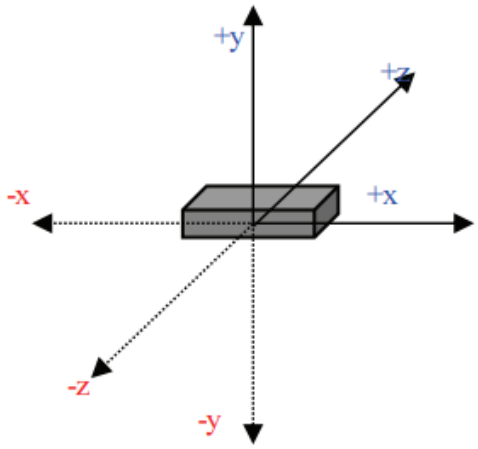

Fig. 1. G-sensor (accelerometer) axes.

There is also a method that uses the image to recognize the license plate of the vehicle using Automatic license plate recognition (ALPR). The distance is calculated from geometric derivation using additional descriptive data such as the distance between the cameras and other specific angles, such as the angle of view of the camera. This method achieves very high accuracy if the calculated distance between the vehicle and the camera is relatively accurate. The importance of measuring vehicle-to-vehicle distances lies in performing some important tasks in automotive vehicle systems, such as vehicle speed calculations and decision support

(e.g.vehicle bypass, route change and speed control). In general, the work of the literature is divided into two types of distance measuring systems based on image processing: mono vision systems and stereo vision systems. In addition, there are algorithms using the ultrasonic sensor , method using vehicle-mounted device-based collision risk identification and warning system, pre-collision hot spot detection method using in-vehicle odometer recorder , magnetic resistance and sonar sensors to detect impending collisions in cars, a distance obstacle detection and safety distance calculation , adopting position control of an object using vision sensor, detecting the precise location of a moving car by using a design system of the gyro sensor and investigating experimental security analysis of a modern automobile. In this paper, A novel algorithm for vehicle crash detection both driving and parking mode is presented. The purposed system concept includes a crash detection and safety distance calculation. The system detects the distance between the vehicle and the vehicle front (object) and uses vehicle CAN signal information from other devices. Moreover, by considering the situation over time, we devised a shock event algorithm that is more suitable for the real world. This paper is structured as follows: Section 2 describes the background with the major concept. Section 3 presents our preliminary work as well as purposed idea. Section 4 presents the experimental results from purposed designs. Finally, Section 5 concludes the paper before proposing the future of study.

3.MOTIVATION

The thought of developing this project comes from social responsibilities towards society. As we see many accidents occurring around us, there is a lot of loss of life due to mismanagement of health care system. According to survey there are around two thousand accidents occurring per day in India. Maximum deaths happen because the patient is not sends to the hospital in due time. Hence, here comes our project "Vehicle Accident alert system using Arduino" handy. This project proposes a quite efficient way to control. First the project deals with prevention of accident by sending alarm for taking care of a nearby vehicle to prevent from front collision, then if due to some reasons collision occurs then the next step is detection for that purpose smart phone based accident detection and notification system which will track the accident with the help of deployed impact sensors, will process the data through micro-controller unit and then with a Smartphone app GPS, GSM it will send a notification to the nearest emergency services and to the victim's family.

4. Design and Methodology

There are various methods for determining the crash event, using images or using autonomous driving techniques, but in this paper, we propose a method using g-sensor, which is a basic method

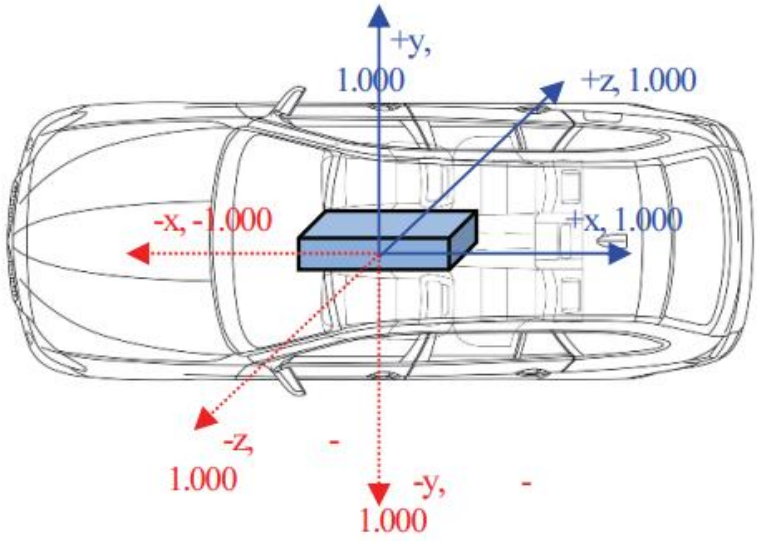

Fig. 2. Vehicle layout of g-sensor, the initial value is specified as 1.000 for convenience and understanding of calculation.

G-sensor:- The g-sensor is commonly referred to as an accelerometer. They are used in various devices such as smartphones, vehicles and of course black boxes. The black box's g-sensor monitors the appropriate acceleration called G-Force. The 3axis accelerometer contains 3 accelerometers, one for each axis, which can measure

the acceleration in the ±x, ±y, ±z, axes as shown in Fig. 1. The accelerometer output is highly dependent on the selected sensitivity expressed as G-force. For example, an accelerometer with 2G sensitivity can output an acceleration of up to 2G. The value is read from 2 bytes register and the precision when using high sensitivity are sufficient for the consumer to use. Decreasing the accelerometer's sensitivity also decreases precision because the length of the register where the value is stored is the same. There are 3 registers where acceleration is stored, X acceleration register, Y acceleration register and Z acceleration register. The data collected on each axis is averaged and the values obtained are used to offset the output each time the sensor is read. Most accelerometers have offset registers, and writing the values obtained after calibration into these registers will offset the output. For instance, the accelerometer's digital output has a full programmable range of ±2G, ±4G, ±8G and ±16GYou can select the appropriate sensitivity according to the application. In this paper, STMicroelectronics g-sensor was used and 2G was set up for measuring the accelerations of a vehicle.

The raw values of the accelerometer are read by the microcontroller and are obtained by using complementary filters to perform data fusion. In this case, the accelerometer is used to correct the drift of the gyroscope. Complementary filter is an equation that creates a weighted arithmetic mean between the values of the gyroscope and accelerometer.

angle = 0.90 x (angle + gyroData x Δt) + 0.10 x accData

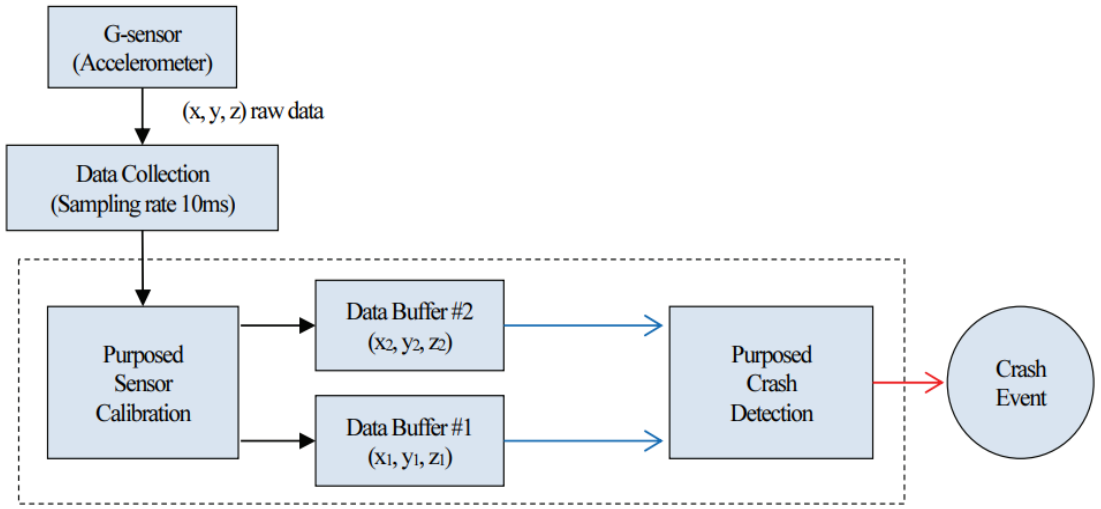

Fig. 3. Architecture of the proposed system.

The weight chosen for the data coming from both sensors depends on the target application. Increasing the weight of the accelerometer data improves the responsiveness of the system, but increases its sensitivity to vibration, which makes the system unstable. If the gyro weighs more than 0.90, it makes a slow but very stable system.

As shown in Fig. 2, the arrangement of g-sensors in a vehicle may vary depending on the vehicle's space and design. In general, the black box is placed in the center of the vehicle because it is considered to be placed in a safe location. In general, g-sensor uses the first value read after system booting as the default value and measures the change of the corresponding value. In this paper, the initial value is specified as 1.000 for convenience and understanding of calculation. There are countless crash detection algorithms. In this paper, the method of detecting impact through absolute values is as follows. |x2| – |x1| > x axis threshold |y2| – |y1| > y axis threshold (2) |z2| – |z1| > z axis threshold.

5.CIRCUIT DIAGRAM

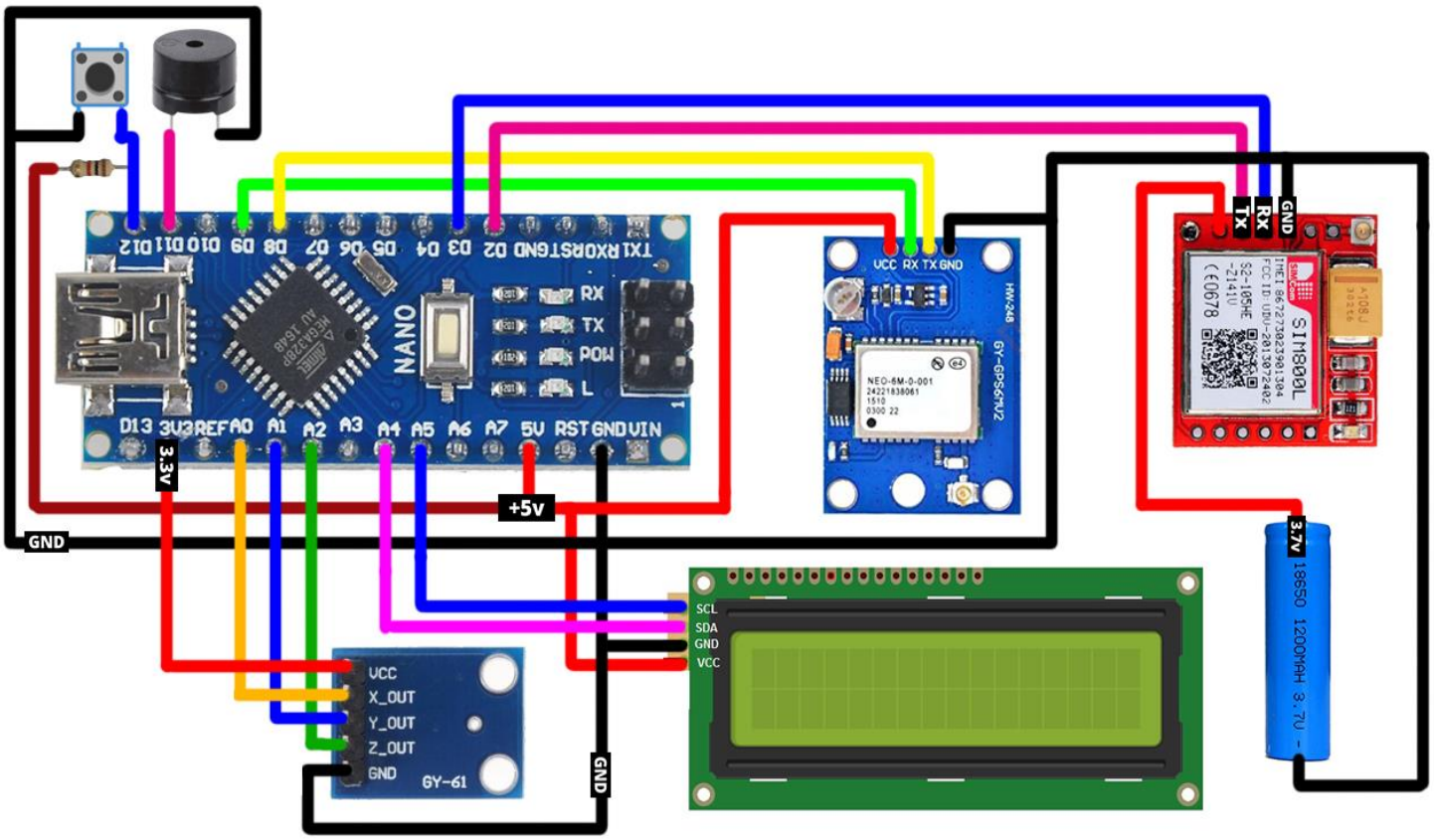

Fig.4. Accident Alert circuit

(i)COMPONENTS USED-

- Arduino Nano
- LCD I2C
- NEO6M GPS Module
- SIM800L GSM Module
- 2G micro sim card
- Piezoelectric Buzzer
- push button with 1K Resistor.
- Accelerometer (ADXL335)

a. Arduino Nano

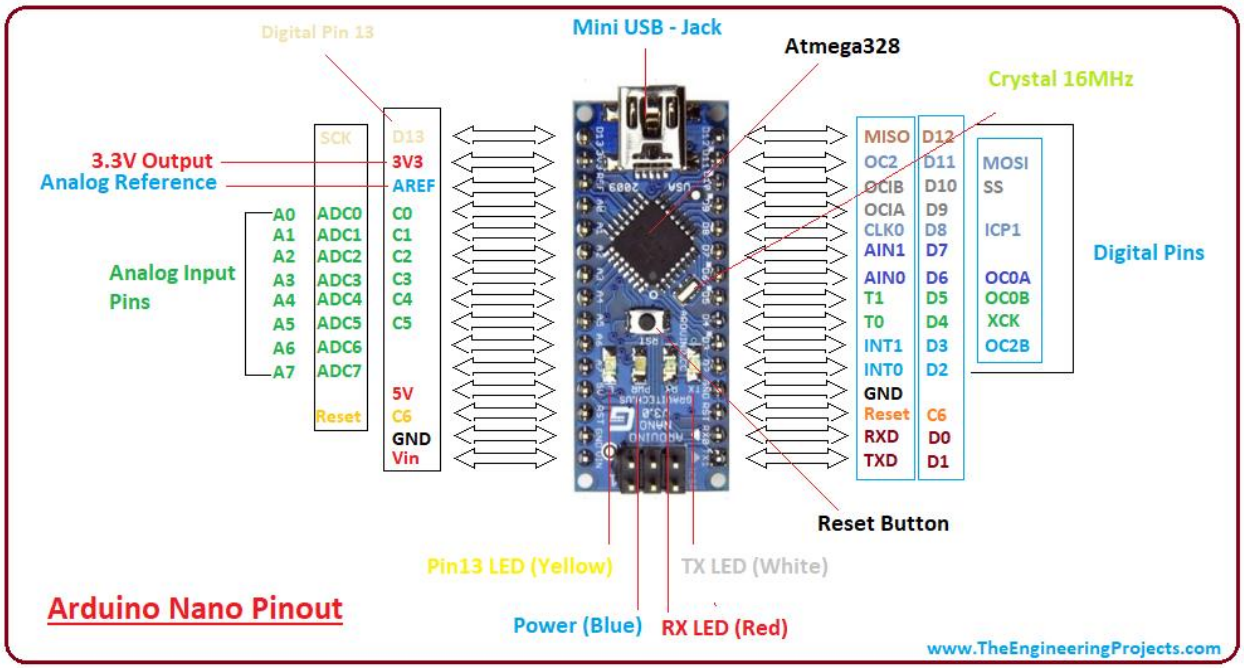

Fig.5. Arduino Nano

Arduino Nano is a small, complete, flexible and breadboard-friendly Microcontroller board, based on ATmega328p, developed by Arduino.cc in Italy in 2008 and contains 30 male I/O headers, configured in a DIP30 style. Arduino Nano Pinout contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins. Arduino Nano is simply a smaller version of Arduino UNO, thus both have almost the same functionalities , It comes with an operating voltage of 5V, however, the input voltage can vary from 7 to 12V.Arduino Nano's maximum current rating is 40mA, so the load attached to its pins shouldn't draw current more than that Each of these Digital & Analog Pins is assigned with multiple functions but their main function is to be configured as Input/Output. There is one limitation of using Arduino Nano i.e.it doesn't come with a DC power jack, which means you cannot supply an external power source through a battery.

b. NEO6M GPS Module

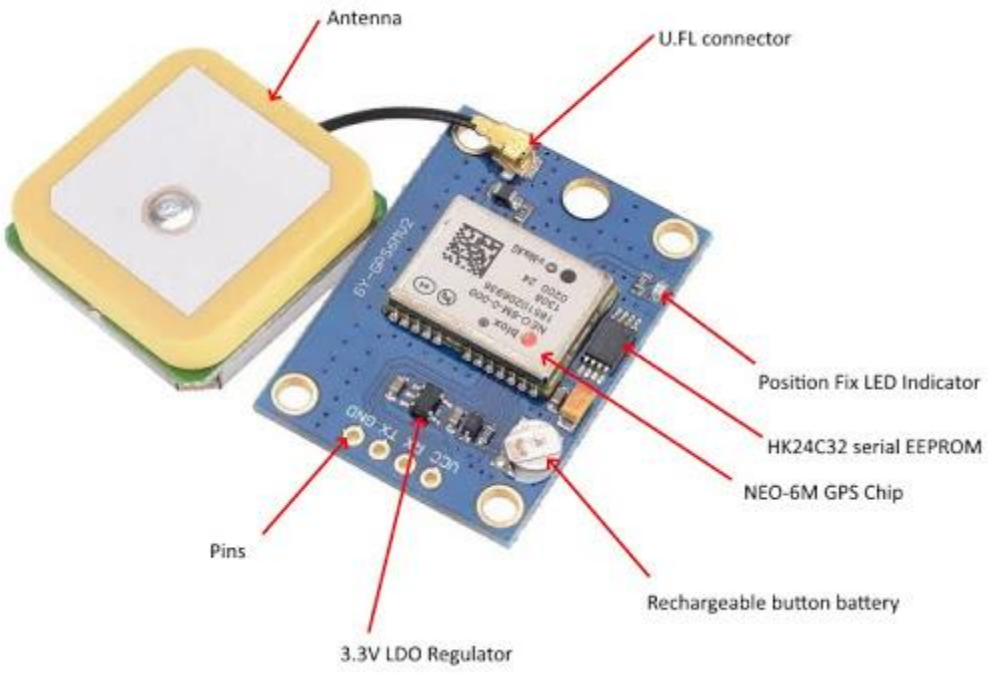

Fig.6. NEO6M GPS

This is a complete GPS module that is based on the NEO-6M. This unit uses the latest technology to give the best possible positioning information and includes a larger built-in 25 x 25mm active GPS antenna with a UART TTL socket. A battery is also included so that you can obtain a GPS lock faster. This is an updated GPS module that can be used with Arduino pilot mega v2. This GPS module gives the best possible position information, allowing for better performance with your Arduino pilot or other Multirotor control platform .The NEO-6M GPS engine on this board is a quite good one, with the high precision binary output. It has also high sensitivity for indoor applications. NEO-6M GPS Module has a battery for power backup and EEPROM for storing configuration settings. The antenna is connected to the module through a ufl cable which allows for flexibility in mounting the GPS such that the antenna will always see the sky for best performance. This makes it powerful to use with cars and other mobile applications.

c. SIM800L GSM Module

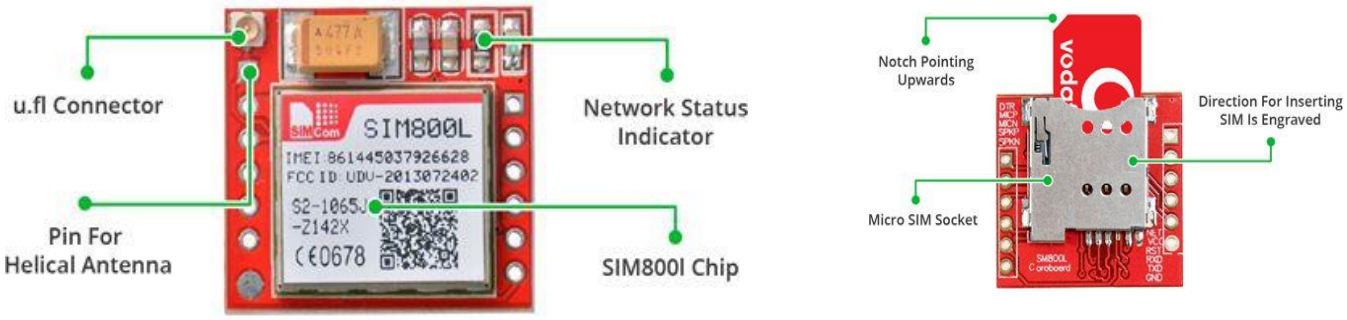

Fig.7. SIM800L GSM

At the heart of the module is a SIM800L GSM cellular chip from SimCom. The operating voltage of the chip is from 3.4V to 4.4V, which makes it an ideal candidate for direct LiPo battery supply. This makes it a good choice for embedding into projects without a lot of space. All the necessary data pins of SIM800L GSM chip are broken out to a "0.1"pitch headers. This includes pins required for communication with a microcontroller over UART. The module supports baud rate from 1200bps to 115200bps with Auto-Baud detection. The module needs an external antenna to connect to a network. The module usually comes with a Helical Antenna and solders directly to NET pin on PCB. The board also has a U.FL connector facility in case you want to keep the antenna away from the board. There's a SIM socket on the back! Any activated, 2G micro SIM card would work perfectly. Correct direction for inserting SIM card is normally engraved on the surface of the SIM socket.This module measures only 1 inch^2 but packs a surprising amount of features into its little frame.

d. Piezoelectric Buzzer

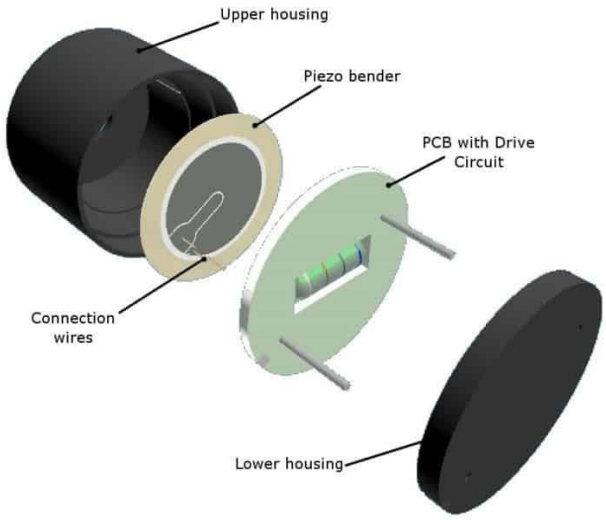

Fig. 8. PIEZO ELECTRIC BUZZER

In simplest terms, a piezo buzzer is a type of electronic device that's used to produce a tone, alarm or sound. It's lightweight with a simple construction, and it's typically a low-cost product. Yet at the same time, depending on the piezo ceramic buzzer specifications, it's also reliable and can be constructed in a wide range of sizes that work across varying frequencies to produce different sound outputs.

For instance, at APC International, Ltd.,offer piezo buzzers without signal generators, self-oscillating buzzers that have signal generators and even multi-tone sound generators — often used in alarms and sirens. Regardless of the model you choose, our piezo buzzers offer high sound outputs. Plus, since they can be mounted on circuit boards, they're highly useful in a wide range of applications and assemblies.

e. Accelerometer (ADXL335)

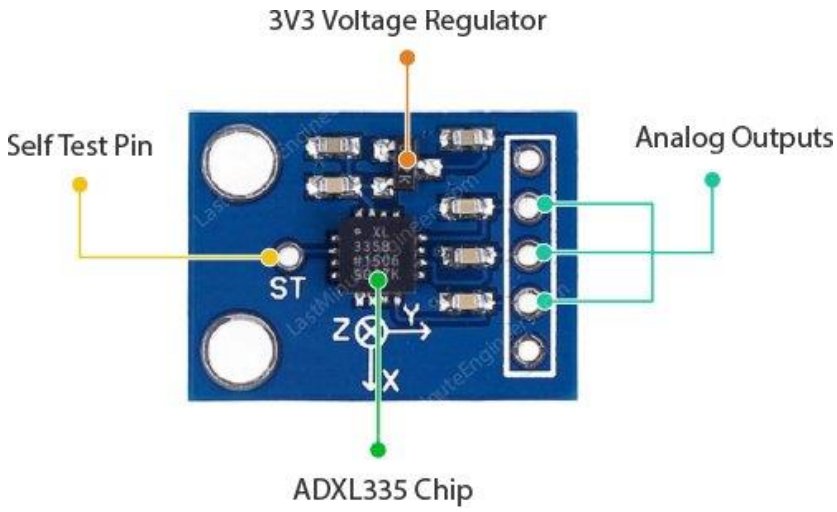

Fig. 9. Accelerometer ADXL335 3-AXIS

An accelerometer is an electromechanical device that will measure acceleration force. It shows acceleration, only due to cause of gravity i.e. g force. It measures acceleration in g unit on the earth, 1g means acceleration of 9.8 m/s2 is present. On moon, it is 1/6th of earth and on mars it is 1/3rd of earth. Accelerometer can be used for tilt-sensing applications as well as dynamic acceleration resulting from motion, shock, or vibration.

ADXL335 module

1.The ADXL335 gives complete 3-axis acceleration measurement.

2.This module measures acceleration within range ±3 g in the x, y and z axis.

3.The output signals of this module are analog voltages that are proportional to the acceleration.

4.It contains a polysilicon surface-micro machined sensor and signal conditioning circuitry.

6. RESULTS

PERFORMATION RESULT

The performance of the proposed crash detection algorithm was evaluated for two scenarios via offline simulations, including crash of various direction (see Fig. 8). To show the benefit of the proposed algorithm, driving, parking scenarios were considered. The driving scenario was considered to compare the crash detection between the proposed algorithm and a general black-box available in a market. The test environment was compared after installing the product proposed to the test vehicle and the product used, and the crash was applied in the actual road and parking environment to determine whether the crash was judged.

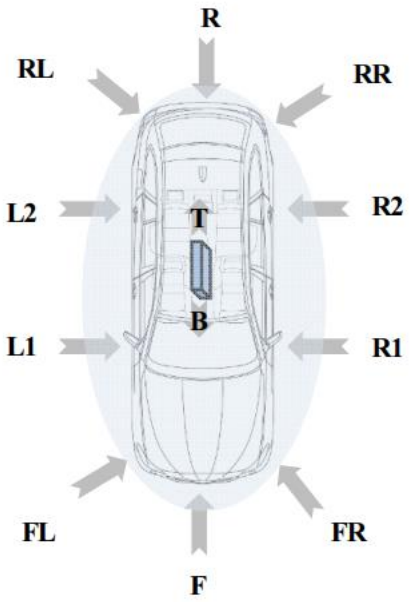

Fig. 10. Direction of vehicle crash detection during driving and parking mode

F (Front), FR(Front Right), R1 (Right Front Door), R2 (Right Rear Door), RR (Rear Right), R (Rear), RL (Rear Left), L1 (Left Front Door), L2 (Left Rear Door), FL (Front Left), T (Top), and B (Bottom).

7. DISCUSSION

This paper has proposed a novel crash detection algorithm applicable to general driving and parking mode scenarios that consider a various direction of car and that extracts as much information as possible from the calibrated data. The algorithm successfully detected in various directions of crash. It is expected that the proposed crash detection algorithm is reliable although further evaluations are required. The proposed algorithm can be used as an integrated collision detection algorithm by integrating tracking information from multiple sources for collision warning, avoidance and mitigation. Throwing new light on existing methods, we hope that the proposed algorithm will complement others and help to reduce overfitting to datasets with little test examples or training as well as contribute to the development of algorithms that work well in the crash detection system of vehicle.

8. FUTURE WORK

1. We can add the feature of video recording so that we can know the cause of accident.

2. We could use the gps module as tracking device , by doing that we can acces the location of car if the car was lost or stolen.

9. REFERENCES

- R. R. Knipling et al., "Assessment of IVHS countermeasures for collision avoidance systems," National Highway Traffic Safety Administration, Washington, DC, USA, Tech. Rep. DOT HS 807 995, May 1993.

- T. Kim and H. Jeong, "A Novel Algorithm for Crash Detection Under General Road Scenes Using Crash Probabilities and an Interactive Multiple Model Particle Filter," in IEEE Transactions on Intelligent Transportation Systems, vol. 15, no. 6, pp. 2480-2490, Dec. 2014.

- V. Naumov, "Analysis of Time and Distance Delays in Car Following Models," 2010 International Conference on Intelligent Systems, Modelling and Simulation, Liverpool, 2010, pp. 296-299.

- Geiger, P. Lenz and R. Urtasun, "Are we ready for autonomous driving? The KITTI vision benchmark suite," 2012 IEEE Conference on Computer Vision and Pattern Recognition, Providence, RI, 2012, pp. 3354- 3361.

- Cismas, M. Ioana, C. Vlad and G. Casu, "Crash Detection Using IMU Sensors," 2017 21st International Conference on Control Systems and Computer Science (CSCS), Bucharest, 2017, pp. 672-676. 6. S. Du, M. Ibrahim, M. Shehata and W. Badawy, "Automatic License Plate Recognition (ALPR): A Stateof-the-Art

Review," in IEEE Transactions on Circuits and Systems for Video Technology, vol. 23, no. 2, pp. 311-325, Feb. 2013.

- A. Zaarane, I. Slimani, A. Hamdoun and I. Atouf, "Vehicle to vehicle distance measurement for selfdriving systems," 2019 6th International Conference on Control, Decision and Information Technologies (CoDIT), Paris, France, 2019, pp. 1587-1591.

- S. Haria, S. Anchaliya, V. Gala and T. Maru, "Car Crash Prevention and Detection System Using Sensors and Smart Poles," 2018 Second International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2018, pp. 800-804.