"Auto Rescue – Accident Detection & Real Time Automatic Alerting System for Automobile"

A Minor Project

Submitted in partial fulfillment of the requirement for the award of

Degree of Bachelor of Technology in Information Technology

Submitted To

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL (M.P.)

Submitted By:

Lokesh Vishwakarma
Enrollment No- 0821IT211020

Under The Supervision Of:

Mr. Vijay Malviya (Senior Asst Prof, IT Dept.)

Malwa Institute of Technology

DEPARTMENT OF INFORMATION TECHNOLOGY

MALWA INSTITUTE OF TECHNOLOGY, INDORE

MALWA INSTITUTE OF TECHNOLOGY, INDORE

Department Of Information Technology

CERTIFICATE

This is to certify that the work embodies in this minor project entitled " **Auto Rescue – Accident Detection & Real Time Automatic Alerting System For Automobile "** being submitted by "**Lokesh Vishwakarma" Roll No: 0821IT211020** for partial fulfillment of the requirement for the award of "**Bachelor of Technology in Information Technology**." to "Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal (M.P.)" during the academic year 2023-24 is a record of Bonafide piece of work, carried out by him under our/my supervision and guidance in the "Department of Information Technology", Malwa Institute of Technology, Indore (M.P.).

APPROVED & SUPERVISED BY:

Mr. Vijay K Malviya

Senior Asst Prof.
IT Dept.

MALWA INSTITUTE OF TECHNOLOGY, INDORE

Department Of Information Technology

CERTIFICATE OF APPROVAL

A minor project entitled " **Auto Rescue – Accident Detection & Real Time Automatic Alerting System For Automobile "** being submitted by "**Lokesh Vishwakarma" Roll No: 0821IT211020** has been examined by us and is hereby approved for the award of degree **"Bachelor of Technology in Information Technology"** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed, or conclusion drawn therein, but approve the dissertation only for the purpose for which it has been submitted.

(Internal Examiner) **(External Examiner)**

Date: **Date:**

MALWA INSTITUTE OF TECHNOLOGY, INDORE

Department Of Information Technology

DECLARATION

I **Lokesh Vishwakarma**, a student of **Bachelor of Technology in IT dept**, at **Malwa Institute of Technology, Indore (M.P.),** hereby declare that the work presented in this dissertation entitled **Auto Rescue – Accident Detection & Real Time Automatic Alerting System For Automobile** is the outcome of our own work, is Bonafide and correct to the best of our knowledge and this work has been carried out taking care of Engineering Ethics. The work presented does not infringe on any patented work and has not been submitted to any other university or anywhere else for the award of any degree or any professional diploma.

Date:

Lokesh Vishwakarma

Enrollment No.: 0821IT211020

Acknowledgement

Foremost, I would like to express my sincere gratitude to my guide **Mr. Vijay Malviya sir** for the continuous support of my study and research, for their patience, motivation, enthusiasm, and immense knowledge. Their guidance helped me in all the time of research and writing of this thesis.

I am ever grateful to **Dr. M.S. Murthy (**Director, Malwa Institute of Technology, Indore) for providing an opportunity to explore this wonderful venture. And I would like to give my regards and remember another source of inspiration, **Mr. Vijay Malviya** (HOD, IT Dept.)

This project would not have been possible without collaboration with my colleagues, and the support of my friends and family.

Lokesh Vishwakarma

Enrollment No.: 0821IT211020

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ABSTRACT

This research addresses the critical issue of accident detection by developing an innovative system that leverages modern sensor technology and machine learning algorithms. The main objective is to enhance road safety through real-time accident identification and swift response mechanisms. Drawing upon a conceptual framework rooted in computer vision, sensor fusion, and artificial intelligence.

This system utilizes data from various sources, including accelerometers, noise sensor, tilt sensor GSM modules and GPS devices. It then employs deep learning techniques to analyze this data for signs of accidents, such as sudden deceleration or collision events. Also on the other hand this research provide call cancellation techniques which are crucial to ensure that false alarms do not trigger emergency services or notifications to loved ones unnecessarily. These techniques help prevent unnecessary panic and stress for the driver and the potential burden on emergency response services.

The system's performance is evaluated through extensive field testing, demonstrating its potential to reduce emergency response times and save lives. This research contributes to the ongoing efforts to improve road safety through advanced technology.

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ABBREVIATIONS

GPS	Global positioning system
GSM	Global System for Mobile communication module
ADXL	Analog Devices Accelerometer.
UART	Universal Asynchronous Receiver/Transmitter
TX	Transmitter X
RX	Receiver X
VCC	Voltage Collector Collector.
GND	Ground

1. INTRODUCTION

1.1 Definition

The Auto Rescue Accident Detection & Real Time Automatic Alerting System For Automobile is an innovative project designed to enhance the efficiency and effectiveness of emergency medical services. In the face of growing urbanization and the increasing demand for swift and reliable ambulance responses, this system aims to revolutionize the way ambulance services are managed and dispatched. By leveraging advanced technology, real-time data, and automation, this project seeks to reduce response times, save lives, and improve the overall quality of emergency medical care. This introduction outlines the key objectives, features, and benefits of the Auto Rescue Automated Ambulance Dispatch System, demonstrating its potential to significantly impact the field of emergency healthcare.

1.2 Accident Challenges

Several technological and sociological advancements have contributed to a reduction in traffic accidents in Bharat. According to data published by the 'Times of India' in 2022, road accident deaths in Bharat accounted for 30% of total deaths, often due to ambulance delays. A mere 1% increase in the usage of seat belts can significantly reduce the number of accidents, potentially saving an estimated 136 lives. Nevertheless, there are still a significant number of accidents occurring .The problem statement outlines the pressing issue of traffic accidents in Bharat, which account for a significant number of deaths, often due to ambulance delays. Even a 1% increase in seat belt usage could save lives. The main concern is the late response of emergency services, especially in remote areas or at night when there are no witnesses. Every minute counts in saving lives, as a one-minute reduction in response time can result in a 6% difference in lives saved. This project aims to address these challenges by reducing ambulance response times, improving navigation to accident locations, providing accurate data to hospitals, and implementing call cancellation techniques to avoid false alarms and unnecessary calls.

1.3 Improving Emergency Response Time

Conventionally during an emergency, a victim or the victim’s caretaker calls ambulance dispatch service by dialling the helpline number. The ambulance dispatcher asks for the detailed address and calls the available ambulance to go to that particular location. This process consumes time. A person have to first make a call and wait until the call connects and then guide the ambulance dispatcher about the location of accident or emergency. The dispatcher then alerts the ambulance near the location of the victim and guides the ambulance to the victim. In case of emergency, every minute is crucial for saving a life and one cannot

afford to wait longer .The need of a system that can reduce this time where the information of the victim flows from the victim to dispatcher and dispatcher to ambulance .This research work proposes a technical that can bypass the need of manual dispatcher and enable the direct communication between nearest ambulance and the victim thus, reducing the delay in communication and ultimately the arrival of the ambulance to rescue the sufferer. Automated Ambulance Dispatch System comprises of three front-ends; victim ambulance and server.

1.4 The Significance of an Auto Rescue System

Creating a system that automatically calls the ambulance of the nearest hospital to the accident point is a highly valuable endeavour with numerous crucial objectives. Firstly, it significantly reduces response time, potentially saving lives in critical situations. This technology ensures that medical assistance is dispatched swiftly, addressing the urgency of accidents and medical emergencies. Seconds can make a difference in life or death situations, and this system can bridge that crucial gap. Moreover, it optimizes resource allocation by directing ambulances to the nearest available hospital, enhancing the overall efficiency of the healthcare system. This not only ensures that patients receive timely care but also reduces the strain on busy hospitals by distributing cases more evenly. Additionally, it can provide real-time information to hospitals, allowing them to prepare for incoming patients, which is vital for better patient care and outcomes. Hospitals can mobilize their resources, including staff and equipment, in advance, leading to more effective and immediate treatment. Overall, such a system has the potential to revolutionize emergency medical services, minimizing delays, and contributing to more effective and timely healthcare interventions. It embodies the essence of using technology to save lives and enhance the overall quality of healthcare delivery.

1.5 Enhancing Emergency Response and Community Health with Advance Systems

This minimization of errors can be a lifesaver in emergencies. The system also facilitates real-time communication, allowing for swift coordination between first responders, medical personnel, and hospitals, optimizing the entire emergency response chain. Furthermore, it offers emergency medical guidance to individuals at the scene, assisting them in providing essential care until the ambulance arrives. This guidance can be invaluable in stabilizing patients before professional help arrive Moreover, such a system benefits community health and safety by making emergency services more accessible and responsive. It is particularly crucial in densely populated areas. Additionally, it helps reduce language barriers by providing clear and concise automated instructions, making it universally applicable .In essence, the system's objectives are cantered around saving lives, improving the quality of emergency medical care, and enhancing overall community well-being.

1.6 How is our Project Different and Unique?

The work related to this project has already been done in our project but the old projects did not have the same accuracy as we are providing in our project and the old projects also did not have the option of call cancellation. In the old project, calling an ambulance even if there was a minor accident was a big problem. But we are providing call cancellation facility in our project. If there is no serious accident, then in this we will be able to cancel the call to the ambulance, so that in case of an ordinary accident, the ambulance will not have to be called. Besides, we are also using different sensors in our project, which makes our project very unique and unique.

2. LITERATURE SURVEY

S. NO	TITLE	AUTHOR	WORK DONE	EFFICIENCY	DRAW BACKS
1.	Accident Detection and Alerting System.	Muhammad Ahemad Baballe	Vibration sensor and Micro electro mechanical sensor is used to detects the accident.	Due to lack of some sensors system efficiency is 79% to 85 %.	Capturing falls vibrations of engine.
2.	Automatic road Accident De tection.	Usman Khalill KASB Institute of Technology	The system uses two ultrasonic sens ors to detect the accident.	It's efficiency is very low because of many falls detection about 60%.	The system range is only 4 meters Also there are many falls detection.
3.	Car crash detection us ing ensemble deep learnin g and multimodal data from dashboard c ameras	Jae Gyeong Choi, Chan Woo Kong	This model uses video and audio data from dashboard cam eras.	According to 300 data sets from YouTube clip s Its validation is 70 %.	The possibility of d amaging the sensors is high. Also the audio can be falls.

Table 2.1 Literature survey

[1] Muhammad Ahemad Baballe(2019) writes in their paper "Accident Detection and Alerting System." that a customized android application designed and develop a low cost solution for accident detection and instant rescue message to emergency services through mobile GSM network system and take longitude and latitude from GPS system of mobile. In this research a Micro electro mechanical sensor is used to detect the accident which decreases the efficiency of the system. MEMS sensor is typically designed to operate within specific ranges. This may not be as effective at detecting very high-speed collisions or extremely slow changes in velocity.

[2] Dr. Usman Khalill KASB Institute of Technology(2018) write in their paper “Automatic road Accident Detection system.” Automatic road accident detection system is developed in order to detect vehicle accident with the help of the two ultrasonic sensors but the major problem with these sensors was that they work in the close range, an average range of this sensors is 4 meters which is quite less to detect the accident. Also this sensor capture many falls accident, their actual work is to assist the car while parking in order to prevent collision.

[3] Jae Gyeong Choi, Chan Woo Kong (2018) write in their paper “Car crash detection using ensemble deep learning and multimodal data from dashboard cameras.” This model uses video and audio data from dashboard cameras to detect accidents. While audio and video data play a crucial role in accident detection, in the case of a major collision with an object, there is a 70% chance of camera damage. This can significantly decrease the system's efficiency and accuracy."

3. PROBLEM ANALYSIS

The persistent global increase in road traffic has led to a corresponding rise in traffic accidents, resulting in significant human casualties, property damage, and economic costs. In an effort to mitigate the consequences of these accidents, researchers and engineers have turned to technological solutions, with accident detection systems emerging as a promising approach. These systems are designed to provide rapid responses to road accidents by automating the process of alerting emergency services. While the potential benefits of such systems are evident, their effective implementation and performance present several critical challenges that warrant in-depth investigation.

3.1. Accuracy and Reliability:

One of the central concerns surrounding accident detection systems is the accuracy and reliability of their accident identification. False alarms, often triggered by road irregularities, minor collisions, or even abrupt braking, pose a significant problem. Such false positives can strain emergency resources, leading to inefficient use of time and funds. Moreover, frequent false alarms may desensitize both emergency services and drivers, diminishing the system's overall effectiveness. Therefore, ensuring that the system can accurately distinguish genuine accidents from non-accident events on the road is of paramount importance. Achieving a high level of accuracy without compromising efficiency is a significant challenge that must be addressed.

3.2. Real-Time Response and Communication:

The effectiveness of an accident detection system relies heavily on the system's ability to initiate a swift and efficient response. Delays in alerting emergency responders can have critical and, at times, fatal consequences for accident victims. Therefore, the system must excel in real-time accident detection, immediate alerting of emergency services, and ensuring that the appropriate response is dispatched promptly. Achieving this level of coordination between the accident detection system and emergency services is crucial, particularly in situations where rapid medical assistance can be a matter of life and death.

3.3. Environmental Adaptability:

The effectiveness of accident detection systems may be compromised by varying environmental conditions. Adverse weather, low-light situations, or poor visibility can challenge the system's ability to operate effectively. The system should be capable of functioning optimally under a wide range of environmental circumstances to ensure its reliability. Developing a system that can adapt to different conditions is a critical aspect of its success.

3.4. AIM

In this research paper, we aim to delve into these challenges by conducting a comprehensive evaluation of existing accident detection systems. We also aim to propose improvements and explore their real-world effectiveness. By addressing these critical issues, we hope to contribute to the development of more accurate, efficient, and cost-effective accident detection systems. These systems have the potential to significantly enhance road safety, reduce the impact of traffic accidents, and ultimately save lives, making our roads safer for everyone.

4. INNOVATION

In the ever-expanding world, the number of accidents is steadily increasing, and as a result, the number of fatalities is on the rise. In some cases, these fatalities occur due to delayed ambulance responses at accident scenes. There are various contributing factors to this issue. For instance, if an accident happens at night, and the driver is rendered unconscious, there may be no one present to provide immediate assistance, leading to tragic outcomes. To address this problem, the concept of an accident detection and calling system has been introduced in the modern era.

The accident detection and calling system automatically identifies accidents, places emergency calls for ambulance services, and transmits accident location details so that nearby ambulances can promptly respond and rescue the driver. However, the system's effectiveness is of paramount importance. It must be accurate, capable of detecting both high and low impact accidents, and able to discern if it is an emergency situation or not to prevent false alarms.

Previous implementations of accident detection systems often lacked the ability to determine the severity of an accident or employ call cancellation techniques, rendering them inaccurate. In our system, we propose solutions to address these issues, offering increased accuracy. By incorporating sensors such as tilt sensors and vibration sensors, we enhance system efficiency. Additionally, the combination of circuits and the application of effective algorithms play crucial roles in achieving this.

In our system, we introduce call cancellation and alarm techniques, allowing users to cancel calls to prevent the transmission of false alarms to emergency services, making the system more user-friendly. Furthermore, we have integrated a mobile application, enabling users to adjust impact threshold limits, tilt sensor settings, and vibration sensor limits according to their specific vehicles, thereby enhancing the system's accuracy for various car models. All of this can be effortlessly managed through their Smartphone’s.

5. OBJECTIVE

Our main objective of this project is to minimized the accident response time to the emergency services when accident occurs and navigated the ambulance toward the spot.

Some of the other objectives of this project are listed below:

- Provide a system that is fully automated to help the detection of accident occur location.
- To send direct notification to nearest hospital and family member.
- To keep the record of major accident, happen in particular place with their name, vehicles number and location of accident in digital way.

The primary objective of an accident detection system in cars is to swiftly identify accidents or potentially hazardous situations and initiate automatic emergency responses, such as deploying airbags and alerting emergency services, with the aim of enhancing vehicle safety, reducing injuries, and potentially saving lives. These systems may also assist drivers in avoiding accidents and collect data for post-accident analysis and insurance claims while minimizing false alarms to ensure their effectiveness..

Accident detection systems often incorporate communication capabilities. In the event of a crash, they can automatically communicate with emergency services, typically dialling 108 or a relevant emergency number, and transmitting critical information about the accident, including the vehicle's location, the severity of the impact, and the number of occupants in the vehicle. This rapid response can significantly reduce the time it takes for emergency services to arrive at the scene, potentially saving lives and minimizing injuries.

Another important aspect of these systems is their role in preventing false alarms. While early detection is crucial, it's equally important to minimize false alarms or misidentifications of non-accident events that could lead to unnecessary panic and emergency responses. The accuracy and reliability of these systems are continually improved through advanced sensor technology and sophisticated algorithms.

6. SOLUTION DOMAIN

Obviously, people now days use Smartphone and easily access to the cellular networks which helps them to know about actual location of the vehicle. But, not always the cellular network can be trusted that is the reason why we built the systems which acts both the cellular network and also the real-time database-based application.

Moreover, due to the increasing nature of the vehicles in the Kathmandu valley the government also come up with the proper managed plan to keep track of the vehicles that run inside and outside the valley which in future may cover the whole nation. By doing this helps in reducing the accident rate and immediate effect even the death of the people with presence of rescue team on time.

The Accident Detection System for Vehicles is a comprehensive solution designed to improve road safety and emergency response. It includes a sensor suite with IMU, GPS, and collision sensors, a central processing unit, communication modules, and a user-friendly interface. Key features encompass accident detection, data logging, emergency alerts, driver assistance, cloud integration, and more. The technology stack involves microcontrollers, real-time operating systems, and connectivity options. Implementation considerations encompass legal compliance, secure hardware installation, and user education. The system offers benefits like enhanced driver safety, rapid emergency response, valuable accident data, vehicle health monitoring, and driver behaviour analysis, making it a critical innovation for vehicle safety and accident management.

7. PROPOSED METHODOLOGY AND ALGORITHM

The methodology is divided into block diagram, algorithm and flow chart of the system. The block diagrams provide the conceptual idea of how each block are interrelated to the whole task. It defines the basic link of various blocks with each other while the hardware specification will detail out the components involved in this design process. Software portion will be detail out the part mainly focused in the platform and its interface with number of sensor where the flow of the system operation will be detailed out elaborately. Since the system is mainly in automation, accuracy is focused more. The system has been being well designed. The algorithm includes the working sequence for the system with expected output. Algorithm defines how the system flows while flowchart section helps understand the flow of the system for better visualization.

Accident detection are done through various sensor data where a threshold limit is set during coding part. We use Accelerometer sensor for X, Y, Z coordinate of vehicle. For better precision and lower the false detection we use sound and tilt sensor which provide additional data to microcontroller to detect accident. Arduino-Nano is attached with the Wi-Fi module this help to transfer the data to IOT database. After detection of accident Arduino-Nano search for nearest location of hospital base on GPS location provided by GPS module with the help of Google API key. SIM 900A, GSM module is used to inform user family.

7.1 Basic Block Diagram:

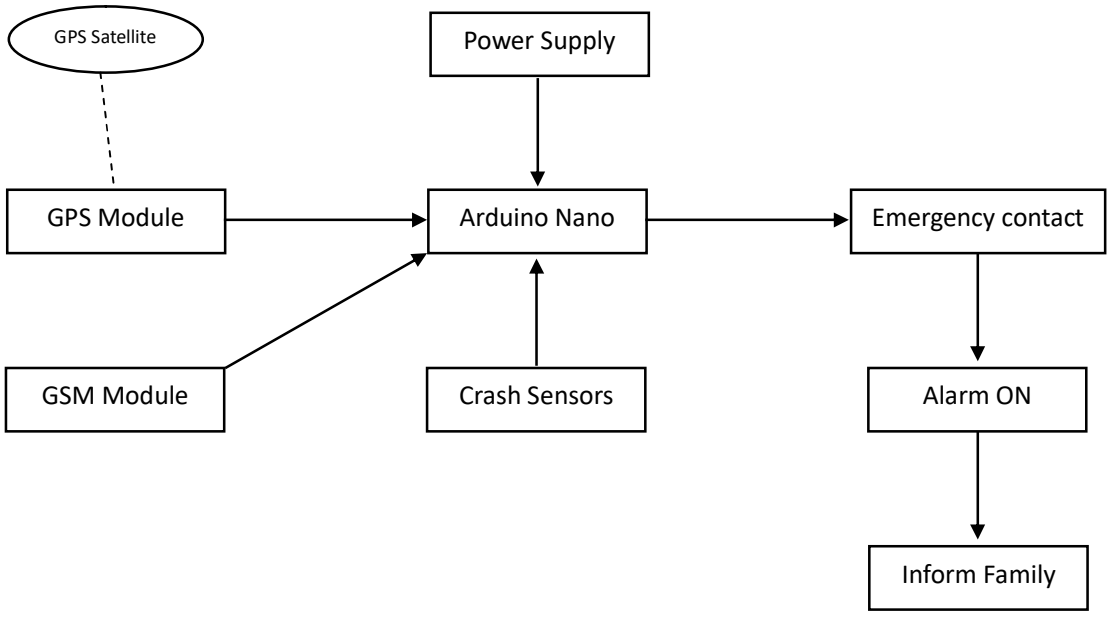

Figure 7.1: Block diagram of Auto-Rescue system

The block diagram above shows the general working process of the system. It consists of the Arduino nano as core of system. Arduino nano is microcontroller unit of our system where all the necessary code are burn and necessary peripheral device are attached for processing the system. The microcontroller takes all the sensor readings data and sends it over to the Database. This system is simple light weight protocol for machine-to-machine communication designed for IoT. Basically, we can control and read nodes remotely using this protocol. Further from gateway we send data over to internet. The different IoT service providers, provides us the platform such to give data to users and public. An android application will be designed which will allow farmers to monitor and control the basic environmental parameters of the farm.

7.2 Algorithm:

Denotation:
- Accelerometer reading = A
- Accelerometer Threshold = AT
- Sound reading = S
- Sound Threshold = ST
- Tilt sensor reading = T
- Tilt sensor Threshold = TT

1. **Start**

2. Take sensor reading

3. Check reading

If ((**A>AT && S>ST**)
||
(T>TT && S>ST) || (A>AT && S>ST))

4. If the condition is false then continue from start

5. If the condition is true then

6. Turn on **ALARM**

If (**ALARM == Cancel**)
Stop the alarm and continue from start
Else
Take GPS coordinates then continue from step (7)

7. Send text Message and Current Location

8. **END**

7.3 Flow Chart:

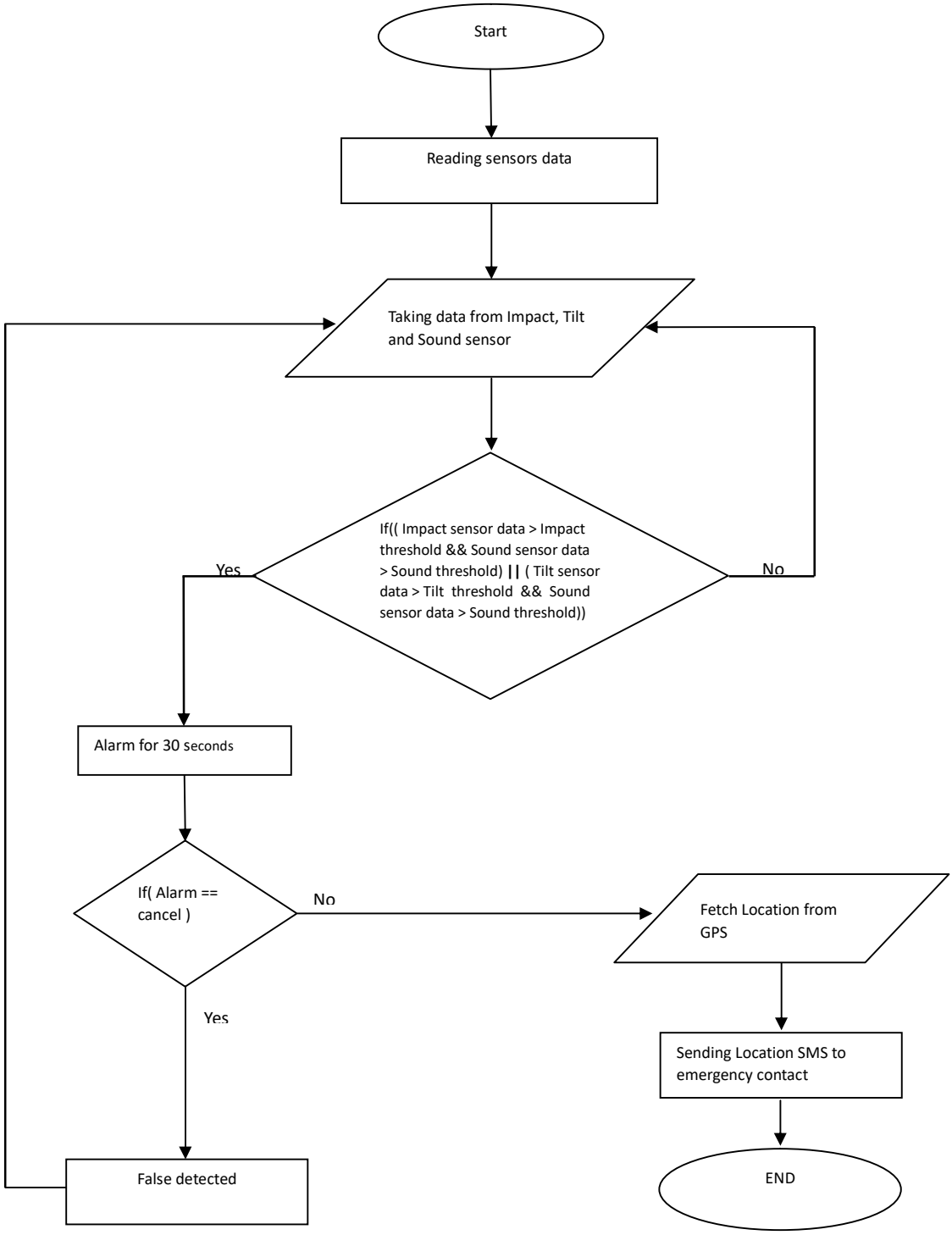

Fig 7.3.1 Flow chart of Auto Rescue System

7.4 Elementary Conditions of Accident:

Elements	Value1	Value2	Value3	Value4
Impact threshold	< Impact	> Impact	< Impact	> Impact
Tilt threshold	> Tilt	< Tilt	< Tilt	> Tilt
Noise threshold	< Noise	< Noise	> Noise	< Noise
Accident	**On**	**ON**	**ON**	**OFF**

Table 7.4.1 Elementary conditions of Accident

Explanation:

This table explains that when two conditions are both active at the same time, only then will the buzzer be triggered and accident is detected. When only one condition is active, the buzzer will remains off.

8. TOOLS AND TECHNOLOGY USED

8.1 Accelerometer Sensor (ADXL-335):

- **Definition:** An accelerometer is a sensor or transducer that measures acceleration, which is the rate of change of velocity of an object. It can detect changes in speed and direction, as well as the force of gravity acting on an object. Accelerometers are commonly used in various applications to measure and monitor motion, tilt, vibration, and orientation.

- **Use of the sensor:** Accelerometers can be used in an accident detection system to sense and identify sudden, high-impact events, such as car accidents, falls, or collisions. When integrated into a system, accelerometers can trigger alerts, call for help, or record data when a significant impact is detected

- **Threshold Limit:** The threshold limit for accelerometer measurement of an accident is around 20 - 30 G's. If the acceleration value is greater than or equal to the threshold value, a message is sent to the emergency contacts as "Accident Detected". If the acceleration value is less than the threshold value, it means "No accident".

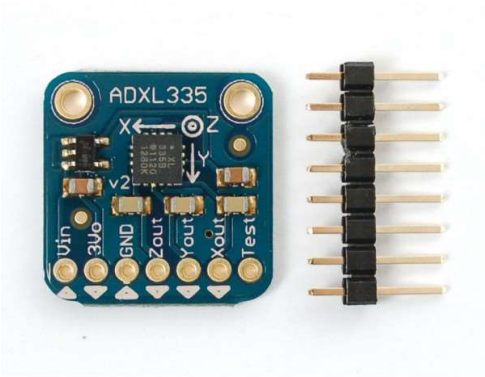

Fig 7.3 Accelerometer sensor

8.2 Noise Sensor

- **Definition:** A noise sensor, also known as a sound or audio sensor, is a device that detects and measures sound levels or specific acoustic events in its environment. It can capture variations in sound intensity, frequency, and duration. In the context of an accident detection system in cars, a noise sensor can be used to enhance the capabilities of the system.

- **Use in system:** In conjunction with other sensors like accelerometers, the noise sensor can help confirm that an accident has taken place. When both the accelerometer and noise sensor detect the characteristic patterns of a crash, it provides a higher level of confidence that an accident has occurred.

- **Threshold Limit:** The noise sensor threshold will be minimum 100 decibels. The threshold value is the current value, which is displayed by the serial monitor. The value ranges from **0 % to 100%**. The threshold value is split into three classes. If the threshold value ranges between 0 and 30%, the accident occurred can be ignored. So, no alert will be given.

Fig 7.4 Noise sensor

8.3 Tilt Sensor

- **Definition:** A Tilt sensor is a sensor used to detect the orientation or tilt of an object with respect to gravity by generating an electrical signal proportional to the angle of tilt.

- **Use in system:** This sensor play a crucial role in detecting the orientation or tilt of a vehicle, which can indicate potential accidents such as rollovers or collisions.

- **Threshold Limit:** The threshold limit of a this sensor refers to the minimum or maximum angle of tilt at which the sensor triggers a response. The threshold limit of tilt is set upto 45 degree. The threshold limit needs to be carefully calibrated based on the desired sensitivity and reliability of the system.

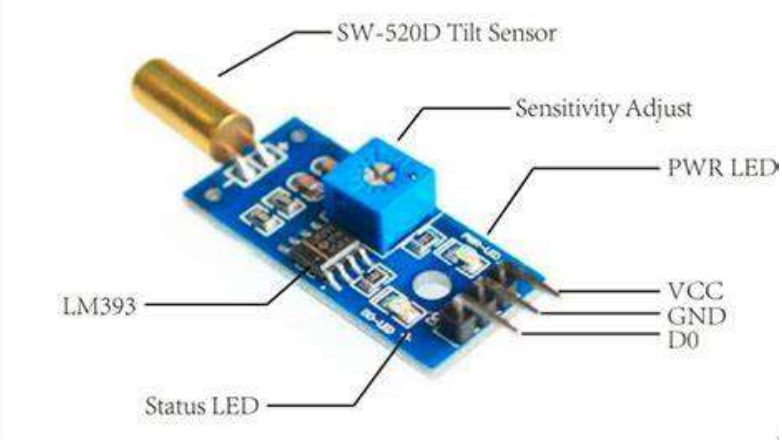

Fig 7.5 Tilt sensor

8.4 Arduino Nano

- **Circuit**: The Arduino Nano is a microcontroller board. You connect it to your computer or power source through USB or an external power supply. It has digital and analog pins, as well as power and ground pins.

- **Use**: The Arduino Nano can be programmed to control various electronic circuits and devices. It's commonly used in DIY electronics projects for tasks like reading sensors, controlling motors, or interfacing with other modules.

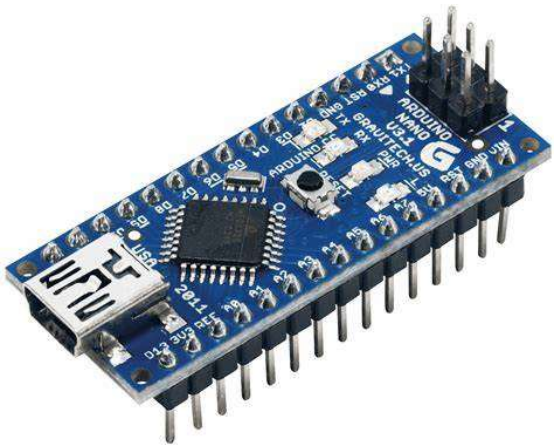

Fig 7.6 Arduino Nano

8.5 GSM Module (SIM800L)

- **Circuit**: The GSM SIM800L module has pins for power, ground, and communication (TX and RX). It also requires a SIM card for cellular connectivity.

- **Use**: This module enables your project to connect to the cellular network. It's used for sending SMS messages, making phone calls, or establishing internet connections. Applications include remote monitoring, tracking, and IoT projects.

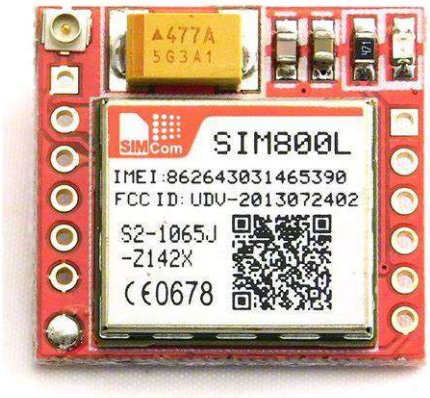

Fig 7.7 GSM Module

8.6 GPS Module (NEO-6M)

- **Circuit**: The NEO-6M GPS module typically connects through UART (TX and RX pins). It also requires power and ground connections.

- **Use**: The GPS module provides accurate location and time data. It's used in projects where you need to track the device's location, such as GPS navigation, vehicle tracking, or geocaching.

Fig 7.8 GPS Module (NEO-6M)

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9. SPECIFICATION SHEET OF TOLERANCE RANGES FOR COMPONENTS

8.1 Arduino Nano

The tolerance of the Arduino Nano itself refers mainly to the precision of its components and the stability of its clock frequency.

Component Tolerance:

Resistors: ±5% to ±10%

Capacitors: ±5% to ±10%

Clock Frequency Stability: ±1%

8.2 GSM module (SIM800L)

The tolerance of the SIM800L GSM module typically includes parameters such as voltage input range, operating temperature range, and communication protocol compatibility.

Component Tolerance:

Input Voltage Tolerance: ±0.1V to ±0.5V

Operating Temperature Range: ±5°C to ±10°C

Communication Protocol Compatibility: GSM 850/900/1800/1900 MHz

SIM Card Compatibility: Standard SIM card

8.3 GPS module (NEO-6M)

The tolerance of the NEO-6M GPS module can include accuracy in position fixing, time synchronization, and signal acquisition

Component Tolerance:

Position Accuracy: ±2.5 meters (CEP)

Time Synchronization: 30 nanoseconds

Operating Voltage Tolerance: ±0.1V to ±0.5V

Operating Temperature Range: ±5°C to ±10°C

8.4 ADXL335 Accelerometer

The tolerance of the ADXL335 accelerometer refers to parameters such as sensitivity, zero-g offset, and frequency response.

Component Tolerance:

Sensitivity Tolerance: ±5% to ±10%

Zero-g Output Tolerance: ±0.5V

Operating Voltage Tolerance: ±0.1V to ±0.5V

Bandwidth Tolerance: ±5%

8.5 Sound sensor

The tolerance of a sound sensor can include sensitivity to sound levels, frequency response, and signal-to-noise ratio.

Component Tolerance:

Sensitivity Tolerance: ±3dB to ±5dB

Frequency Response Tolerance: ±10%

Signal-to-Noise Ratio Tolerance: ±3dB

Operating Voltage Tolerance: ±0.1V to ±0.5V

8.6 Tilt sensor

The tolerance of a tilt sensor depends on its construction and mechanism.

Component Tolerance :

Detection Angle Tolerance: ±10 degrees

Response Time Tolerance: ±1ms

Operating Voltage Tolerance: ±0.1V to ±0.5V

8.7 LM2596 step-down converter

The tolerance of the LM2596 step-down converter includes parameters such as output voltage regulation, efficiency, and thermal performance.

Component Tolerance:

Output Voltage Regulation Tolerance: ±2%

Efficiency Tolerance: ±5%

Ripple Rejection Tolerance: ±3dB

Operating Temperature Range: ±10°C

8.8 Buzzer

The tolerance of a buzzer typically refers to parameters such as operating voltage range, sound output level, and frequency response.

Component Tolerance:

Operating Voltage Tolerance: ±0.1V to ±0.5V

Sound Output Level Tolerance: ±3dB

Frequency Tolerance: ±5%

Operating Current Tolerance: ±5%

8.9 Button

The tolerance of a button mainly refers to its mechanical durability and electrical contact reliability.

Component Tolerance:

Contact Rating Tolerance: ±5%

Operating Life Tolerance: ±10%

Dimensions: Variable depending on mode

10. IMPLEMENTATION

The proposed accident detection system serves as a potential life-saver for individuals involved in accidents. Designed with simplicity in mind, it boasts user-friendliness, ensuring even non-technical individuals can operate it effortlessly. The system comprises both hardware and software components, each playing a crucial role in its functionality.

Hardware Components:

At the heart of the system lies the hardware unit, encompassing accident detection sensors. These sensors are meticulously selected for their ability to accurately detect various types of accidents, ranging from collisions to sudden impacts. These sensors are seamlessly integrated and controlled by an Arduino board, renowned for its versatility and ease of use. Installed within the vehicle, these sensors serve as vigilant guardians, constantly monitoring the surrounding environment for any signs of danger.

Software Components:

Complementing the hardware unit is the software component, which forms the intelligence behind the system's operation. The software is meticulously crafted to interpret data from the sensors, analyze it in real-time, and make informed decisions in case of an accident. Developed with simplicity and efficiency in mind, the software ensures seamless interaction with the hardware, enabling swift and accurate detection of accidents.

Ease of Use:

What sets this system apart is its exceptional ease of use. Its intuitive interface and straightforward operation make it accessible to individuals of all technical backgrounds. Whether it's a seasoned driver or a novice, anyone can utilize the system without encountering any complexities. In times of distress, when every second counts, the system's user-friendly design proves to be a valuable asset, enabling swift action and potentially saving lives.

10.1 Pin Diagrams:

1. Arduino Nano

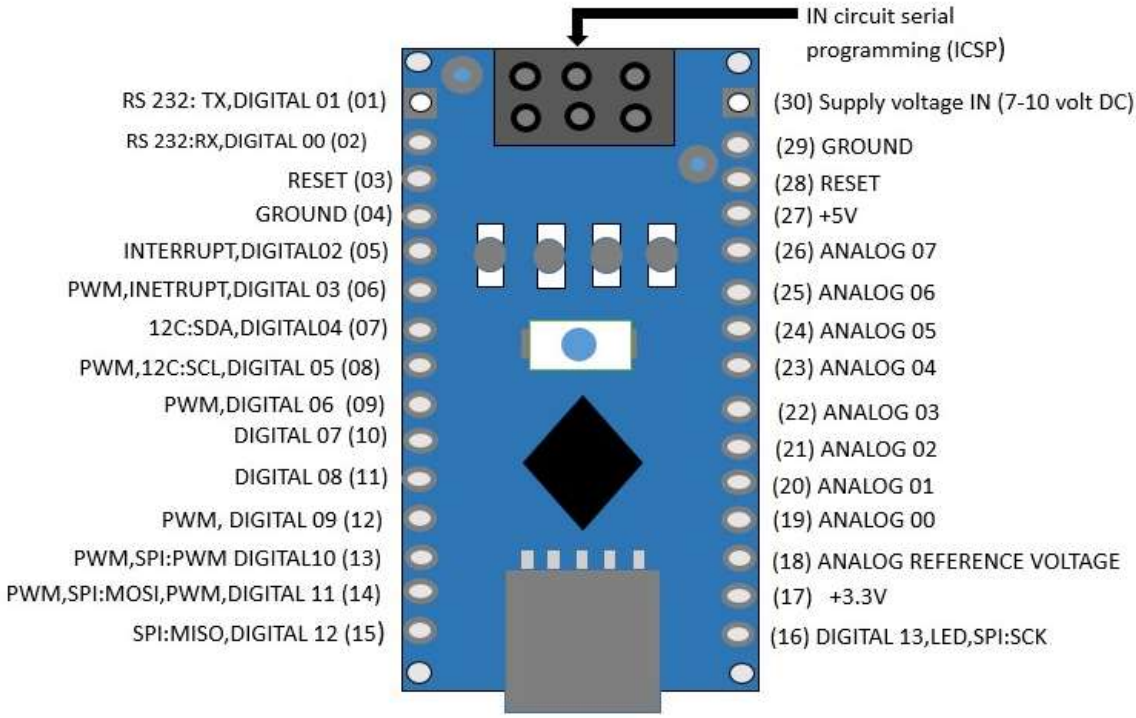


Fig 10.1.1 Arduino Nano

2. GPS Module SIM 800L

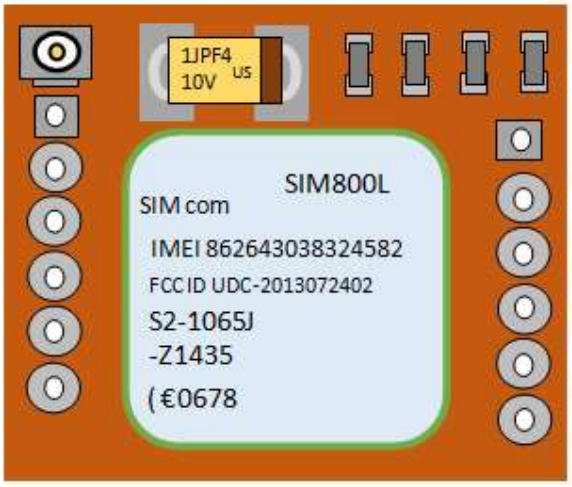


Fig: 10.1.2 GSM Module Sim-800L

3. GPS Module Neo-6M

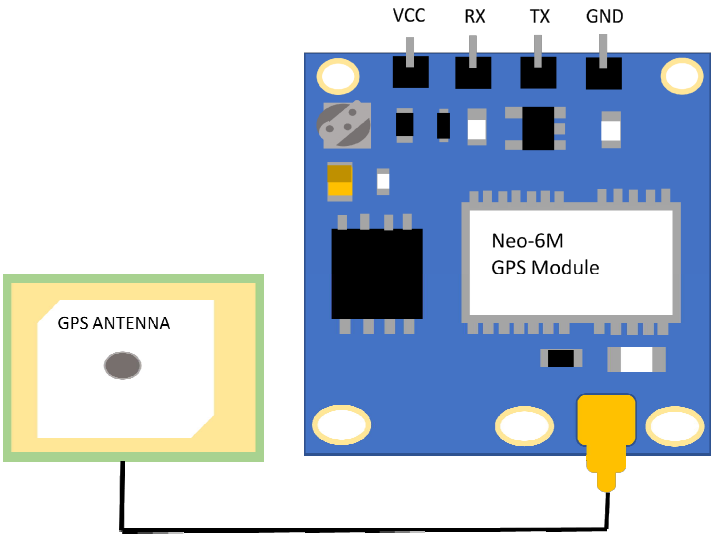


Fig 10.1.3 GPS Module Neo-6M

4. ADXL-335 Accelerometer

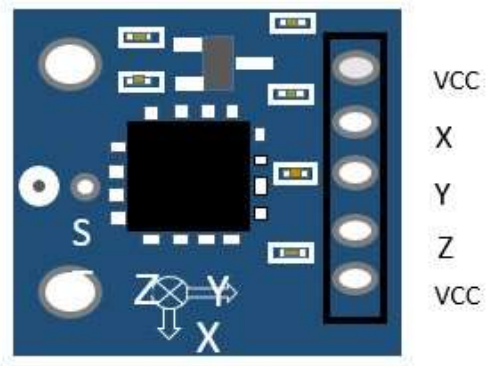


Fig 10.1.4 ADXL 335

5. Sound Sensor

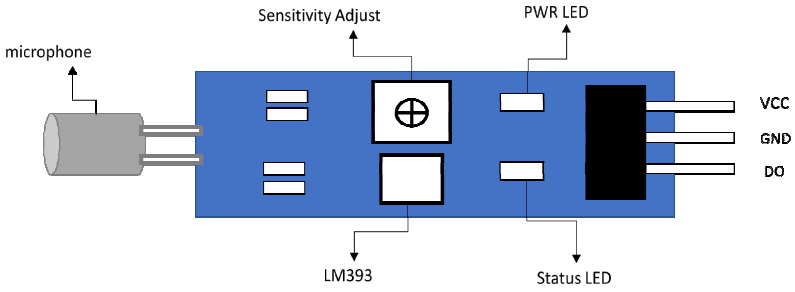


Fig: 10.1.5 Sound sensor

6. Tilt Sensor SW-520D

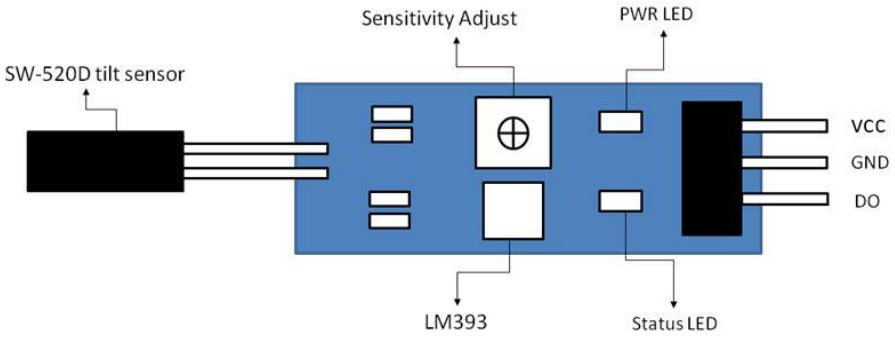


Fig: 10.1.6 Tilt Sensor

10.2 Circuit Diagram of System:

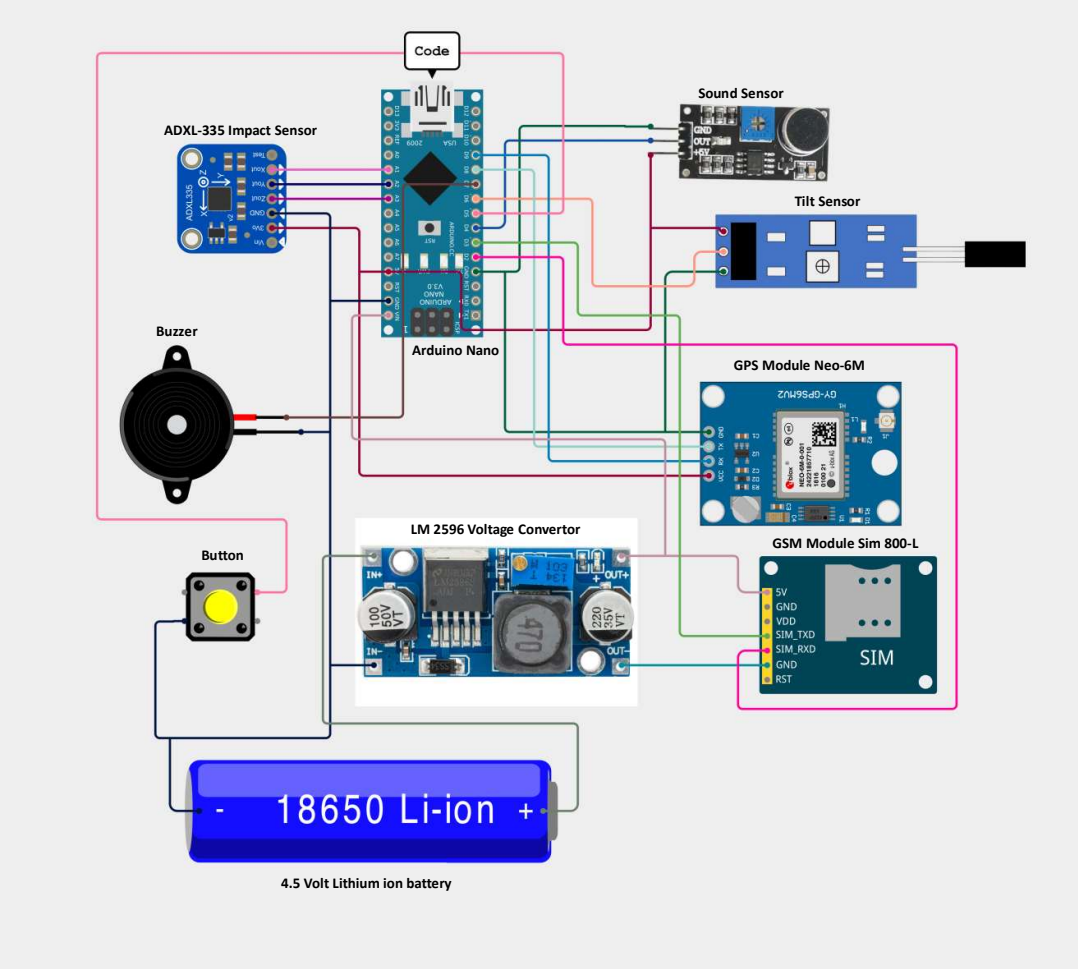
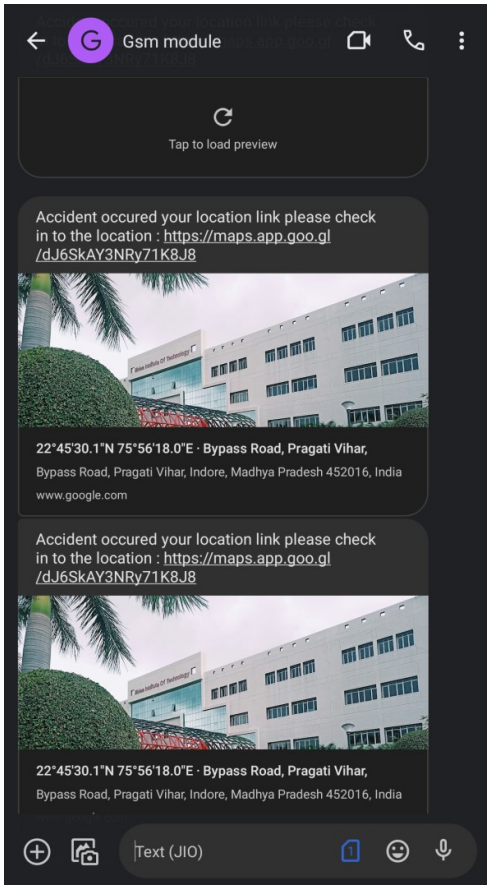


Fig: 10.2 Circuit diagram of Auto Rescue system

11. RESULT ANALYSIS

In Fig., the SMS sub-system of the framework has been shown. The SMS is sent via the GSM module to the number that is already stored in the database. The message will contain detailed information on the accident location. When the system collecting the stored contact numbers of users, the system will send SMS of accident location link to the users by GSM Module. GSM (Global System for Mobile Communication) is an architecture used for mobile communication in almost all of the countries now a day.



When a user clicks on the link of the point of accident, the location will be displayed on google map. By knowing the location, any user or the rescue team can dynamically take the shortest route to reach the destination, an ambulance will also head towards the accident location to provide emergency medical assistance. The result and testing part is divided into two sections which represent the uniqueness of the framework and accuracy of the results.

System testing of software or hardware is conducted in a complete and integrated environment to evaluate its compliance with the specified requirements. System. testing takes all integrated modules that have passed integrated testing as its input. The testing then aims to detect any inconsistencies between the units integrated.. System testing can detect bugs with the interaction between different modules of a framework. Oftentimes, these interactions glitches may not have a huge impact on a modular level, but when the impact is measured on the overall performance of the system, such minor modular level impacts may become more serious than anticipated initially. Shows test cases, expected results and observed results of system

11.1 Table Integration test Result

Test Case Expected	Expected Result	Observed Result	Test Result
When the accident occurred the Accelerometer and Sound sensor should be able to detect the accident	Can detect an accident.	Can detect an accident	Pass
When the accident occurred the Accelerometer and Tilt sensor should be able to detect the accident	Can detect an accident.	Can detect an accident	Pass
When the accident occurred Tilt and Sound sensor should be able to detect the accident	Can detect an accident.	Can detect an accident	Pass
GPS Module of this system should be able to detect vehicle location correctly	Location should be exact.	Location is exact.	Pass
GSM Module of this system should be able to send SMS Correctly	SMS will be sent.	SMS has been sent.	Pass
The microcontroller should be able to process data from the sensors and modules	Can send and retrieve data to and from the sensors.	Can send can retrieve data.	Pass

Table 11.1.1 Integration Test Result

12. CONCLUSION

In general, the benefits of this system are low cost, secure and simple to use. The system introduced in this work reduces the casualties due to accidents The proposed programmed accident detection system can be a rescuer of life for the people who met with accidents. The proposed system is exceptionally easy to understand and even a non-specialized Person can use it without any problem. The system consists of equipment and programming segments. The equipment unit includes accident detection sensors the are constrained by an Arduino board and is fitted in the vehicle.

Accident Detection Sensors: These are the primary components responsible for identifying accidents. They could include accelerometers, gyroscopes, and other sensors capable of detecting sudden changes in speed, direction, or impact. These sensors are strategically placed within the vehicle to capture relevant data during a collision or accident.

Arduino Board: An Arduino board serves as the control unit for the sensors. It processes the data collected by the sensors and executes predefined algorithms to determine whether an accident has occurred. Arduino boards are popular microcontroller platforms known for their versatility and ease of use in prototyping electronic projects.

Programming Segments: This refers to the software or firmware that runs on the Arduino board. The programming segments are responsible for analyzing sensor data, detecting abnormal events indicative of an accident, and triggering appropriate responses. These responses could include activating emergency signals, sending alerts to emergency services or predefined contacts, or recording data for later analysis

Speed is one of the most significant causes of an accident. Nowadays, GPS receiver has become an integral part of a vehicle. Besides using in other purposes, the GPS can also monitor the speed and detect an accident. It can use a very cheap and popular GSM modem to send the accident location to the Alert Service Centre. It can also send the last speed before accident which will helps to assess the severity of the accident and can initiate a voice call. Beside the automatic detection system, the vehicle occupant will be able to manually send the accident situation by pressing the Manual Detection Switch. A rescue measures in time with sufficient preparation at the correct place can save many life. Thus, the proposed system can serve the humanity by a great deal as human life is valuable.

13. FUTURE WORK

The future of an auto rescue system like this could involve advanced sensors integrated into vehicles to detect accidents in real-time. These sensors would trigger an automatic alerting system that notifies emergency services and designated contacts. Moreover, they might incorporate technologies like vehicle-to-vehicle communication to provide more comprehensive accident information to emergency responders. Overall, it's a promising direction for enhancing vehicle safety and response efficiency. Auto Rescue is a cutting-edge system designed to revolutionize automobile safety. This innovative system aims to minimize response times, enhance passenger safety, and ultimately save lives on the road.

13.1 ADXL345

Using a gyroscope sensor alongside the ADXL335 accelerometer can enhance your project's ability to detect tilt and orientation. Here's how:

- **Improved Accuracy**: While the ADXL335 accelerometer is great for detecting tilt, it may have limitations in accurately detecting the exact orientation, especially when the tilt angle is small. Gyroscope sensors excel in measuring angular velocity and can provide more precise information about the device's orientation.

- **Faster Response:** Gyroscopes respond quickly to changes in orientation, providing real-time data about rotational movement. This can improve the responsiveness of your project, making it more dynamic and interactive.

- **Combining Sensor Data:** By combining data from both the accelerometer and gyroscope sensors, you can create a more robust orientation detection system. This fusion of sensor data, often referred to as sensor fusion, allows for more accurate and reliable orientation tracking, even in challenging environments with vibrations or sudden movements.

- **Expanded Functionality:** Adding a gyroscope sensor expands the capabilities of your project beyond simple tilt detection. You can implement features such as gesture recognition, motion tracking, or even augmented reality applications by leveraging the additional information provided by the gyroscope.

- **Calibration And Integration:** Integrating A Gyroscope Sensor Requires Careful Calibration And Integration With Your Existing System. You'll Need To Synchronize the Data From Both Sensors And Possibly Apply Filtering Algorithms To Improve Accuracy And Reduce Noise.

Overall, Incorporating A Gyroscope Sensor Into Your Project Alongside The ADXL335 Accelerometer Can Significantly Enhance Its Orientation Detection Capabilities, Providing Greater Accuracy, Responsiveness, And Versatility.

14. REFRENCE

[1] Muhammad Ahemad Baballe(2019) writes in their paper "Accident Detection and Alerting System." that a customized android application designed and develop a low cost solution for accident detection and instant rescue message to emergency services through mobile GSM network system and take longitude and latitude from GPS system of mobile.

[2] Dr. Usman Khalill KASB Institute of Technology(2018) write in their paper "Automatic road Accident Detection system." Automatic road accident detection system is developed in order to detect vehicle accident with the help of the two ultrasonic sensors.

[3] Jae Gyeong Choi, Chan Woo Kong (2018) write in their paper "Car crash detection using ensemble deep learning and multimodal data from dashboard cameras." This model uses video and audio data from dashboard cameras to detect accidents.

[4] Times of India, Information about the death rate due to delay of accident

Link; https://ieeexplore.ieee.org/document/8076818

[5] Steps taken by government to reduce deaths due to accident

Link: Steps taken by government to prevent road accidents | Carlo.in Blog