# SAFETRAVALERT

**A PROJECT REPORT**

***Submitted by***


**KUMAR S N (311620104302)**

**THEJAS KUMAR D P (311620104060)**

**GOKULAKRISHNAN S (311620104301)**


***in partial fulfilment for the award of degree***

***of***

**BACHELOR OF ENGINEERING**

**IN**

**COMPUTER SCIENCE AND ENGINEERING**


**MISRIMAL NAVAJEE MUNOTH JAIN ENGINEERING COLLEGE**

**THORAIPAKKAM, CHENNAI-600097**


**ANNA UNIVERSITY: CHENNAI 600025**

**MAY 2024**

# ANNA UNIVERSITY: CHENNAI 600 025

## BONAFIDE CERTIFICATE

Certified that this project report “**SafeTravAlert**” is the bonafide work of **“ KUMAR S N, THEJAS KUMAR D P & GOKULAKRISHNAN S**” who carried out the project work under my supervision.

| | |
|---|---|
| **SIGNATURE** | **SIGNATURE** |
| **Dr. A.GeethaPriya B.E, ME., Ph.D** | **Dr. N.Savaranan B.E., ME.,Ph.D** |
| **HEAD OF THE DEPARTMENT** | **SUPERVISOR**<br>**PROFESSOR** |
| Department of Computer Science and Engineering | Department of Computer Science and Engineering |
| Misrimal Navajee Munoth Jain Engineering College,<br>Thoraipakkam,<br>Chennai-600097 | Misrimal Navajee Munoth Jain Engineering College,<br>Thoraipakkam,<br>Chennai-600097 |

Submitted for the Project Viva-Voce Examination held on ___________________

**INTERNAL EXAMINER** **EXTERNAL EXAMINER**

## MISRIMAL NAVAJEE MUNOTH JAIN ENGINEERING COLLEGE

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

- **VISION:**

Producing competent computer engineers with a strong background in the latest trends and technology to achieve academic excellence and to become pioneers in software and hardware products with an ethical approach to serve the society

- **MISSION:**

To provide quality education by inculcating strong fundamentals in basic science, mathematics and engineering concepts through the state-of-the-art facilities. To provide the learning ambience that helps the students to enhance problem solving skills and to inculcate in them the habit of continuous learning in their domain of interest. To serve the society by providing insight solutions to the real-world problems by employing the latest trends of computing technology with strict adherence to professional and ethical responsibilities

# ACKNOWLEDGEMET

We express our sincere gratitude to our honourable Secretary (Administration) **Dr. Harish L Metha** and Secretary (Academic) **Shri L. Jaswant S Munoth** for providing the infrastructure facilities to do this project during our course period.

We thank our **Principal**, **Dr. C. C. Christopher,** for his valuable suggestions and guidance for the development and completion of this project.

We express profound sense of gratitude and thanks to our **HEAD OF THE DEPARTMENT, Dr. A. GeethaPriya, Associate Professor,** for her valuable suggestions and guidance for the development and completion of this project.

We thank our supervisor **Dr. N. Savaranan, Professor** for his constant help and valuable suggestions. We thank him for his whole hearted guidance right from the inception to the completion of our project.

We thank our Coordinator, **Mr. K. Varunamuthu, Assistant Professor**, for his valuable suggestion for the development and completion of this project.

Finally, we thank all the **Teaching and Non-Teaching Staff members** of our Department who helped us to complete our project.

Above all we thank the Almighty, our parents and Siblings for their constant support and encouragement for completing this project.

# ABSTRACT

The project "SafeTravAlert" addresses the pressing issue of road safety by introducing a comprehensive vehicle tracking and accident alert system. Through the integration of advanced sensors and real-time monitoring technology, the system continuously monitors the vehicle's route. In the event ofan accident, the system triggers an automatic phone call alert to pre-defined contacts, providing immediate notification. Concurrently, it shares the vehicle's precise location, facilitating swift response from emergency services or concerned individuals. By combining proactive accident detection with rapid response capabilities, SafeTravAlert aims to significantly enhance driver safety and minimize the impact of road accidents. This abstract encapsulates theproject's objectives, methodology, and potential impact, highlighting its significance in improving road safety. Through real-world testing and validation, SafeTravAlert demonstrates its effectiveness in providing timely assistance during critical situations on the road. The project underscores the importance of leveraging technology to mitigate road accidents and emphasizes the role of proactive safety measures in saving lives. Overall, SafeTravAlert represents a promising initiative towards creating safer road environments and fostering a culture of responsible driving

## TABLE OF CONTENTS

## LIST OF FIGURES

# LIST OF ABBREVIATIONS

| Abbreviations | Expansion |
|---|---|
| GPL | General Public License |
| GPS | Global Positioning System |
| GSM | Global System for Mobile Communication |
| IOT | Internet Of Things |
| IP | Internet Protocol |
| UART | Universal Asynchronous Receiver/Transmitter |
| MPU | memory protection unit |
| MCU | Microcontroller Unit |
| SMS | Short Message Service |
| IDE | Integrated Development Environment |

# CHAPTER 1

# INTRODUCTION

## 1.1 INTERNET OF THINGS (IOT)

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an Internet Protocol (IP) address and is able to transfer data over a network. Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business. An IoT ecosystem consists of web- enabled smart devices that use embeddedsystems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments

## 1.2 ARDUINO

Arduino is an open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Arduino boards are available commercially from the official website or through authorized distributors.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that maybe interfaced to various expansion boards ('shields') or breadboards (forprototyping) and other circuits. The boards feature serial communications interfaces, The Arduino Software (IDE)makes it easy to write code and uploadit to the board offline. The Arduino Integrated Development Environment - or Arduino Software (IDE) connects to the Arduino boards to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension

## 1.3 NEO6M GPS

The NEO-6M GPS module is a compact and affordable GPS receiver widely utilized in various projects. With its low power consumption and high sensitivity, it quickly acquires satellite signals for precise positioning and timing information. Operating within a voltage range of 3.3V to 5V, it interfaces seamlessly with microcontrollers through UART communication. Its default baud rate of 9600 bps ensures efficient data transmission. This module's versatility extends to applications such as vehicle tracking, asset management, and IoT devices requiring location-based services. While its integration requires minimal external components, it may benefit from an external antenna for enhanced reception in challenging environnts. Despite limitations like limited indoor reception and susceptibility to signal interference, its reliability and ease of use make it a popular choice for both hobbyists and professionals seeking dependable GPS functionality in their projects.

## 1.4 MPU6050

The MPU6050 is a versatile motion-tracking device combining a gyroscope and accelerometer in a single chip. Renowned for its accuracy and affordability, it provides precise measurement of angular velocity and acceleration along three axes. Operating with a supply voltage range of2.375V to 3.46V. The MPU6050 communicates via I2C or SPI interfaces, facilitating seamless integration into various projects. Its compact size and low power consumption make it ideal for applications such as motion- controlled gaming, drone stabilization, and wearable devices. Despite occasional noise and calibration requirements, its robust performance and richfeature set make it a popular choice among hobbyists and professionals alike for motion sensing and orientation tracking tasks.

### 1.5 GSM

The GSM module's significance lies in facilitating real-time communication for the SafeTravAlert device. Integrated with the Arduino, it enables SMS alerts, calls, and real-time tracking. The module's SIM card provides network access and authentication. Utilizing AT commands, the Arduino communicates with the GSM module. Network connectivity involves searching for available networks and registering with operators. Seamless data transmission encompasses SMS messaging and voice calls. Overall, the GSM module plays a pivotal role in realizing the project's goal of enhancing road safety through timely alerts and tracking.

### 1.6 NODE MCU

The NodeMCU serves as a crucial component in the SafeTravAlert project, facilitating wireless connectivity and IoT capabilities. Integrated with the Arduino platform, it enables seamless communication between the device and the internet. Its compact size and built-in Wi-Fi functionality make it ideal for IoT applications. The NodeMCU is based on the ESP8266 microcontroller, offering a powerful and cost-effective solution for wireless communication.

# CHAPTER 2

## LITERATURE SURVEY

Nikhil Kumar et al.[4] worked on An IoT Based Vehicle Accident Detection and Classification System using Sensor Fusion.This work presents an IoT-based automotive accident detection and classification (ADC) system, which uses the fusion of smartphone’s built-in and connected sensors not only to detect but also to report the type of accident.

Harshit Srivastava et al.[1] worked on the project IoT-Based Road Accident Rescue System Implementation for Smart City Applications. Here the IMU's three axis accelerometer, gyroscope, and magnetometer data are programmed to determine the vehicle's orientation and position. A Wi-Fi-based communication is established using to send data received from sensor units to Google Firebase cloud servers in real-time.

Shaik Mazhar Hussain et al.[5] worked towords A Conceptual Framework on IOT based System Designto Prevent Road Accidentsin Accident Prone CitiesIn this paper, A conceptual frame work has been proposed that highlights different causes of road accidents to take place. This paper also covers possible measuring parameters and approaches that draws a solution to prevent road accidents in the light of IOT technology

Mohammad Ehsanul Alim et al.[2] Designed & Implementation of IoT Based Smart Helmet for Road Accident Detection. This project focus that The Bike rider's engine will start only when the rider buckle the helmet. GPS & GSM Technology is used for tracking the location of the bike rider and sending text message to the family members of the Bike rider when an accident occurs.

Nazia Parveen et al.[3] worked on IOT Based Automatic Vehicle Accident Alert System This system uses a GPS receiver to detect the coordinates of the vehicle. The GSM module sends the coordinates to the rescue team via SMS. The accelerometer detects accidents or sudden changes in movement and this system displays coordinates or status messages on an LCD display and also this system alerts the rescue team with the accident location via SMS

# CHAPTER 3

# SYSTEM ANALYSIS

## 3.1 EXISTING METHOD

The current system relies heavily on smartphone sensors for vehicle tracking and accident detection. It continuously monitors the vehicle's route and utilizes smartphone sensors to detect accidents. In case of an accident, the system initiates an automatic phone call alert to predefined contacts and shares the vehicle's location. However, this system faces several limitations. Firstly, it is dependent on the accuracy and reliability of smartphone sensors, which may lead to false positives or false negatives in accident detection. Moreover, its effectiveness is limited in areas with poor cellular or internet connectivity, affecting its performance in remote or rural areas. Additionally, privacy concerns arise due to the collection of data from smartphones, potentially impacting user adoption. Furthermore, continuous monitoring and data transmission can drain the smartphone's battery quickly, potentially reducing user acceptance. Despite these drawbacks, the existing system highlights the importance of leveraging technology for enhancing road safety but also underscores the need for improvements in reliability, coverage, and user acceptance.

### 3.1.1 Disadvantages

- Dependency on Smartphone Sensors: The system relies heavily on the accuracy and reliability of smartphone sensors. If these sensors malfunction or provide inaccurate data, it could lead to false positives or false negatives in accident detection and classification.

- Limited Coverage**:** The effectiveness of the system may be limited in areas with poor cellular or internet connectivity, as it relies on IoT platforms for data transmission. In remote or rural areas with limited network infrastructure, the system's performance may be compromised.
- Privacy Concerns: Collecting data from smartphones raises privacy concerns, as users may be apprehensive about sharing their sensor data, especially if it involves continuous monitoring of their movements and activities.
- Power Consumption: Continuous monitoring and data transmission can drain the smartphone's battery quickly. Users may be reluctant to use the system if it significantly impacts their device's battery life.

## 3.2 PROPOSED SYSTEM

The proposed system aims to revolutionize road safety through a comprehensive approach that encompasses real-time tracking, efficient accident detection, automated alert systems, location sharing, and enhanced overall road safety features. By implementing advanced sensors and analytics, the system ensures continuous, real-time monitoring of vehicle routes, enabling immediate detection of accidents. In the event of an accident, an automated phone call alert system notifies predefined contacts, facilitating swift response from emergency services or concerned individuals. Additionally, the system shares accurate location information, further expediting assistance during emergency situations. With seamless integration with mobile devices, the proposed system ensures accessibility and user-friendly interaction, ultimately contributing to a safer road environment through timely alerts and enhanced safety measures

### 3.2.1 Advantages

- Real-Time Tracking: Implement a robust system for continuous, real-time monitoring of vehicle routes.
- Accident Detection: Utilize advanced sensors and analytics for efficient and immediate accident detection.
- Automated Alert System: Develop an automated phone call alert system to notify predefined contacts in case of an accident.
- Location Sharing: Enable swift response by sharing accurate location information during emergency situations.
- Enhanced Road Safety: Implement features that enhance overall road safety, providing timely alerts to drivers and emergency services.
- Mobile Integration: Create seamless integration with mobile devices for accessibility and user-friendly interaction with the system.

## 3.3 FEASIBILITY STUDY

The feasibility study for the project involves assessing its technical, economic, and operational viability to determine if it's practical and achievable. it also evaluates potential risks and mitigation strategies to address challenges that may arise during project implementation. Furthermore, stakeholder analysis is conducted to assess the level of support and involvement from key individuals or organizations. The study explores alternative solutions and technologies to determine the most effective approach for achieving project objectives. Lastly, the feasibility study outlines a comprehensive plan for project execution, including resource allocation, timeline, and milestones, to ensure a structured and systematic approach towards achieving project goal

### 3.3.1 Technical Feasibility

Evaluate the availability and compatibility of required technologies such as GPS, sensors, and communication systems. Assess the feasibility of integrating these technologies into a cohesive system capable of real-time tracking and accident detection. Consider potential technical challenges and determine if viable solutions exist.

### 3.3.2 Operational Feasibility

Assess the practicality of implementing and operating the system within existing regulatory frameworks and infrastructure. Consider factors such as user acceptance, ease of use, and scalability. Evaluate the potential impact on existing workflows and procedures, particularly for emergency response services. Identify any operational challenges or constraints that may affect the successful deployment and utilization of the system.

### 3.3.3 Economic Feasibility

Conduct a cost-benefit analysis to determine the project's financial viability. Evaluate the initial investment required for hardware, software development, and testing. Estimate ongoing operational costs, including maintenance, support, and data transmission expenses. Compare projected costs with potential benefits, such as reduced accident response time and improved road safety, to determine if the project is economically feasible.

# CHAPTER 4

# SYSTEM REQUIREMENTS

## 4.1 HARDWARE REQUIREMENTS

The hardware requirements may serve as the basis for a contract for the implementation of the system and should therefore be a complete engineer as the starting point for the system design.

- Bug Converter
- GPS
- Arduino Uno
- MPU6050
- GSM
- Node MCU
- Adaptor-12v
- Sim Card
- Connector wires

## 4.2 SOFTWARE REQUIREMENTS

The software requirements give a detailed description of the system and all its features.

- Arduino IDE

# CHAPTER 5

# SYSTEM DESIGN

## 5.1 OVERVIEW OF ARCHITECTURE

The diagram shows the overall architecture of the project which consists of the procedure and components. Each block shows the functional and connections components of the project.

The setup consists of a Tilt sensor (MPU6050) interfaced with an Arduino UNO, along with a communication module (NEO6M GPS & SIM800L) and Adafruit io Sensor for location sharing. When triggered, the system sends call and SMS alerts containing the device's location information obtained from the GPS module. This integrated solution provides real-time notification capabilities with precise location tracking, enhancing user safety and security.

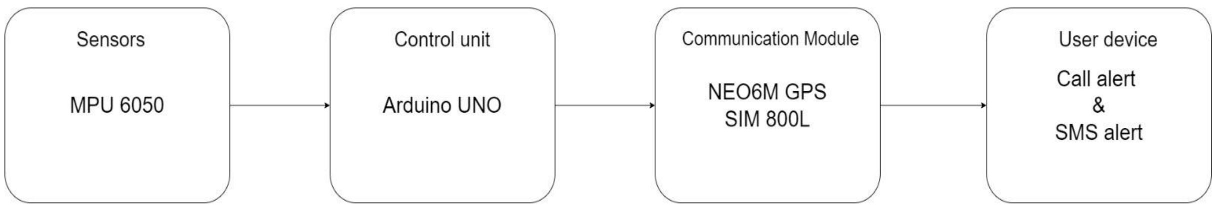


**Figure 5.1 System Architecture**

## 5.2 CIRCUIT DIAGRAM

The circuit diagram illustrates the arrangement of electrical components and their connections within a circuit. Each component, and lines indicate the pathways for electrical current flow. It provides a concise visual representation facilitating analysis, design, and troubleshooting of electrical circuits.

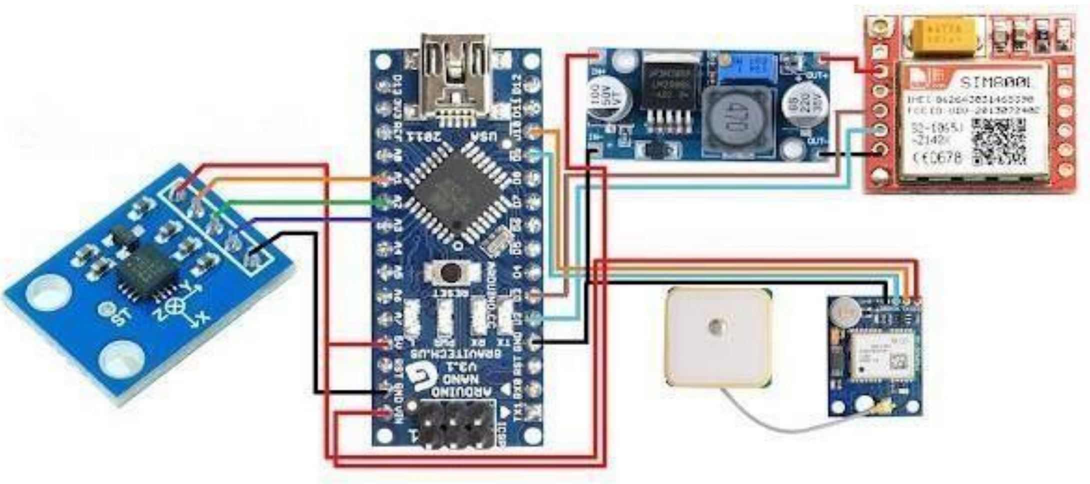

**Figure 5.2 Circuit Diagram**

## 5.3 ACTIVITY DIAGRAM

This module diagram represents the flow from one activity to another activity. The activity can be described as an operation of the system. Some activities are based on conditions satisfied by the actor/object.

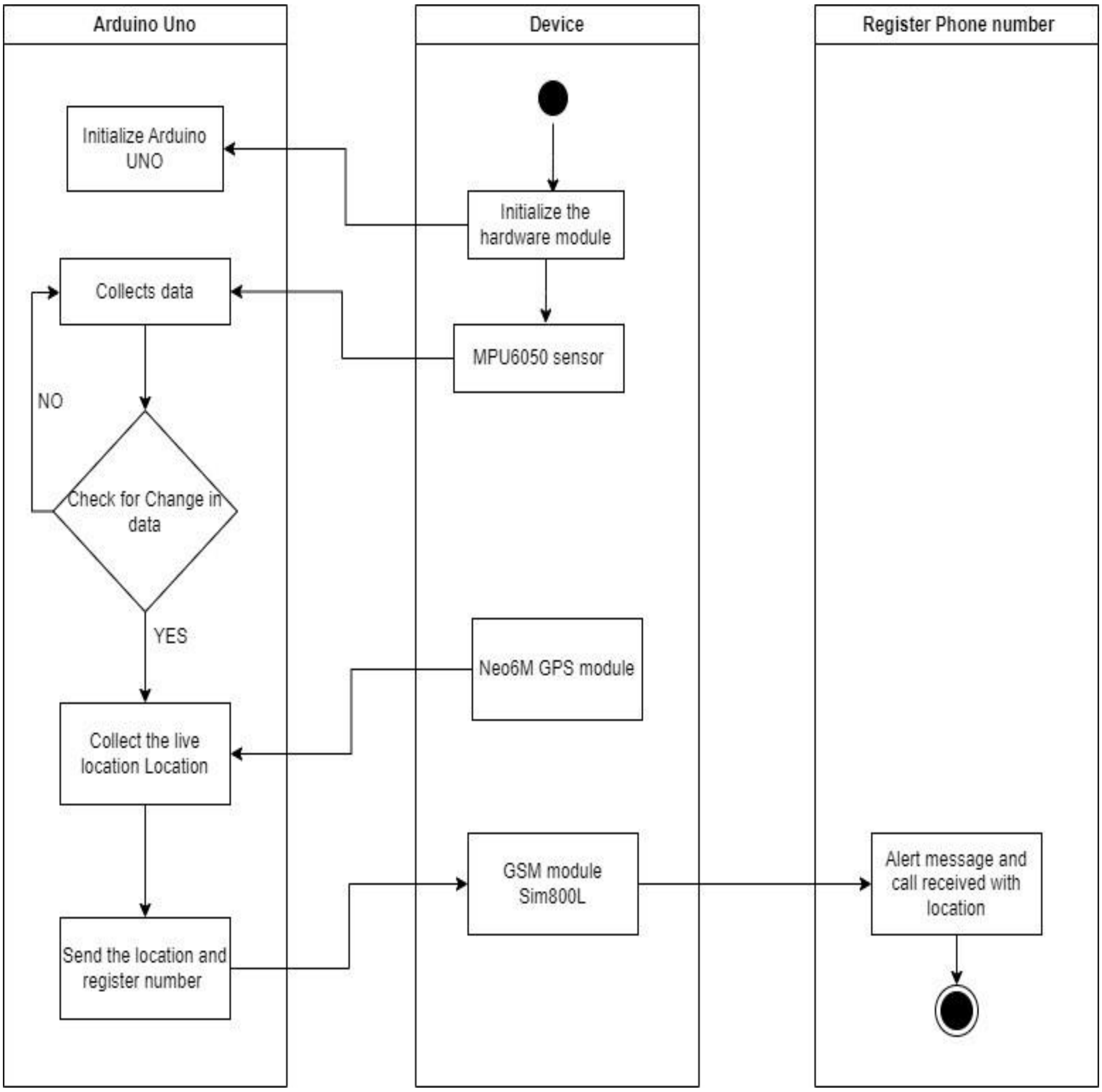


**Figure 5.3 Activity Diagram for SafeTravAlert**

## 5.4 USE CASE DIAGRAM

This diagram shows the user such as actor, system and the role of developer in this project. This behavior diagram models the functionality of the system using use cases.

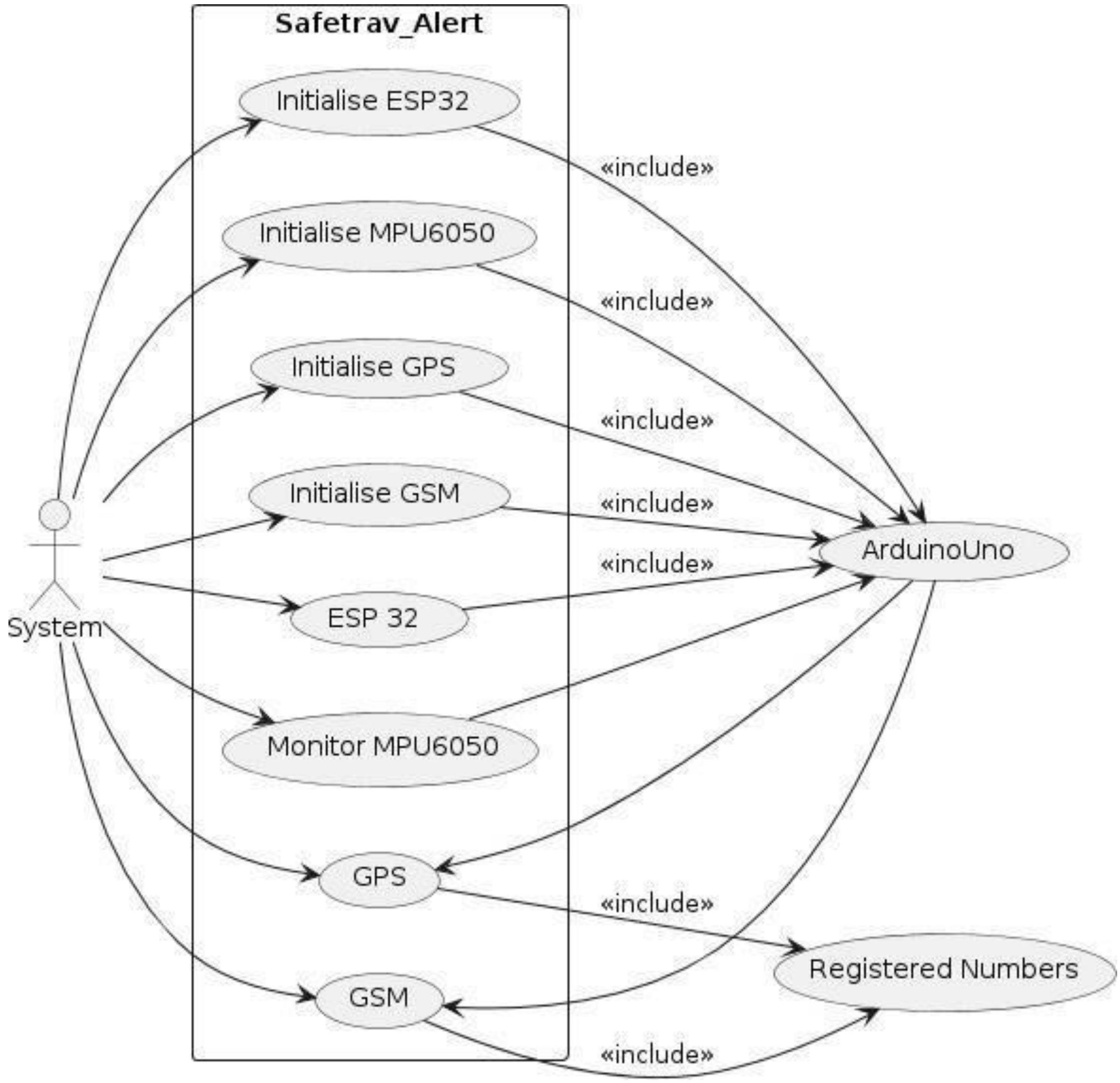


**Figure 5.4 Use Case Diagram for SafeTravAlert**

# CHAPTER 6

# SYSTEM IMPLEMENTATION

## 6.1 MODULES

- BUILDING HARDWARE FOR SYSTEM
- PREPROCESSING OF MODULES
- IMPLEMENTATION AND TESTING OF SYSTEM

### 6.1.1 Building Hardware for System

Firstly, building the hardware for an accident detection system involves a systematic process of selecting, wiring, and integrating various components to ensure the system's functionality and reliability. The initial step in this process is the selection of appropriate components based on the system requirements and desired functionality. For the accident detection system, crucial components include the Arduino Uno microcontroller board, MPU6050 accelerometer sensor, NEO-6M GPS module, GSM module, and a reliable power source. Each component plays a vital role in the overall functionality of the system, with the Arduino Uno serving as the central processing unit, the MPU6050 sensor detecting motion changes, the NEO-6M module determining location, and the GSM module enabling communication for sending alerts.

Once the components are selected, the next step is to wire and connect them together effectively. This involves referring to the datasheets and pinout diagrams of each component to ensure proper connections. The MPU6050 accelerometer sensor and NEO-6M GPS module are connected to the Arduino Uno, while ensuring appropriate power and ground connections for all components. Additionally, the GSM module is connected to the Arduino Uno to facilitate communication with external devices or services for sending alerts.

We create a solid foundation for the accident detection system's hardware setup. This setup enables seamless communication and data transfer between thevarious components, ensuring accurate detection and timely alerts in case of accidents. Through this process, we establish a reliable hardware infrastructure that forms the backbone of the accident detection system, laying the groundworkfor its successful implementation and functionality.

### 6.1.2 Preprocessing of Modules

In the process of implementing an accident detection system using Arduino Uno, MPU6050, NEO-6M GPS module, GSM module, ESP32, Bug converter, and a power source, preprocessing of modules plays a crucial role in ensuring the proper functioning and integration of each component. Let's delve into the preprocessing procedures for each component:

**Arduino Uno**: As the central processing unit, the Arduino Uno requires initial setup and configuration. This involves installing the necessary libraries and drivers to enable communication with other components, such as the MPU6050, NEO- 6M GPS module, and GSM module. Additionally, configuring the Arduino Uno'sinput and output pins for interfacing with these components is essential.

**MPU6050 Accelerometer Sensor**: Before integrating the MPU6050 accelerometer sensor into the system, calibration may be required to ensure accurate readings. This typically involves running calibration routines provided by the sensor manufacturer to account for any biases or offsets. Once calibrated, the sensor needs to be initialized in the Arduino code, configuring settings such as sensitivity and range.

**NEO-6M GPS Module**: The preprocessing of the NEO-6M GPS module involves configuring the module's baud rate and communication protocol to match the requirements of the Arduino Uno. Additionally, the module may require initialization commands to enable GPS data output. Once configured, the Arduino code needs to parse the incoming GPS data to extract relevant information such as latitude, longitude, and speed.

**GSM Module**: Configuring the GSM module involves setting up communication parameters such as baud rate, serial interface, and PIN authentication. Additionally, the module may require initialization commands to establish a connection with the cellular network. Once configured, the Arduino code needs to handle sending SMS alerts or making phone calls in the event of an accident detection.

**ESP32**: Preprocessing the ESP32 module involves setting up the development environment and installing the required libraries and drivers. Configuration of the ESP32's Wi-Fi or Bluetooth capabilities may also be necessary, depending on the intended functionality. Once configured, the ESP32 can be programmed to handle additional tasks such as data logging, remote monitoring, or transmitting alerts via Wi-Fi or Bluetooth.

**Bug Converter**: The Bug converter acts as an intermediary between the Arduino Uno and the GSM module, facilitating communication between the two components. Preprocessing involves configuring the Bug converter's settings, such as baud rate and serial interface, to ensure compatibility with both the Arduino Uno and the GSM module. Additionally, the Bug converter may require initialization commands to establish proper communication.

### 6.1.3 Implementation and Testing of System

This phase encapsulates the transformation of the system architecture and requirements into functional code while rigorously examining the system's performance to validate its reliability and effectiveness. Initially, the implementation process commences with the translation of system design into code logic. This involves coding for the initialization and configuration of each hardware component, ranging from the Arduino Uno to the MPU6050, NEO-6M

GPS module, GSM module, ESP32, Bug converter, and power source. Moreover, algorithms are developed to process sensor data, detect potential accidents based on predefined criteria, and execute alerts when necessary. The integration of all components into a cohesive system architecture ensures proper communication and interaction between hardware and software elements.

Subsequently, the coding phase primarily involves the development of Arduino sketches to control and coordinate the functionality of the system components. This encompasses the creation of setup() and loop() functions to initialize the system and execute the main program logic continuously, respectively. Utilizing Arduino libraries and functions facilitates interfacing with sensors, communication with the GSM module and Bug converter, and overall system management. Furthermore, custom functions and algorithms are crafted to process sensor data, detect accidents, and trigger alert messages, complemented by error- handling mechanisms to manage unexpected events effectively. Finally, thetesting phase scrutinizes the system's functionality through unit, integration, functional, and performance testing, ensuring its efficacy across various scenariosand under different conditions. By meticulously coding the system logic, testing its functionality, and iterating on improvements, the accident detection system attains the reliability and effectiveness necessary to enhance road safety and provide timely assistance in case of accidents.

# CHAPTER 7

# SYSTEM TESTING

## 7.1 TESTING OBJECTIVES

System Testing is a type of software testing that is performed on a complete integrated system to evaluate the compliance of the system with the corresponding requirements. System testing detects defects within both the integrated units and the whole system. The result of system testing is the observed behavior of a component or a system when it is tested. System Testing is basically performed by a testing team that is independent of the development team that helps to test the quality of the system impartial

## 7.2 TYPES OF TESTS

### 7.2.1 Unit Test Cases

Unit Testing, also known as Component Testing, is a level of software testing where individual units or components of software are tested. The purpose is to validate that each unit of the software performs as designed. A unit is the smallest testable part of any software. It usually has one or a few inputs and usually a single output. Unit testing increases confidence in changing / maintaining code. It is concerned with functional correctness of the standalone modules.

The testing takes place as:

**Module Name:** Preprocessing of modules

**Input:** Tilt the device for the sensor detection

**Output:** Recognizing the motion from the sensor and collect the exact location, where the motion detected

### 7.2.2 Integration Testing

Integration testing takes as its input modules that have been unit tested.groups them in larger aggregates, applies tests defined in an integration test plan to those aggregates, and delivers as its output the integrated system ready for system testing. It involves the combination of many modules which are tightly coupled with each other. The main function or goal of this testing is to test the interfaces between the units/modules. Integration testing can be started once the modules to be tested are available. It does not require the other module to

be completed for testing to be done.

The testing takes place as:

**Module Name:** Building Hardware for System, Preprocessing of modules

**Input:** Power supply to the device by the component (adapter)

**Output:** Sending the welcome message to the configured mobile number

### 7.2.3 System Testing

A validation test is used to test and verify the final outcome before delivering it to the customer. This process involves understanding the objective of the product so that it would be easy to validate the outcome. It is the process of checking the validation of product. The process of evaluating s.3oftware at the end of the development process to determine whether software meets the customer expectations and requirements. Execution of code is coming under Validation. The process of checking whether the software product is up to the mark or in other words product has high level requirements.

The testing takes place as:

**Module name:** Implementation and testing of Device

**Input:** Power supply to the device and tilt the device for the sensor detection

**Output:** Recognizing the motion from the sensor and collect the exact location, where the motion detected then sends the information via SMS and a call through GSM module to the configured mobile number

# CHAPTER 8

# CONCLUSION AND FUTURE ENHANCEMENT

## 8.1 CONCLUSION

SafeTravAlert presents a robust solution for enhancing road safety and providing real-time assistance during emergencies. By integrating advanced sensors and communication modules, the device effectively detects accidents and promptly notifies pre-configured contacts via SMS and phone calls. The incorporation of a GSM module ensures reliable communication even in remote areas. Additionally, the ability to track vehicle movement in real-time enhances accountability and aids in swift response in case of emergencies. Through this project, we have successfully demonstrated the potential of technology to mitigate road accidents and improve overall safety measures.It is not only enhances individual safety but also facilitates more efficient emergency response coordination, potentially reducing response times and improving outcomes. The scalability of SafeTravAlert allows for widespread adoption across various transportation modes, including cars, motorcycles, and public transport vehicles, thereby maximizing its impact on road safety.

## 8.2 FUTURE ENHANCEMENT

**Integration with Advanced Driver Assistance Systems (ADAS):** Incorporating ADAS features such as lane departure warning, collision avoidance, and adaptive cruise control can further enhance the device's ability to prevent accidents.

**Vehicle-to-Everything (V2X) Communication**: Utilizing V2X communication technology to enable communication between vehicles, infrastructure, and pedestrians can enhance situational awareness and provide advanced warning of potential hazards.

**Smart Road Infrastructure Integration:** Integrating the device with smart road infrastructure, such as traffic lights and road signs, can enhance communication and coordination between vehicles and the surrounding environment, further improving safety.

**Enhanced Energy Efficiency:** Implementing energy-efficient components and renewable energy sources, such as solar panels or kinetic energy harvesting systems, can prolong battery life and reduce the device's environmental impact.

**Integration with Wearable Devices:** Integrating the device with wearable devices, such as smartwatches or fitness trackers, can enable seamless monitoring of vital signs and provide additional safety features for users.

Notification when Low Signal: Through the GPS tracker, if the vehicle reaches the low signal areas, automatically a notification will be sent to the pre-defined contact

# APPENDICES

# APPENDIX 1

# SAMPLE CODING

**Arduino code**

```
//declaring an variables
const int RunningAverageCount1 = 64;
float RunningAverageBuffer1[RunningAverageCount1],
RunningAverageVolt1;
int NextRunningAverage1;
int i1;// declaring a variable
const int RunningAverageCount2 = 64;
float RunningAverageBuffer2[RunningAverageCount2],
RunningAverageVolt2;
int NextRunningAverage2;
int i2;
int mv, x_axis, y_axis;
//including packages
#include <TinyGPS++.h>
#include <SoftwareSerial.h>
SoftwareSerial mySerial(10, 9); // RX = pin 10, TX = pin 9
TinyGPSPlus gps;
double latitude, longitude;
char mob_no[] = "9487384543", q;
char at_flag, echo_flag, net_flag;
```

```
void gsm_init(void);
void gsm_msg(char mode2);
//////////////
int ms0p125 = 0;
char update_flag = 0;
char flag2 = 0;
char accident_flag;
String link;
void setup()
{
 Serial.begin(9600);
 mySerial.begin(9600);
 cli();//stop interrupts
 //set timer2 interrupt at 8kHz
 TCCR2A = 0;// set entire TCCR2A register to 0
 TCCR2B = 0;// same for TCCR2B
 TCNT2  = 0;//initialize counter value to 0
 // set compare match register for 8khz increments
 OCR2A = 249;// = (16*10^6) / (8000*8) - 1 (must be <256)
 // turn on CTC mode
 TCCR2A |= (1 << WGM21);
 // Set CS21 bit for 8 prescaler
 TCCR2B |= (1 << CS21);
 // enable timer compare interrupt
 TIMSK2 |= (1 << OCIE2A);
```

```
 sei();//allow interrupts
 gsm_init();
 gsm_msg(99);
}
ISR(TIMER2_COMPA_vect)
{
 ++ms0p125;
 if(ms0p125 > 8000) //1sec
 {
  update_flag = 1;
  ms0p125 = 0;
 }}
void loop()
{//Read GPS data
  mySerial.listen();
  while(mySerial.available())
  {
   gps.encode(mySerial.read());
  }
  if(gps.location.isUpdated())
  {
   latitude = gps.location.lat();
   longitude = gps.location.lng();
   link = "http://www.google.com/maps/place/" + String(latitude) + "," +
String(longitude) ;
```

```
  //Serial.print("Link Google Maps : ");
  //Serial.println(link);
  //Serial.print("Satellite Count : ");
  //Serial.println(gps.satellites.value());
  //Serial.print("Latitude : ");
  //Serial.println(latitude, 6);
  //Serial.print("Longitude : ");
  //Serial.println(longitude, 6);
  //Serial.print("Speed MPH : ");
  //Serial.println(gps.speed.mph());
  //Serial.print("Altitude Feet : ");
  //Serial.println(gps.altitude.feet());
  //Serial.println("");
 }
 //Read accelerometer value
 RunningAverageBuffer1[NextRunningAverage1++] = analogRead(A0);
 if(NextRunningAverage1 >=
RunningAverageCount1)NextRunningAverage1 = 0;
 RunningAverageVolt1 = 0;
 for(i1=0; i1< RunningAverageCount1; ++i1)RunningAverageVolt1 +=
RunningAverageBuffer1[i1];
 RunningAverageVolt1 /= RunningAverageCount1;
 RunningAverageBuffer2[NextRunningAverage2++] = analogRead(A1);
 if(NextRunningAverage2 >=
RunningAverageCount2)NextRunningAverage2 = 0;
```

```
RunningAverageVolt2 = 0;
for(i2=0; i2< RunningAverageCount2; ++i2)RunningAverageVolt2 +=
RunningAverageBuffer2[i2];
RunningAverageVolt2 /= RunningAverageCount2;
if(update_flag == 1)
{
 x_axis = map((int)RunningAverageVolt1, 260, 400, 0, 180);  //280, 420
      if(x_axis <   0)x_axis =   0;
 else if(x_axis > 180)x_axis = 180;
 y_axis = map((int)RunningAverageVolt2, 260, 400, 0, 180);
      if(y_axis <   0)y_axis =   0;
 else if(y_axis > 180)y_axis = 180;
 //////////////////
 mySerial.print("%X-axis: ");
      if(x_axis < 10)mySerial.print(" ");
 else if(x_axis < 100)mySerial.print(" ");
 mySerial.print(x_axis);
 mySerial.print(" deg, Y-axis: ");
      if(y_axis < 10)mySerial.print(" ");
 else if(y_axis < 100)mySerial.print(" ");
 mySerial.print(y_axis);
 mySerial.print(" deg, ");
 mySerial.print("Location: ");
 mySerial.print(link);
 mySerial.print(", Status: ");
```

```
  if( (x_axis <= 45) || (x_axis >= 135) || (y_axis <= 45) || (y_axis >= 135) )
  {
   mySerial.print("ACCIDENT OCCURRED");
   mySerial.println("#");
   if(flag2 == 0)
   {
    gsm_msg(2);
    flag2 = 1;
   }}
  else
  {
   mySerial.print("SAFE");
   mySerial.println("#");
   flag2 = 0;
  }
  update_flag = 0;
 }
 delay(10);
}
void gsm_init(void)
{
  at_flag = 1;
  while(at_flag)
  {
   Serial.println("AT");
```

```
 while(Serial.available()>0)
 {
  if(Serial.find("OK"))at_flag=0;
 }
 delay(1000);
}
delay(500);
echo_flag = 1;
while(echo_flag)
{
 Serial.println("ATE0");
 while(Serial.available()>0)
 {
  if(Serial.find("OK"))echo_flag=0;
 }
 delay(1000);
}
delay(500);
net_flag = 1;
while(net_flag)
{
 Serial.println("AT+CPIN?");
 while(Serial.available()>0)
 {
  if(Serial.find("+CPIN: READY"))net_flag = 0;
```

```
    }
    delay(1000);
   }
  delay(500);
}
 void gsm_msg(char mode2)
 {
  Serial.print("AT+CMGF=1\r\n"); delay(500);
  //Serial.print("AT+CNMI=2,2,0,0,0\r\n"); delay(500);
  Serial.print("AT+CMGS="); Serial.write('"'); for(q = 0; q <= 9;
q++)Serial.write(mob_no[q]); Serial.write('"'); Serial.print("\r\n");
delay(500);
       if(mode2 ==  2)Serial.println("Accident occured..");
  else if(mode2 == 99)Serial.println("Welcome..");
  Serial.println("Location:");
  Serial.println(link);
  if(mode2 == 2)Serial.println("Please take some action soon..");
  delay(500);
  Serial.write(26);
  delay(5000);
  //Serial.println("ATDxxxxxxxxxx;");
  Serial.print("ATD"); for(q = 0; q <= 9; q++)Serial.write(mob_no[q]);
Serial.println(";");
  delay(500);
 }
```

# APPENDIX 2

## SCREEN SHOTS

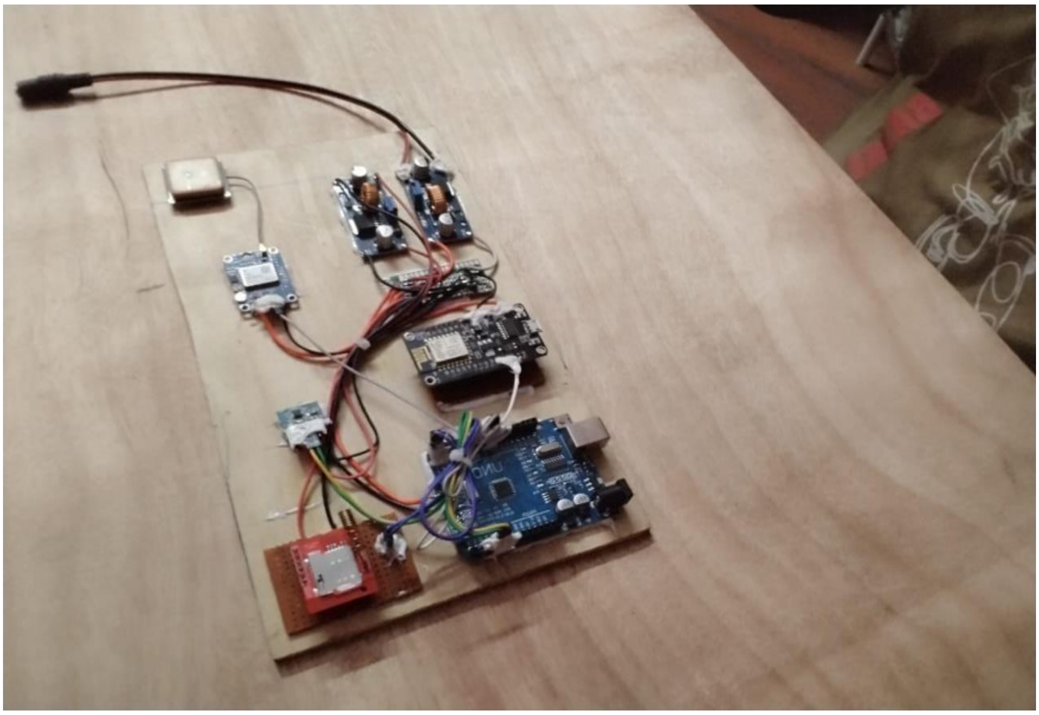

**Figure A2.1 IOT device stable condition**

This picture represents the Connection of an Iot device with all the components, without the power supply

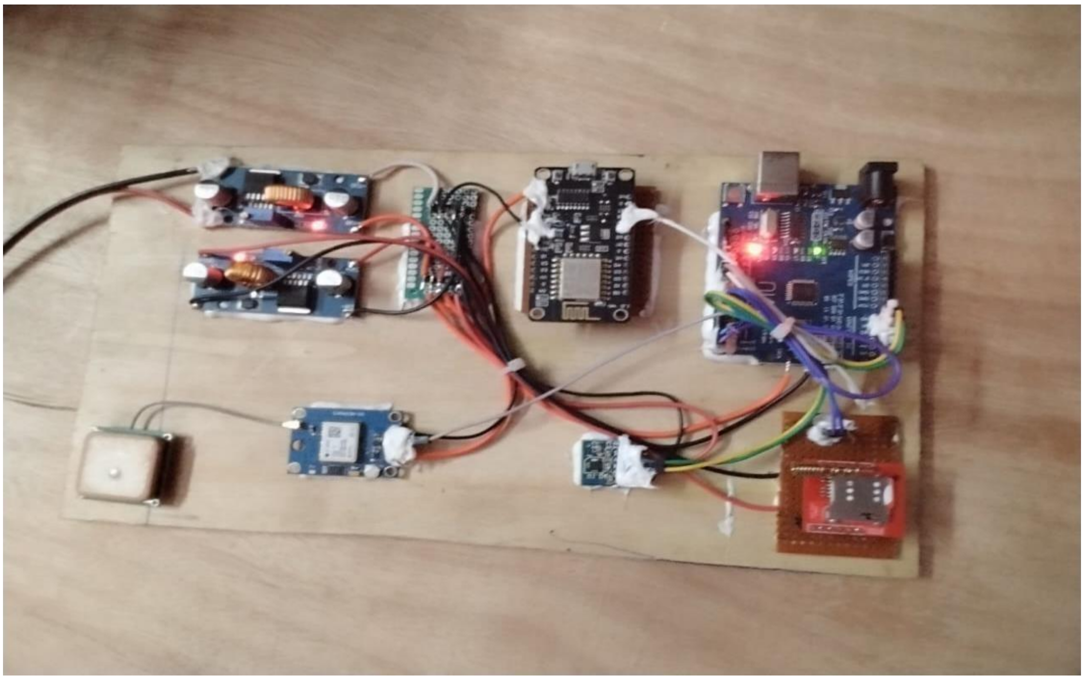

**Figure A2.2 IOT device after tilt condition**

This picture represents the Iot device with a power supply by the adaptor, after the tilt condition


**Figure A2.3 welcome message from device**

This picture represents a welcome message to the configured mobile number, when the device is in the ON condition,

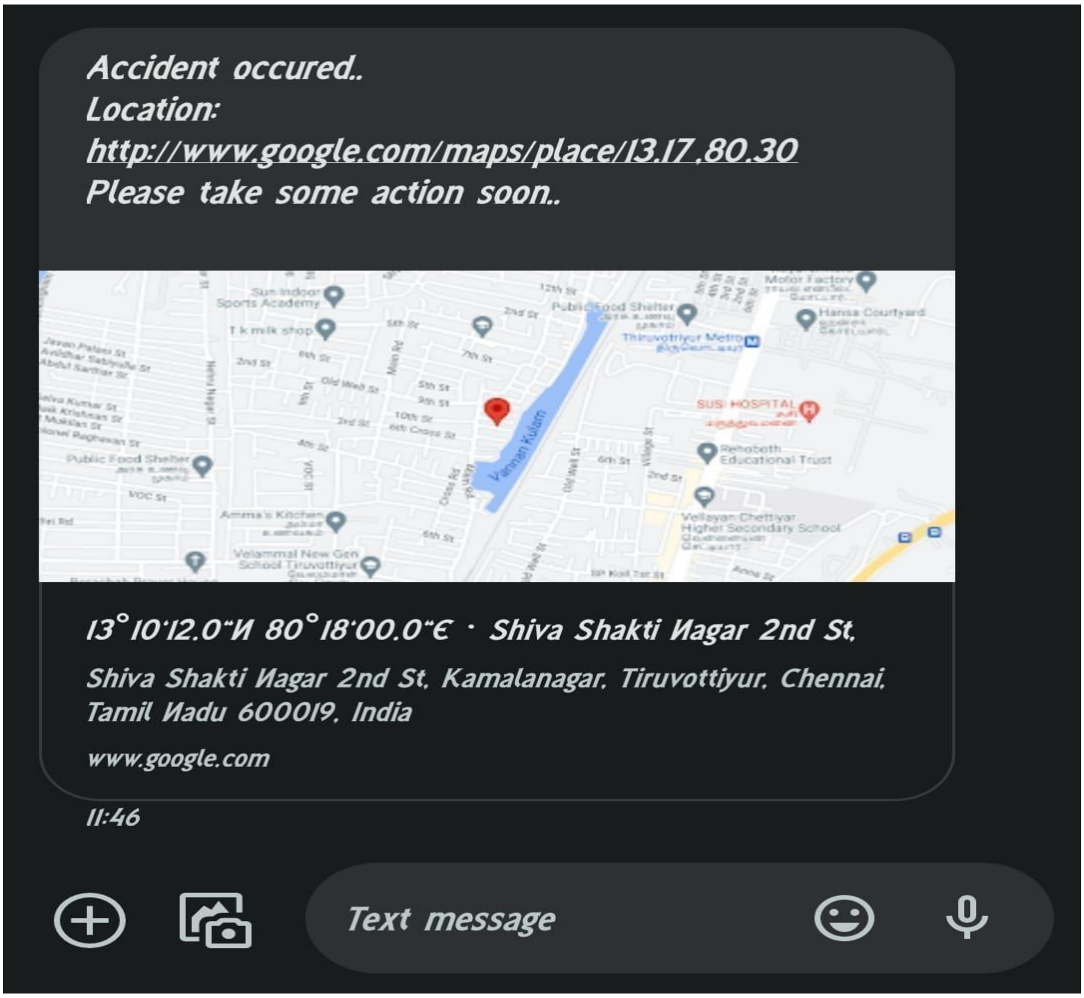


**Figure A2.4 Message after an accident occurs**

This picture represents Alert message with a Location from the device to which the mobile number configured when the device is in tilt condition

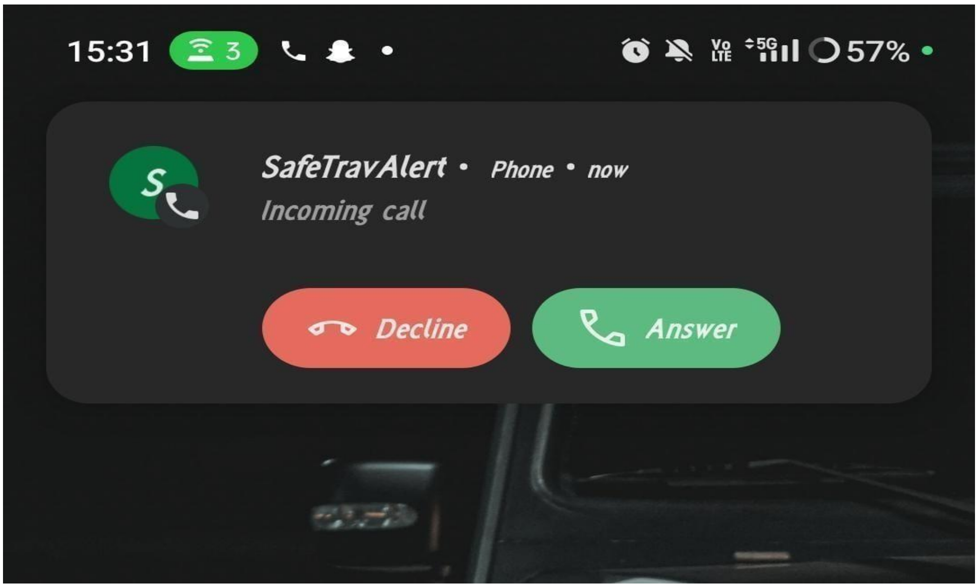


**Figure A2.5 Call from the device**

This picture represents the call from the device to the configured mobile number, when the device is in tilt condition

## REFERENCES


1. Harshit Srivastava, Goutam Kumar Sahoo, Senanayake .D.D; Maduwantha.B.A.U, Samudrini .M.G.C, Nanayakkara .A.I;Santos Kumar Das, Poonam Singh (2022) “IoT-Based Road Accident Rescue System Implementation for Smart City Applications”, IEEE 2nd International Symposium on Sustainable Energy, Signal Processing and Cyber Security (iSSSC), pp.517-531

2. Mohammad Ehsanul Alim, Sarosh Ahmad, Marzieh Naghdi Dorabati and Ihab Hassoun(2020) “ Design & Implementation of IoT Based Smart Helmet for Road Accident Detection”, 11th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), pp.783-797

3. Nikhil Kumar, Debopam Acharya, and Divya Lohani (2021) “An IoT Based Vehicle Accident Detection and Classification System using Sensor Fusion”, IEEE Internet of Things Journal, volume 8, pp.869-880

4. Nazia Parveen,Ashif Ali and Aleem Ali (2020) “IOT Based Automatic Vehicle Accident Alert System”, IEEE 5th International Conference on Computing Communication and Automation (ICCCA), pp.951-963

5. Shaik Mazhar Hussain, Kamaludin Mohamad Yusuf, Shaik Ashfaq Hussain(2017) “A Conceptual Framework on IOT based System Design to Prevent Road Accidents in Accident Prone Cities”, International Conference on Infocom Technologies and Unmanned Systems (Trends and Future Directions) (ICTUS), pp.626-641

# COs, PO Mapping, PSO Mapping

Course Code & Name: CS8811 Project Work

REGULATION: R2017 YEAR/SEM: IV/VIII

## COURSE OUTCOMES

| | |
|---|---|
| CS8811.1 | Identify the problem by applying acquired knowledge. |
| CS8811.2 | Analyze and categorize executable project modules after considering risks. |
| CS8811.3 | Choose efficient tools for designing project modules. |
| CS8811.4 | Combine all the modules through effective team work after efficient testing. |
| CS8811.5 | Elaborate the completed task and compile the project report. |

## CORRELATION LEVELS

| | |
|---|---|
| Substantial/ High | 3 |
| Moderate/ Medium | 2 |
| Slight/ Low | 1 |
| No correlation | |

## CO – PSO CORRELATION LEVEL MATRIX

| COs | PSO1 | PSO2 |
|---|---|---|
| CS8811.1 | 3 | 1 |
| CS8811.2 | | 2 |
| CS8811.3 | | 3 |
| CS8811.4 | | 3 |
| CS8811.5 | | |

## CO-PO CORRELATION LEVEL MATRIX

| COs | POs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CS8811.1 | 3 | 3 | | 1 | | | 1 | 2 | 3 | | | |
| CS8811.2 | | 3 | 2 | 3 | | 3 | 1 | | 3 | 3 | | 2 |
| CS8811.3 | | | 3 | 3 | 3 | | | 3 | 3 | 3 | 1 | 2 |
| CS8811.4 | | | | | | | 3 | 3 | 3 | 3 | 2 | 3 |
| CS8811.5 | | | | | | | | | 3 | 3 | | 3 |