Accident reporting and big data analysis implementation to make road safer

Submitted in partial fulfillment of the requirements for the degree of

Bachelor of Technology
in
Computer Science

By

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VIT, Vellore.

November, 2022

DECLARATION

We hereby declare that the thesis entitled "**Accident reporting and big data analysis implementation to make road safer** " submitted by Shubham Shankaram 19BCT0092, Shreyash Patil 20BCT0259, Manan Chhikara 20BCT0281, Atul Kumar 20BCE0054, for the award of the degree of Bachelor of Technology in Computer Science to VIT is, a record of bonafide work carried out by me under the supervision of Prof. / Dr. S. Jafar Ali Ibrahim.

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Student Name

Executive Summary

As per the review report "Street Accidents in India, 2011", by the survey of street transport and parkways, an aggregate of 1,42,485 individuals had lost their lives because of lethal street mishaps. One can't change what is there in destiny but providing medical facilities as early as possible gives a sense of satisfaction to the people. In order to circumvent these problems, we are trying to develop a system that will help to reduce the response time after the accident, the main agenda is to transfer the information about accidents from machine to machine without the intervention of humans and inform the respective authorities through wireless technologies which will involve as much less time as possible. MySafeRoad is a web-based multi-platform accident reporting and tracking system. India is a nation where we experience perhaps the most elevated frequency of street mishaps in Asia. The

measurements of street mishaps, particularly those including loss of lives in India are disturbing. Despite continuous efforts of the government to control this situation, India ranks first in the number of deaths due to road accidents among the 199 countries almost 11% of the total share of deaths in the world occur in India. On diving deeper into the studies, it was known that 84% of these deaths are of people of working age i.e. in 16-60. Many lives have been lost because of an absence of prompt clinical consideration for mishap casualties. This is largely due to the deplorable conditions of our road network; resources are not used efficiently so as to bring a maximum positive impact. Expansion in the human populace has likewise brought about an ensuing increment in traffic. It is intended to give a road to provoke detailing of mishaps and keep away from conceivable loss of lives. Additionally, this system gives valuable and enormous information investigating past accidents due to which appropriate moves can be made to stay away from future mishaps. The framework has three significant modules I. e. The tracker, The reporter, and The Analysis or Big Data module. The framework gives proficient and legitimate announcing just as following vehicles engaged with a mishap following the mishap event. The following module was contrived with the utilization of a Simulated Sensor. A program constantly monitors the data being received from the sensors and when a sensor value crosses a particular threshold value the program detects mishaps events and vehicle state and client data just as alert areas will be communicated to the Pre-set of treatment focus. The number of accident cases these days is constantly increasing and with the advent of winter in northern India, these cases are even going to increase more in the coming days.

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1.ABSTRACT

Accident cases are on the rise these days, and as winter approaches in northern India, the number of instances will only rise in the following days. Accidents cannot be predicted, therefore all we can do is ensure that we are ready for any type of disaster and that the harm to the individual is kept to a minimal. Inadequate medical facilities are frequently to blame for accidents because of late reporting. In order to provide automatic assistance to the injured individual, we have attempted to incorporate all the elements necessary to detect the accident as soon as it occurs and notify it to the family member, local rescue personnel, and hospitals. When a driver has an accident, a MEMS sensor built into the body of the vehicle detects the tilt, or the direction in which the accident occurred, and sends the value to an Arduino-UNO board that is interfaced to it. When the input value exceeds the threshold programmed value, the accident is confirmed. An alarm is now set off to warn those in the area, and the driver can deactivate the warning if it turns out to be false. The GPS module then extracts the information from the GSM module and sends a message with crucial details about the accident, including the location of the accident in terms of latitude and longitude, as well as a link to Google Maps. These data are retrieved and kept in a location for further study, which can be used to recommend to the government authorities the implementation of traffic lights, speed brakes, or traffic police in order to lessen the frequency of accidents. As we can track down the car and temporarily suspend the driver's license, this can also be used to uphold law and order in the community. The system was designed with Indian roads and driving habits in mind, but we anticipate it will function just as well everywhere else in the world with any type of terrain.

2 INTRODUCTION

2.1 Objective

Accident cases are on the rise these days, and as winter approaches in northern India, the number of instances will only rise in the following days. Accidents cannot be predicted, therefore all we can do is ensure that we are ready for any type of disaster and that the harm to the individual is kept to a minimal. Inadequate medical facilities are frequently to blame for accidents because of late reporting. In order to provide automatic assistance to the injured individual, we have attempted to incorporate all the elements necessary to detect the accident as soon as it occurs and notify it to the family member, local rescue personnel, and hospitals. When a driver has an accident, a MEMS sensor built into the body of the vehicle detects the tilt, or the direction in which the accident occurred, and sends the value to an Arduino-UNO board that is interfaced to it. When the input value exceeds the threshold programmed value, the accident is confirmed. An alarm is now set off to warn those in the area, and the driver can deactivate the warning if it turns out to be false. The GPS module then extracts the information from the GSM module and sends a message with crucial details about the accident, including the location of the accident in terms of latitude and longitude, as well as a link to Google Maps. These data are retrieved and kept in a location for further study, which can be used to recommend to the government authorities the implementation of traffic lights, speed brakes, or traffic police in order to lessen the frequency of accidents. As we can track down the car and temporarily suspend the driver's license, this can also be used to uphold law and order in the community. The system was designed with Indian roads and driving habits in mind, but we anticipate it will function just as well everywhere else in the world with any type of terrain.

2.2 Motivation

Road accidents are one of the major cause of deaths in India. Despite continuous efforts of the government to control this situation India ranks first in the number of deaths due to road accidents among the 199 countries almost 11% of total share of deaths in the world occur in India. On diving deeper into the studies, it was known that 84% of these deaths are of the people of working age i.e., in 16-60. There have been several reasons for the death of the people of these age like not following traffic rule, driving on wrong the wrong side of the road, because of feeling tired during driving as a result of overworking and by drunk driving and rash driving. This is not just an issue in India but it a major issue faced by people worldwide. A lot of times it is known that the casualty happened only because of delay in providing the medical facilities, in such type of emergency situations delay of even 10 to 15 minutes may lead to death. Moreover, even after trying to get the medical facilities 70 times out of 100, calls made by phone, lack to provide exact location which leads to further delay.

In India national highway comprises of 2.03% of total network which accounts for disproportionate share of 35.7 per cent of deaths (as of 2019) as opposed to other types of roads which constitute 95% of total roads were responsible for 39 per cent of deaths, this is mainly because at times when the road is vacant the other person who caused the accident tries to run away rather than looking for medical help of the victim and also it is very difficult to locate a hospital nearby when the person is new to a place.

At times after the death the people concerned for the victims regrets that if only the accident was discovered early, they would have saved the life of their loved ones. One can’t change what is there in destiny but providing medical facilities as early as possible gives sense of satisfaction to the people .In order to circumvent these problems we are trying to develop a system that will help to reduce the response time after the accident , the main agenda is to transfer the information of accident from machine to machine without intervention of humans and inform the respective authorities through wireless technologies which will involve as much less time as possible.

2.3 Background

India is a country where street accidents may occur more frequently than any other in Asia. This is largely because of the terrible state of our transportation system, which prevents money from being deployed effectively to have the greatest positive impact. The statistics on street accidents, especially those involving fatalities in India, are alarming. Despite ongoing attempts by the government to regulate this situation, India tops the list of 199 countries for the number of people killed in traffic accidents. Nearly 11% of all deaths worldwide take place in India. Further research revealed that 84% of these fatalities involved people between the ages of 16 and 60, or those in the working population. Lack of quick clinical attention for accident victims has resulted in the loss of many lives. The growth of the human population has also resulted in an increase in traffic. According to the assessment study "Street Accidents in India, 2011," an overall total of 1,42,485 people had lost their lives as a result of deadly street incidents. Although destiny cannot be changed, giving individuals access to medical care as soon as feasible makes them feel satisfied. We are working to create a system that will help to speed up the reaction time following an accident. The major goal is to transmit accident information from machine to machine without human interaction and notify the appropriate authorities using wireless technologies in the shortest amount of time. A web-based, multi-platform accident reporting and tracking system is called MySafeRoad. It is meant to provide a route to prompt reporting of accidents and prevent potential life losses. The framework offers competent and reliable announcements as soon as additional automobiles involved in an accident occur. Additionally, this system provides extensive and essential information on prior events, allowing for the proper action to be taken to prevent future accidents. The tracker, the reporter, and the analysis or big data module are the three key components of the framework. The following module was created using a Simulated Sensor. A software continuously analyses the data coming from the sensors, and when a sensor value exceeds a predetermined threshold value, the program recognizes accidents events and communicates them to the pre-set of treatment focus together with vehicle and client data as alert regions. These days, there are more accidents than ever before, and as winter approaches in northern India, there will be even more of them in the days to come. Accidents cannot be predicted, so all we can do is make sure we are ready for them on our end, minimizing any harm they may cause to others. Lack of appropriate medical facilities often results from reporting incidents too late. In order to provide automatic assistance to the injured individual, we have attempted to incorporate all the elements necessary to detect the accident as soon as it occurs and notify it to the family member, local rescue personnel, and hospitals. When a driver has an accident, a MEMS sensor built into the body of the vehicle detects the tilt, or the direction in which the accident occurred, and sends the value to an Arduino-UNO board that is interfaced to it. When the input value exceeds the threshold programmed value, the accident is confirmed. Right now, an alarm is set off to warn those in the area, and the driver can manually deactivate the alarm if it turns out to be false. The GPS module then extracts the information from the GSM module and sends a message with crucial details about the accident, including the location of the accident in terms of latitude and longitude, as well as a link to Google Maps. These data are retrieved and kept in a location for further study, which can be used to recommend to the government authorities the implementation of traffic lights, speed brakes, or traffic police in order to lessen the frequency of accidents. This can also be utilized to uphold law and order because we can track down any cars that are causing too many collision ns and temporarily suspend the driver's license. The system was designed with Indian roads and driving habits in mind, but we anticipate it will function just as well everywhere else in the world with any type of terrain. Following the receipt of similar upsetting information, the treatment facility will display this information on its guide. The working team at the treatment center will check to see that the controller who is most conveniently located for the accident arrives at the scene first after receiving warning data. The

Big Data analysis module provides real-time insights that can be examined to identify areas that are more prone to accidents so that appropriate actions can be taken, such as reducing vehicle speeds in that area, deploying guards, and positioning ambulances in appropriate areas so that they remain close to the area in the event of an emergency.

3 DESIGN APPROACH AND DETAILS

3.1 Design Approach / Material & Methods

3.1.1 Introduction

Most of the studies on this topic as per our survey just worked on the improvement of hardware and giving alerts in lesser time but none of the studies have made efforts to try to remove the root cause of the accident by trying to analyze the data and imply more safety measures in the accident-prone areas and giving an automatic reminder to the driver as soon as he enters more accident-prone area. This will also help the authorities to be well prepared with ambulances and other first aid services nearby that area.

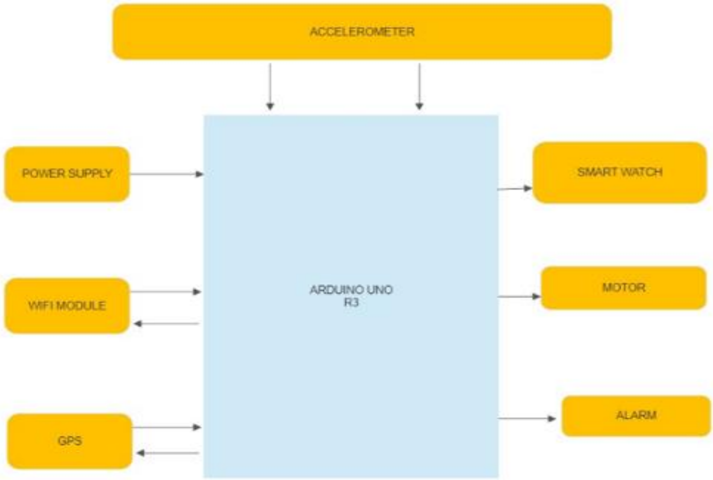
Example of such analysis can be: -

1>Ambulances and medical services can be placed strategically on the spots closer to more accident-prone areas thus this will increase the probability of presence of first aid service nearby.

2>We can mark down critical areas where an accident can cause huge traffic jams because of the heavy traffic on the road, so the police department can place traffic police officers closer to the spot so that they can take appropriate measures to control the traffic as soon as possible.

In this system we are planning to make use of an ACCELEROMETER sensor, WI-FI module, and GPS connected to an Adriano UNO board.

3.2.2 Power Supply

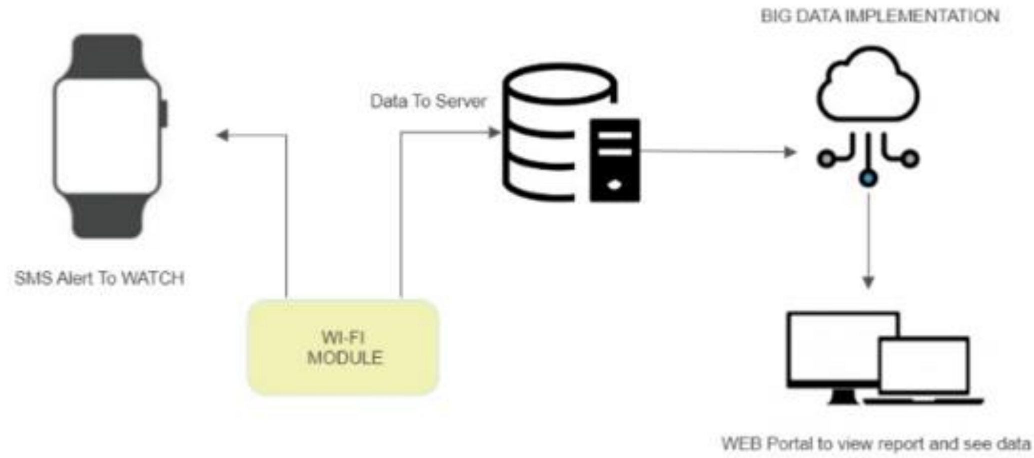


(Basic Model Structure)

Fig.1 Power supply

In the project we propose to use ACCELEROMETER sensors to identify the acceleration, the readings in the means sensors are to be compared with pre-set threshold values designed for specific vehicles collected over a period of time after several experiments on how that particular vehicle behaves in case of an accident. ACCELEROMETER sensors also help us to identify the side from where the vehicle has faced an impact. In case If an accident is detected our system take on the current GPS coordinates from

GPS sensors moreover fetch details of driver and vehicle like age, vehicle number etc. from the pre stored memory. After this the details of the accident are simultaneously pushed to the server using the WI-FI module where this collected data over time is analyzed and a list of meaningful outcomes are achieved. After these outcomes are analyzed governments can prepare road safety policies according to this data and all together reduce the probability of accidents from hot zones. The driver is first promoted to switch off the alarm in 10 sec if he does not switch it off. The message of the accident along with the location is sent to the hospital and other emergency services providers and to his family, this thus ensures that only genuine requests are sent up to the police, hospitals and family members.



(Big Data Analysis and implementation basic diagram)

Fig 2. Big Data implementation

3.3 Circuit Diagram

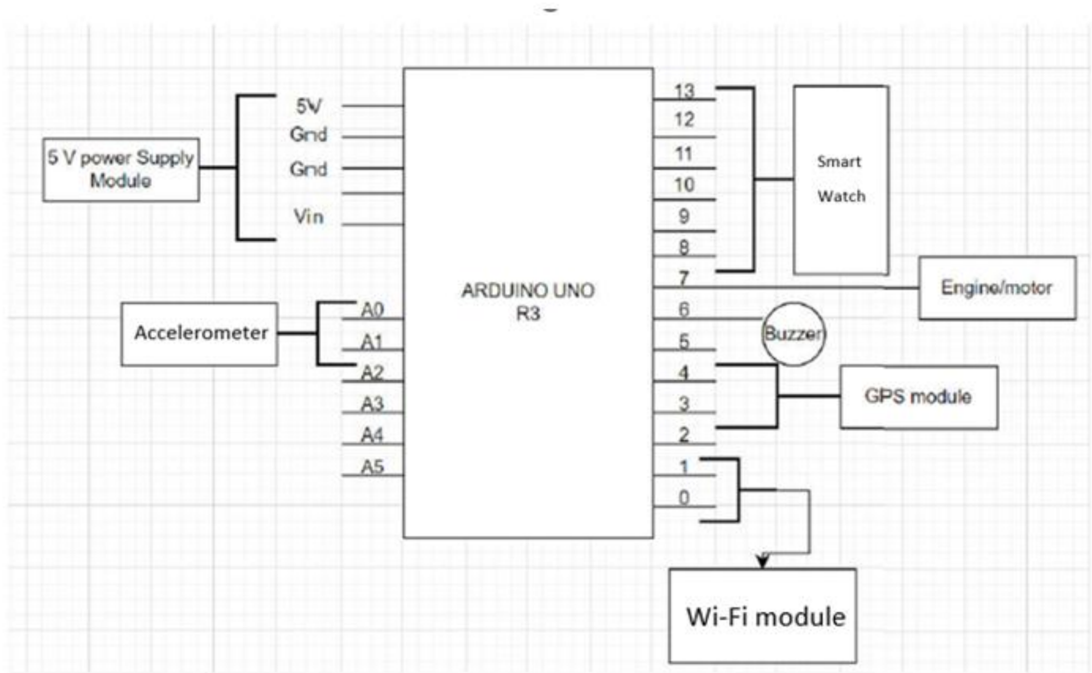


Fig 3. Circuit Diagram

3.4 Algorithm

Let vibr , acc , incl be the values of vibration , acceleration , inclination of MEMS sensor

Let p1 denote the peak value of vibration , let p2 denote the peak value of the accelerometer and

p3 denote the peak value of the sensor .

1.readLinkedSensorDataFileDirectory( )

2.Process the sensory input

3.LocationMap= createLocationFromLinkedSensorDataFile( )

4.locationObject = fillLocationInformationFromLinkedSensorDataFile( )

5.locationMap.put(sensorName , locationObject)

6.sensorValuelist= {vibr , acc , incl }

7.while(incl ==LOW). {

8. if(acc==p2 AND vibr !=p1) {

9. \\there is sudden change in acceleration due to crossing of pets etc may or may not be accident

10. “Alarm for accident”

11. if (button.reset( )){

12. Return [step 6]

13. }

14. Else if(acc==p2 AND vibr ==p1){

15. \\there is sudden change in acceleration and there is collision with some object

16. “ Alarm for accident “

17. Send locationMap to centralised
Server}

18.if(incl ==p3){

19. “ Alarm for accident “

20. Send locationMap to centralised server

21.Send data to server}

22..Exit .

4.2 Codes and Standards

```
#include <Arduino.h>
```

```
#include <ESP8266WiFi.h>
#include <Firebase_ESP_Client.h>
#include <NTPClient.h>
#include <WiFiUdp.h>
#include <Adafruit_ADXL345_U.h>
#include <SimpleDHT.h>
Adafruit_ADXL345_Unified accel=Adafruit_ADXL345_Unified(12345);

//sonar
const int trigPin = 12;
const int echoPin = 14;

SimpleDHT11 dht11(13);
//define sound velocity in cm/uS
#define SOUND_VELOCITY 0.034
#define CM_TO_INCH 0.393701

long duration;
float distanceCm;

// Provide the token generation process info.
#include "addons/TokenHelper.h"
// Provide the RTDB payload printing info and other helper functions.
#include "addons/RTDBHelper.h"


// Insert your network credentials
#define WIFI_SSID "Shub"
#define WIFI_PASSWORD "gtsx4780"

// Insert Firebase project API Key
#define API_KEY "AIzaSyCo9vo9CVAGpJzX3Pdio6cm2x8dc3q0x6I"

// Insert Authorized Email and Corresponding Password
#define USER_EMAIL "georgeli4455@gmail.com"
#define USER_PASSWORD "ooopagal"

// Insert RTDB URLefine the RTDB URL
#define DATABASE_URL "https://accident-detection-2225c-default-
rtdb.firebaseio.com/"

// Define Firebase objects
FirebaseData fbdo;
FirebaseAuth auth;
```

```
FirebaseConfig config;

// Variable to save USER UID
String uid;

// Database main path (to be updated in setup with the user UID)
String databasePath;
// Database child nodes
String lati = "/lat";
String lon = "/lon";
String type = "/type";
String temp="/temp";
String hum="/hum";
String timePath = "/timestamp";
String xAcc="/xAcc";
String yAcc="/yAcc";
 int x,y,a,b;

String parentPath;

FirebaseJson json;

// Define NTP Client to get time
WiFiUDP ntpUDP;
NTPClient timeClient(ntpUDP, "pool.ntp.org");

// Variable to save current epoch time
int timestamp;

// BME280 sensor
//Adafruit_BME280 bme; // I2C
float temperature;
float humidity;
float pressure;

// Timer variables (send new readings every three minutes)
unsigned long sendDataPrevMillis = 0;
unsigned long timerDelay = 180000;



// Initialize WiFi
void initWiFi() {
  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
```

```
  Serial.print("Connecting to WiFi ..");
  while (WiFi.status() != WL_CONNECTED) {
    Serial.print('.');
    delay(1000);
  }
  Serial.println(WiFi.localIP());
}

// Function that gets current epoch time
unsigned long getTime() {
  timeClient.update();
  unsigned long now = timeClient.getEpochTime();
  return now;
}

void setup(){
  pinMode(0, OUTPUT);
  Serial.begin(9600);
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input
  initWiFi();

  if(!accel.begin())
  {
    Serial.println("fkjhslaihf");
  }
  //accel.setRange(ADXL345_RANGE_2_G);
  sensors_event_t event;
  accel.getEvent(&event);
  a=event.acceleration.x;
  b=event.acceleration.y;

  timeClient.begin();

  // Assign the api key (required)
  config.api_key = API_KEY;

  // Assign the user sign in credentials
  auth.user.email = USER_EMAIL;
  auth.user.password = USER_PASSWORD;

  // Assign the RTDB URL (required)
  config.database_url = DATABASE_URL;
```

```
  Firebase.reconnectWiFi(true);
  fbdo.setResponseSize(4096);

  // Assign the callback function for the long running token generation task */
  config.token_status_callback = tokenStatusCallback; //see
addons/TokenHelper.h

  // Assign the maximum retry of token generation
  config.max_token_generation_retry = 5;

  // Initialize the library with the Firebase authen and config
  Firebase.begin(&config, &auth);

  // Getting the user UID might take a few seconds
  Serial.println("Getting User UID");
  while ((auth.token.uid) == "") {
    Serial.print('.');
    delay(1000);
  }
  // Print user UID
  uid = auth.token.uid.c_str();
  Serial.print("User UID: ");
  Serial.println(uid);

  // Update database path
  databasePath = "/UsersData/" + uid + "/readings";

}
float getCm(){
   digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  // Sets the trigPin on HIGH state for 10 micro seconds
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Reads the echoPin, returns the sound wave travel time in microseconds
  duration = pulseIn(echoPin, HIGH);

  // Calculate the distance
  return duration * SOUND_VELOCITY/2;
}

void loop(){
```

```
  byte temperature = 0;
  byte humidity = 0;
  float latitude=12.9701;
  float longitude=79.164;
  int err = SimpleDHTErrSuccess;
  if ((err = dht11.read(&temperature, &humidity, NULL)) !=
SimpleDHTErrSuccess) {
    Serial.print("Read DHT11 failed, err=");
Serial.print(SimpleDHTErrCode(err));
    Serial.print(","); Serial.println(SimpleDHTErrDuration(err));
//    delay(1500);
//    return;
  }else{
    Serial.print("Sample OK: ");
    Serial.print((int)temperature); Serial.print(" *C, ");
    Serial.print((int)humidity); Serial.println(" H");
  }

  //Accelerometer
  sensors_event_t event;
  accel.getEvent(&event);
  x=event.acceleration.x;
  y=event.acceleration.y;
  Serial.println(x);
  if(x-a>2){
    type="left";
    Serial.println("left");
  }
  if(a-x>2){
    type="right";
    Serial.println("right");
  }
  if(b-y>2){
    type="back";
    Serial.println("Back");
  }
  if(y-b>2){
    type="front";
    Serial.println("front");
  }

  //Ultrasonic
```

```
  int cm=getCm();
  Serial.print("Distance: ");
  Serial.print(cm);
  if(cm<=50)
  {
    digitalWrite(0, HIGH);
    Serial.print("DANGER\n");
  }
  else
  {
    digitalWrite(0, LOW);
    Serial.print("SAFE\n");
  }
    // Send new readings to database
  if (Firebase.ready() && (millis() - sendDataPrevMillis > timerDelay ||
sendDataPrevMillis == 0)){
    sendDataPrevMillis = millis();

    //Get current timestamp
    timestamp = getTime();
    Serial.print ("time: ");
    Serial.println (timestamp);

    parentPath= databasePath + "/" + String(timestamp);
    json.set(lati.c_str(), String(latitude));
    json.set(lon.c_str(), String(longitude));
    json.set(type.c_str(), type);
    json.set(timePath.c_str(), String(timestamp));
    if ((err = dht11.read(&temperature, &humidity, NULL)) ==
SimpleDHTErrSuccess){
      json.set(temp.c_str(), String(temperature)+" *c");
      json.set(hum.c_str(), String(humidity) +" H");
    }
    json.set(xAcc.c_str(), String(x));
    json.set(yAcc.c_str(), String(y));
    Serial.printf("Set json... %s\n", Firebase.RTDB.setJSON(&fbdo,
parentPath.c_str(), &json) ? "ok" : fbdo.errorReason().c_str());
  }
  delay(1500);
}
```

5. RESULT & DISCUSSION

Data Set generated via simulations

Fig 4. Zoomed Geo located

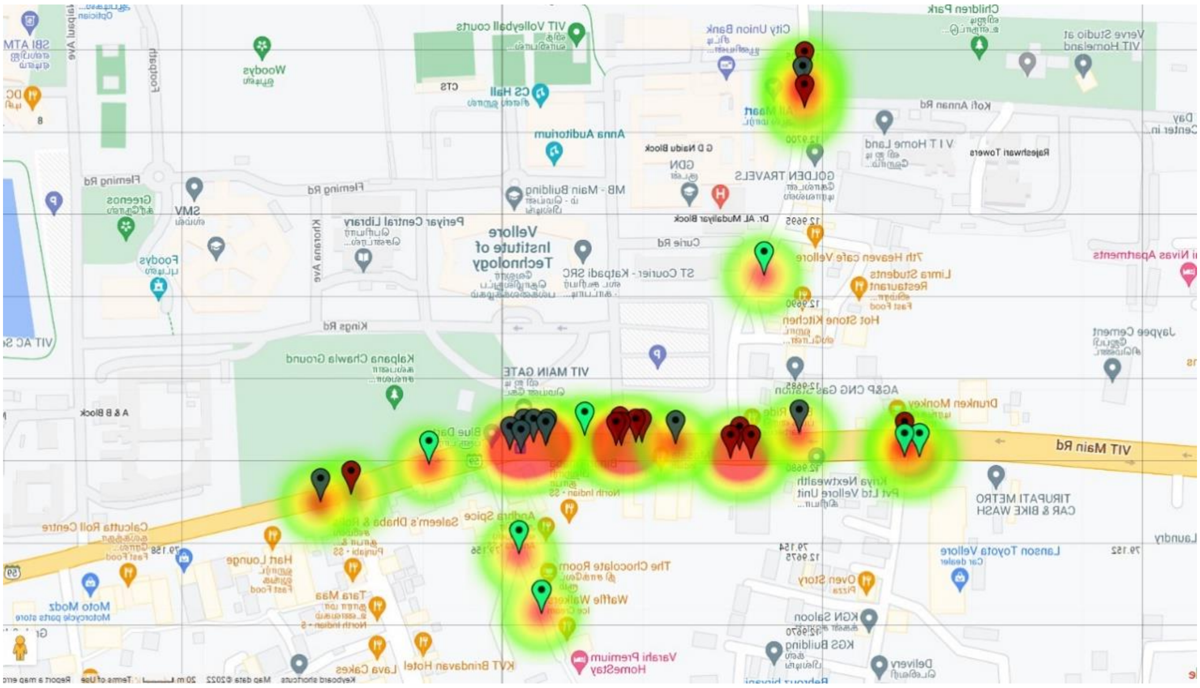


Fig 5. Read zoned area

We have used color code to demonstrate different types of accidents on map that tookplace:

The color code is as follows:

RIGHT ACCIDENT: PURPLE

LEFT ACCIDENT: GREEN

BACK ACCIDENT: RED

FRONT ACCIDENT: BLUE

The data used to produce these results was generated by one of our teammates, he took the system on his vehicle and manually activated the sensors, in order to simulate and gather data for further analysis. This Simulation was performed to show what the future large-scale implementation would look like. The data were simulated in Rourkela city atUdit Nagar

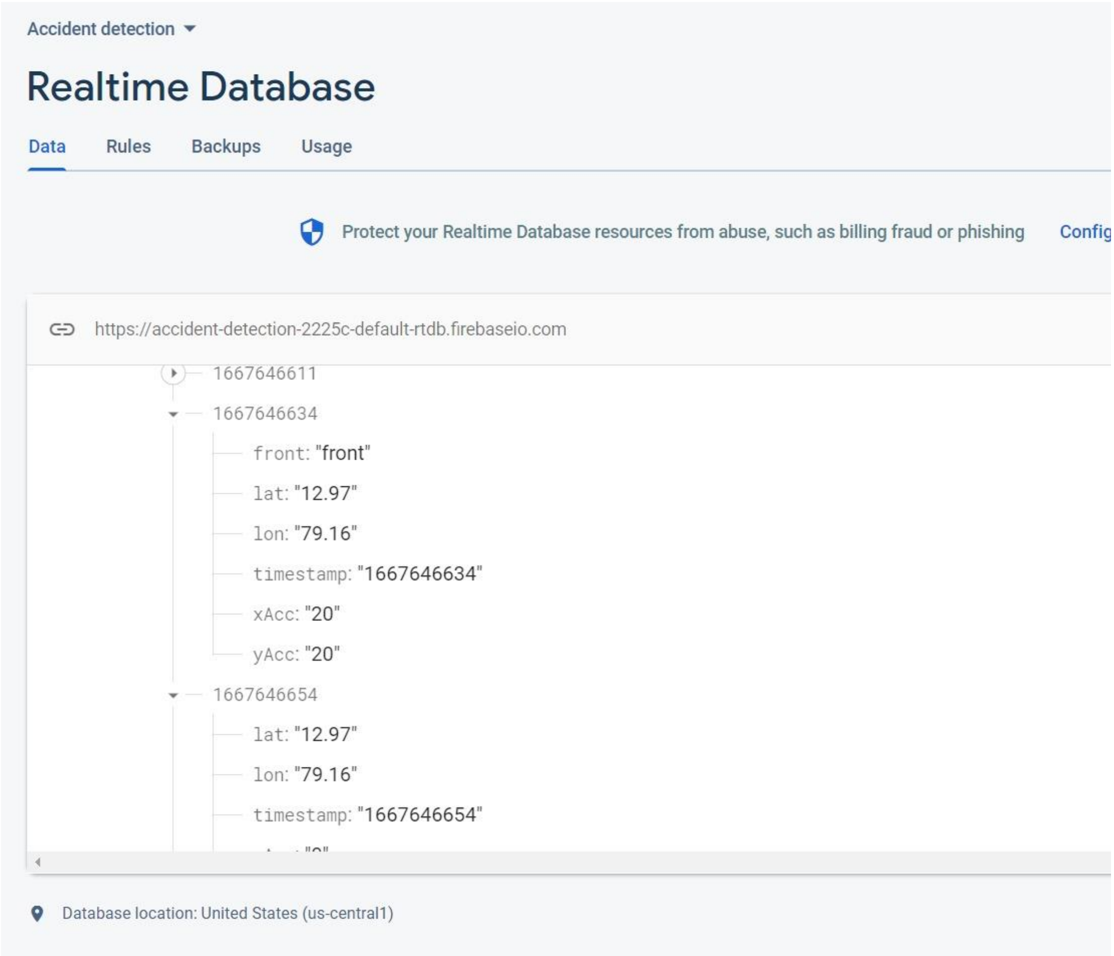


Fig 6. Data on what type of accident happened

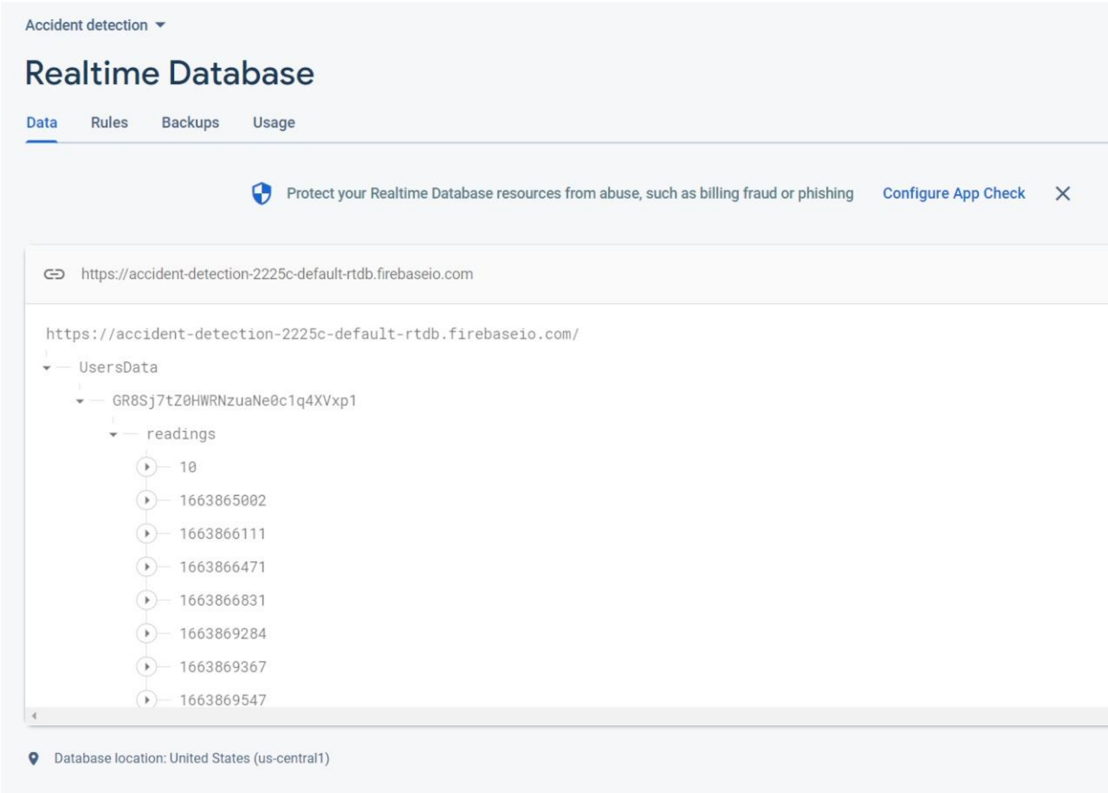


Fig 7. Geo Co-ordinates Based data

6. CONCLUSION AND FUTURE WORK

After doing this project we can conclude that by making use of features of GSM we can communicate with anyone at any time, an accelerometer helps to know anytime of tilt or mechanical disturbance in the system and GPS helps us to know the coordinate of any place around the world. Combining features of GSM, GPS and accelerometer with few other components like power supply sensors LCD etc we can develop an IOT based platform to determine if any accident has taken place and report it automatically to the nearest station this emerging technology can be very useful in saving lives of people, not only this there are severalother fields where IOT can be implemented to automate the process and enhance the luxury, security, safety and other necessary aspects of life.

This project is already in a working state, but like nothing is perfect in this world few drawbacks are always inevitable so we welcome any kind of suggestion which we will try to implement in future in order to improve this project. The first and the foremost work would be to make every hardware enclosed in a case so that it is less vulnerable to breakage and can be used in rough and tough conditions. In addition to the features available right now we also plan to implement additional features which will track the movement and progress of the help pre-stations by making use of a passkey over phone. Our system right now detects only front, back, right and left accidents, it may not work well for fall in valleys where large change in altitude takes place because it is difficult to track the change

in altitude using the sensors attached so we will work on implementing features which detects fall in cliff or any kind if destruction that occurs from below. Also, in order to increase the reliability of the result we can have planned to attach a greater number of MEMS sensors along with the existing ones We also plan to produce a second version of this project which will be basically an application over play store and IOS store where the same features will be implemented but by making the use of sensors that are present in the phone, so that the service readily is available to anyone.

7. Summary

After doing this project we can conclude that by making use of features of GSM we can communicate with anyone at any time, an accelerometer helps to know anytime of tilt or mechanical disturbance in the system and GPS helps us to know the coordinate of any place around the world. Combining features of GSM, GPS and accelerometer with few other components like power supply sensors etc. we can develop an IOT based platform to determine if any accident has taken place and report it automatically to the nearest station this emerging technology can be very useful in saving lives of people, not only this there are several other fields where IOT can be implemented to automate the process and enhance the luxury, security, safety and other necessary aspects of life. This project is already in a working state, but like nothing is perfect in this world few drawbacks are always inevitable so we welcome any kind of suggestion which we will try to implement in future in order to improve this project. The first and the foremost work would be to make every hardware enclosed in a case so that it is less vulnerable to breakage and can be used in rough and tough conditions. In addition to the features available right now we also plan to implement additional features which will track the movement and progress of the help pre-stations by making use of a passkey over phone. Our system right now detects only front, back, right and left accidents, it may not work well for fall in valleys where large change in altitude takes place because it is difficult to track the change in altitude using the sensors attached so we will work on implementing features which detects

fall in cliff or any kind if destruction that occurs from below. Also, in order to increase the reliability of the result we can have planned to attach a greater number of MEMS sensors along with the existing ones We also plan to produce a second version of this project which will be basically an application over play store and IOS store where the same features will be implemented but by making the use of sensors that are present in the phone, so that the service readily is available to anyone. We have also planned to implement such feature for fleets, as they are also prone to accidents and blockade (as in case of ever given) According to the observations during the course of the project we can implement many future upgrades to the project, like implementing 4 individual systems for every tire of the vehicle in order to detect bumps and uneven roads and to upload this data to a data base, a mini computer may be installed onboard the vehicle to collect , analyze and upload this data to a server where it can provide government officials data on bad road conditions and accident prone zones, We can utilize an onboard minicomputer for many other functionalities, like uploading real time data to a server to allow monitoring of road conditions when used in conjecture with the 4 corner system, we can analyze the data for further conclusions and analysis. Post the application of the 4-tire system and the minicomputer the system can be used to detect large potholes and ditches which cause accidents, implementation of a gyroscope can detect toppling of the vehicle, the data collected by the 4 tire system and the minicomputer maybe used to by engineers to design an efficient suspension system. This system can also assist drivers over very rough terrain. The current design is very rudimentary and does not show the severity or the altitude of the crash, we may include piezo electric cells to measure impact force and the utilization of an altimeter can provide us data regarding the current altitude of the car, this will be useful for detecting lost wreckages and finding survivors in accidents in hilly regions and mountainous roads.

8. References

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