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IoT based Accident Prevention system on High Altitude integrated with Android Application enabled with emergency Service Facility

Divya Ebenezer Nathaniel[1], Sonia Panesar[2*]

[1,2]Computer Science Engineering, Babaria Institute of Technology, Gujarat Technology University, Gujarat, India

[*]*Corresponding Author: leosonia@gmail.com*

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***Abstract*—** In today's fast era, vechicle accidents are considered to be the main agony faced all over the world that may be due to steep turns present in high altitudes dense population or traffic hazards. Although there are many distinct reasons behind automobile accidents, maximum accidents arise in hilly areas due to uncontrolled speed and ignorance of steep turns by the driver. More often youth just like the pace and when they drive they forget everything around them like vehicles coming from another side, steep turn present in high altitude, sometimes visibility is poor due to pollution and other atmospheric hazards. And if accident occurs, there appears to be a trouble attaining the emergency service at certain locations in mountainous areas or it is difficult to spot the place of accident in time for lack of know-how. As an answer, the integration of internet of things (IoT) and android application technologies can reduce the quantity of accidents and improve the emergency service provider facility for the travellers travelling to hilly areas. In this paper, a clever app is designed that anyone (service provider or traveller) can download and register and get the emergency contact service provider nearby and it will monitor the distance between the car and other vehicle coming from other side using a distance sensor at the steep turns present in high altitudes. It also notifies the traveller with a push message having temperature and weather information so that driver can be warned to keep a track of pace and reduce it gradually.

***Keywords*—**IOT, Arduino, Sensor, Android, high altitud esteep turns

I. INTRODUCTION

Every year, approximately 1.35 million people lost their life as a result of road accidents. Because of these accidents, more than 20 to 50 million people suffer from non-fatal injuries. And many become disabled from these injuries. Road crashes cost USD $518 billion globally, costing individual countries from 1-2% of their annual GDP [1].

All over the world India bangs the top most positon in accidental deaths. Nearly 1.2 lakh of people killed every year on Indian roads. Rollovers tend to be more serious than other types of accidents. While taking a curve three types of forces are involved which are directional force, momentum force and centrifugal force. Accident in curve roads of high altitudes generally occurs when the centrifugal force is more than the direction and momentum force which makes the car to move in a straight line instead of curved path. The challenge is to reduce the number of accidents. For which, it's better to act before an accident occurs. But sometimes it's not in our hands. And so, many injured lose their lives for not getting informed beforehand. An automated intelligent system would be the best solution considering the circumstances.

The existing solution aids passengers when an accident occurs. The injured must launch the system to request for help manually. But it would not have been possible if he/she were under critical or serious non-vital situation. There exists no system that controls vehicle speed to prevent accidents with automatic alert. The main contributions of this paper are: (a) Developing a new smart IoT based solution which will reduce the number of road accidents. (b) Providing proper alert to the community to lower the rate of death. (c) Availing emergency service to user at remote site by tracking there. (d)Implementing an alert system for the prompt awareness of drivers.
(e) Observing the distance from the vehicle to another vehicle in opposite direction.

In the beginning of this paper, a statistical study on car accident is presented. Sections II, III, IV describe the related work, the proposed system, and implementation consecutively. Sections V and VI give results, conclusions and future work.

II. RELATED WORK

This section overlooks similar existing systems and examines their advantages and disadvantages. There are a lot of systems that only detects accidents. There has not been a system to prevent and detect accidents at the same time in an efficient manner Smartphone application to detect car accidents [2], proposed a system that detects a vehicle accident using vibration sensor and sends an alert message to police control room for rescue. Global Navigation Satellite Systems, such as the Global

Positioning System (GPS), are being increasingly used in many applications, especially for vehicle positioning and navigation. Indeed, many vehicles that are shipped today have GPS devices that sense the position of the vehicle and send this information to cloud servers [2]. Other sensors, for use in accident detection or smart transport management, are also present in modern vehicles and continually acquire and store data. High sampling rates, driven by a desire for increased accuracy and algorithm efficacy, lead to significant challenges in the storage and analysis of this data.

In the literature, we can find a significant amount of research attempting to address the problem of low-cost retrofitted solutions for identifying and notifying of vehicle accidents, based on mobile phone technology. Accident detection depending on the vehicle position and vehicle theft tracking, reporting systems [3] have proposed a crash notification system that utilises mobile devices, detecting accidents through accelerometer and GPS data. Automatic Vehicle Accident Detection and Messaging System Using GSM and GPS Modem [4,5] the authors propose a system that uses the gravitational force, speed, and noise to detect an accident. An emergency notification is sent to a web server that then sends an SMS to the emergency contact number. The main weakness of this system is that there is a possibility of false reporting of an accident at low speeds, where the system struggles to ascertain reliably whether the user is in the vehicle. This system delays in sending a message about an accident.

Alcohol Detection and Accident Prevention of Vehicle [6], this system used alcohol detecting sensor in vehicle which detects alcohol gases and sends messages with location to their relatives. This process is useful for special purpose, not for overall accident detection and prevention An IoT Approach to Vehicle Accident Detection, Reporting, and Navigation [8] focus on the accelerometer as the main sensor in a smartphone for the detection of an accident. This system continuously receives data from the accelerometer and use this to determine the severity of an accident. It notifies the medical service provider of accident location and sends information about the owner/driver. The problem with both of these systems is their reliance on a single sensor gives a tendency for false reporting since there is no other information to corroborate a suspected accident. Accident Detection and Reporting System using GPS, GPRS and GSM Technology [9], this paper proposes a system that has the capability of detecting accident based on monitored speed and send an alert to police stations. Speed of a vehicle will be monitored and compared using GPS. This system has no alert facilities that can prevent accidents.

Go Safe: Android application for accident detection and notification. [10] propose a smartphone-based system that detects an accident using an accelerometer and finds the nearest emergency point to send the location of the accident. Again, this system has the problem of a single point of failure leading to a tendency of false reporting. This system is able to provide accident location. It has no facility to prevent accident. In [11] this paper projected the system provides correct detection of driver fatigue by detection yawning and s it will alert the driver via play a sound in a loop. It will stops by pressing the ok button in the dialog box. It can even facilitate drivers to remain awake once driving by giving a warning once the driving force is sleepy headed. In [12] proposes a system consist of sensors along with Arduino and for indication purposes IR sensors, buzzers and RGB LED light. They have used the proximity sensor to critically detect the distance between the vehicles and avoid accidents. This can be installed at the junction of two or more roads even in plain areas, but they implemented it only in case of hilly curves which are even more dangerous than normal junctions, and are more prone to accidents.

III. PROPOSED SYSTEM

In the developing countries accident is the major cause of death. If we gaze at the top 10 dangerous roads in the world we can see that all of them are roads lied on high altitude and curve roads. In the high-altitude roads there will be tight curves and the roads will be narrow. In these kinds of situations, the driver of a vehicle cannot see vehicles coming from opposite side. Thousands of people lose their lives each year because of this problem. As the discussion is about high-altitude road here other side might be led to a cliff.

1. The solution for this problem is alerting the driver about the vehicle coming from opposite side. This is done by keeping an ultrasonic sensor in one side of the road before the curve and keeping a LED light after the curve, so that if vehicle comes from one end of the curve sensor senses and LED light glows at the opposite side. By looking at the LED light on/off criteria driver can become alert and can slow down the speed of the vehicle.
2. Sometimes accidents also occur due to over speeding, Climate of road & sudden turns. So, as a precautionary measure the alert messages are pushed for those registered users with the application.
3. The system is integrated with the emergency services like ambulance and other essential services like nearby vehicle maintenance service in system module for further convenience.

The figure 1 describes the system architecture, which modelled in two tiers. one of them is designed as an external device which has two sensors Distance measuring sensor and Temperature sensors. The external device is interfaced to the android application and sends the weather report to alert the driver.

The other tier of the system allows the registration of emergency service based on the location. so that in any emergency time the driver can be in easily accessible of service. Modules available in the system are discussed below.

Admin Module:
It manages all other modules. Mainly After the sign in, admin monitors all the activities and also responds to the complain of the users.

Service Manger Module:
It manages the services that the user requests. It also views the complain of users and sends the service as per the users request.

Registered User Module:
The Registered user who use the System and send the request if any help is required. The users are provided with the facility of feedbacks or complains. Further the system pushes the Alert message about the weather condition on higher Altitude. the following section discuss the type of sensors used.

Feedback and Complaint module:
In this module registered user can file his complaint as well as feedback against the service provided. and user can track the follow up action taken against the service provider. The user rating can help other user to choose the service provider. The following Data base for user, admin, feedback, service provider are maintained for easy storage and retrieval of data

Interfacing Module:
The Arduino board is interfaced with android application with the blue tooth so that the temperature sensor can push the message to the registered user.

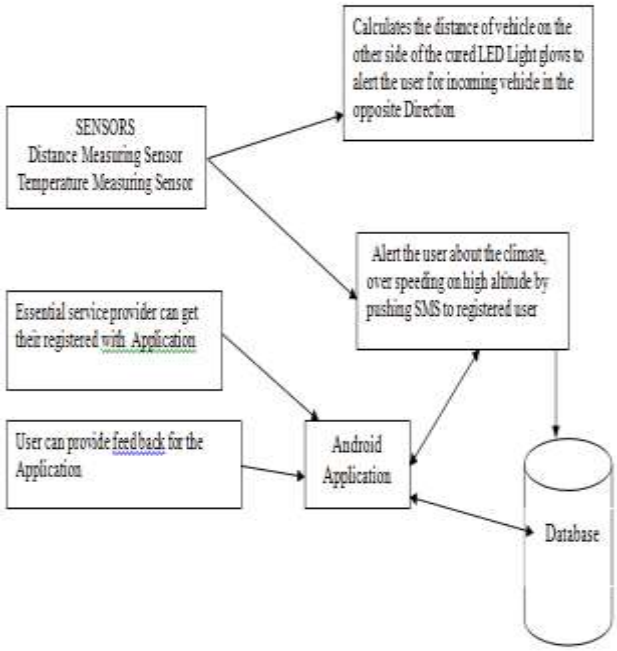

Figure -1 System Architecture

Sensors Used
Distance sensors
Distance sensors sense distance from the object and the measuring device through outputting a current. Currents can be in the form of ultrasonic waves, laser, IR, etc

Ultrasonic Sensor
The most common type of distance measuring sensor is the Ultrasonic Sensor, also known as the Sonar sensor, it detects the distance to objects by emitting high-frequency ultrasonic waves.

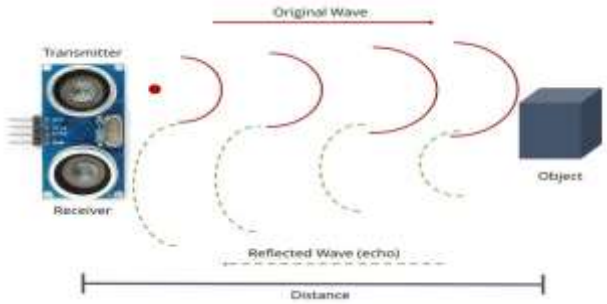

Figure 2-Working principle of ultrasonic sensor

The ultrasonic sensor emits high-frequency sound waves towards the target object
Target object picks up the sound waves
Sound waves are then bounced off and reflected back towards the ultrasonic sensor
The time it took for the sound wave to return is used as the measurement of the distance between

Raindrop Module: (Temperature Sensor)
It is used for the detection of rain in high Altitude. It can also be used for measuring the intensity of the rain [7]. It has both digital output as well as analog output. This module measures the moisture through analog output pin and when the threshold of moisture exceeds too much it provides a digital output. The more water or the lower resistance means lower output voltage. Whereas, the less water means higher resistance, i.e, high output voltage on the analog pin.

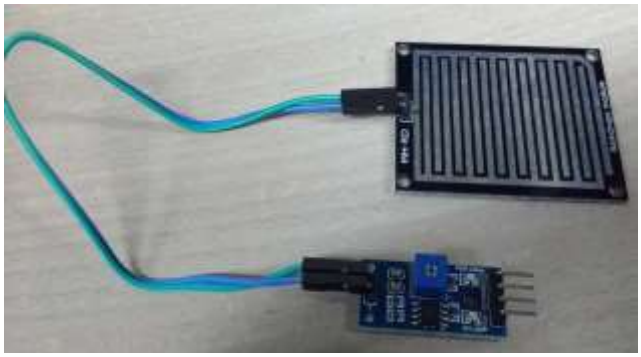

Figure -3 Raindrop Module

Interfacing of Arduino with Android:
The Bluetooth-Module HC-05/HC-06 is communicating with the Arduino via the UART-Interface. Every message the Arduino wants to send, is first given to the Bluetooth-Module, which sends the message wirelessly. To avoid problems with the UART, Arduino and Bluetooth-Module **have to** use the same baud-rate (in default 9600). It is possible to change the baud-rate and the password (and many other things) of the HC-05/HC-06.

Implementation:
The system is developed in such a way that the android application has the following module for maintaining the information about the user, service provider, Type of service, and feedback with complaints. In the later part the System is interfaced with External circuit which has the Sensor namely the Ultrasonic Sensor to calculate the distance of the vehicle approaching in opposite direction and warn the driver. similarly, another sensor Raindrop module sensor located on various heights of Altitude measure the temperature and push the message to the Registered user. The paragraphs given below will discuss the how the distance is measured with ultrasonic sensor and algorithm used for Rain drop module

Ultrasonic Sensor
With Ultrasonic Sensor, an object is placed at a distance d cm away from the sensor, the speed of sound in air is 340 m/s or 0.034 cm/µs. It means the sound wave needs to travel for the duration of d/0.034 µs. the Echo pin double the distance (forward and bounce backward distance). So, to find the distance in unit of centimetre multiply the received travel time value with echo pin by 0.034 and divide it by 2.
The distance between Ultra Sonic HC-SR04 and an object is:
Distance=(Speed*Time)/2

Rain drop module:

Algorithm used for Rain drop module:

```
Input: temp, humidity, press,LDR, rain;
Output sms, loop {
temp=temperature value measured;
humidity=humidity value measured;
press=pressure value measured;
LDR=light intensity measured;
rain=rain value measured;
if (temp && humidity && press && LDR && rain)
{
serial.println(temp
serial.println(humidity);
serial.println(press);
serial.println(LDR);
serial.println(rain);
}
else
{
serial.println("error! check the sensors.");
}
if(temp>=40)
{
sms=" The current temperature is" + temp;
}
if(humidity>=50)
{

sms=" The current humidity is" + humidity;
}
if(rain>=200)
{
sms=" It's raining Reduce the speed of driving";
}
if (LDR>=150)
{
post only once in a day
{
sms=" Good Morning";
}
}
```

IV. RESULTS AND DISCUSSION

The figure 4 is the screen shot of the working model of the proposed system which depicts the features available in the system and the show the registered service provider the Figure 5 depicts the location map of the service provider nearby Figure 6 shows the image of working of ultrasonic sensor.

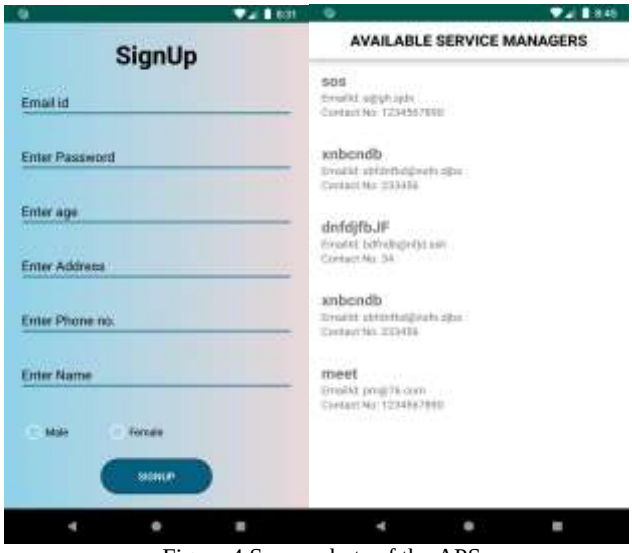

Figure 4 Screen shots of the APS

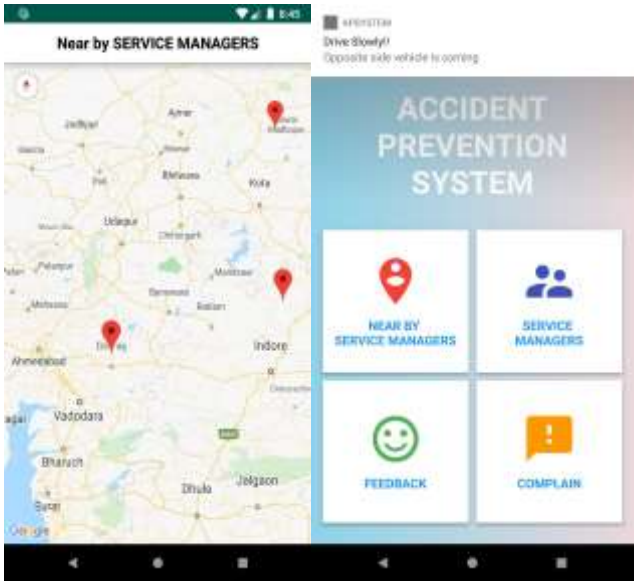

Figure 5 Location map

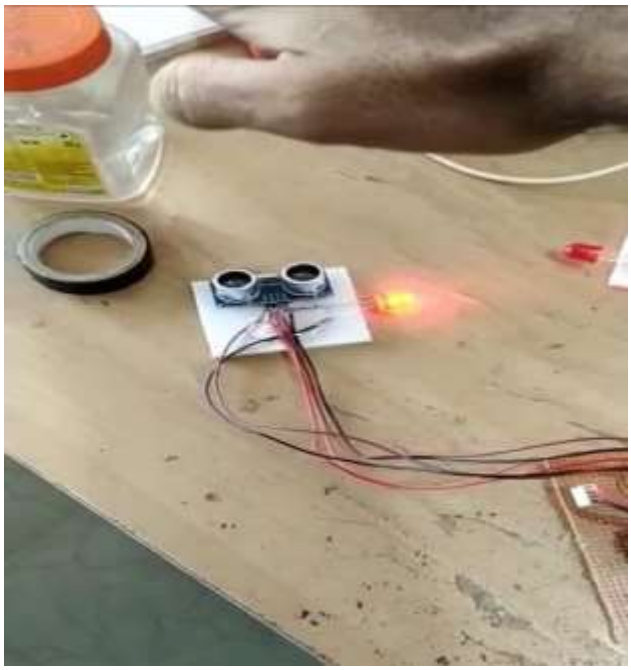

Figure 6 Interfacing of ultrasonic server

V. CONCLUSION AND FUTURE SCOPE

The unique feature of the system ensures the user do not need to worry about the turns in the mountainous areas every time while driving.

- All essential services are in our app so user don't need to dial every single emergency service no. and user can easily access our app from anywhere.
- With such features travellers can easily plan a safe trip & get every require service. User will be notified about the presence of vehicle detected by ultrasonic sensor at every turn, temperature and weather information with a push message.
- 24/7 available
- Alert Message, Weather Alert
- Emergency Services
- Complaints and Feed Back for service improvisation

In future a circuit designed with an alarm in car that would start to alert the driver about the distance of the approaching vehicle and start honking more over all of the above the vehicle is slow down by reducing the flow of the fuel into the engine when a vehicle is approaching at a dangerous distance with any obstacles in the opposite direction.

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AUTHORS PROFILE

Prof Divya Ebenezer Nathaniel Assistant professor M.Tech, Department of Computer Science and Enggineering, Babaria Institute of Technology, Vadodara, Gujarat. divya.mtech2010@gmail.com

Prof Sonia Panesar Assistant professor M.Tech, Department of Computer Science and Enggineering, Babaria Institute of Technology, Vadodara, Gujarat. leosonia@gmail.com