SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

IBM NALAIYA THIRAN

PROJECT REPORT

Submitted By

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BONAFIDE CERTIFICATE

Certified that this project report titled **"SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY"** is the bonafide work of **"KALAIMANIVEL KA (73771913130), ARVINTHAN DS (73771913107), GUGAN K (73771913124), GOWTHAM S (73771913123), ARULSELVAN J (73771913106)"** who carried out the project work under my supervision.

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CHAPTER – 1

INTRODUCTION

1.1 Project Overview:

Smart connected Signs for Improved Road Safety in present Systems the road signs and the speed limits are Static. But the road signs can be changed in some cases. We can consider some cases when there are some road diversions due to heavy traffic or due to accidents then we can change the road signs accordingly if they are digitalized. This project proposes a system which has digital sign boards on which the signs can be changed dynamically. If there is rainfall then the roads will be slippery and the speed limit would be decreased. There is a web app through which you can enter the data of the road diversions, accident prone areas and the information sign boards can be entered through web app. This data is retrieved and displayed on the sign boards accordingly.

Road accident nowadays has become a national catastrophe for over populated developing countries. One of the main cause of accident in the sensitive public zones like school, college, hospitals etc. and sharp turning points is the over speed of vehicles avoiding the speed limit indicated in the traffic sign board. Drivers endanger the lives of passengers, pedestrians and fellow drivers not limiting their vehicle speed in these sensitive public zones. The main objective of the proposed system isto operate the vehicles in a safe speed at critical zones minimizing the possible riskof unwitting accidents and casualties. This project paves a system to alert the driverabout the speed limits in specific areas and reduce the speed of the vehicles in sensitive public zones without any interference of the drivers. The controls are takenautomatically by the use of a wireless LAN

1.2 Purpose:

The purpose of this scenario is to improve vehicle safety by providing real-time traffic information to the driver. Road signs play an important role in road safety. To be effective, road signs must be visible at a distance that enables drivers to take the necessary actions.

When this proposed solution is set to work, the problem can be reduced, as the caretaker on the other side. Roads are used for general transportpurposes, but they can be deadly as well. More than half of all road traffic deaths and injuries involve vulnerable road users, such as pedestrians, cyclists and motorcyclists and their passengers.

An emotionally charged person can undergo enough stress to experience tunnel vision where one is less likely to notice things happening outside the car. The observation time and reaction become slower and one maneuver in pandemonium. There is lack of precision and ability to perform driving skills and exercise reflexes.

High quality safety data should be used to determine the nature of the road safety problems, used to identify safety problems on a large or a small scale, such as roadway characteristics, traffic volume, driver history

CHAPTER – 2
LITERATURE SURVEY

2.1 Existing problem:

The early effects to prevent road accidents and to ensure road safety includes the use of speed detection device, speed limiters and emergency accident units as the first phase. Despite achieving the state-of-the-art performance, the existing systems suffer from two main problems,

• Over Speed: These systems cannot control speed at some specific zones.

• Exact location of accident occurred: These systems cannot give the precise location of accident.

The technology **enables you to control traffic, catch the lawbreakers, and provide road safety**. Light Detection and ranging gun is a weightless and simple tool, which enables law officials to catch and book vehicles that crosses the speed limit.

2.2 References:

1. W. Farhat, S. Sghaier, H. Faiedh, and C. Souani, "Design of efficient embedded system for road sign recognition." Journal of Ambient Intelligence and Humanized Computing, vol. 10, no. 2, pp. 491-507, 2019.

2. A. Hechri, R. Hmida, and A. Mtibaa, "Robust Road lanes and traffic signs recognition for driver assistance system," Inter-national Journal of Computational Science and Engineering,

vol. 10, no. 1-2, pp. 202-209, 2015.

3. W. H. Ling and W. C. Seng, "Traffic sign recognition model on mobile device," in Proceedings of the 2011 IEEE Symposium on Computers & Informatics, pp. 267-272, Kuala Lumpur, Malaysia, March, 2011.

4 H. Rajale, A. Khachane, and A. Oak, "Design of a road sign informing system based on GPS and RFID," in Proceedings of the 2014 International Conference on Control, Instrumenta- tion, Communication and Computational Technologies

(ICCICCT), pp. 963-967, Kanyakumari, India, July, 2014. [21] A. Katajasalo and J. Ikonen, "Wireless identification of traffic

2.3 Problem Statement Definition:

Creating a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will like.

I am	I'm trying to	But	Because	Which makes me feel
Family man	Buy a car for my family.	Doesn't have idea to choose Right one.	Trying to find the car that keep within my Budget.	Sorrowful
Traveler	I am trying to find less fuel usage car over luxury.	Can't find the car for travelling	For my weekly vacation	Confused
Corporate worker	Buy a car for my personal use	Don't have time to check my requirements in my new car	Of work pressure	Frustrated
Dealer	Sell a car to the Customers.	Unable to predict the right value to customers	Of variety of cars and features also Different.	Distressed

.

If there is rainfall then the roads will be slippery and the speed limit would be decreased. There is a web app through which you can enter the data of the road diversions, accident prone areas and the information sign boards can be entered through web app. This data is retrieved and displayed on the sign boards accordingly.

CHAPTER – 3

IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it.

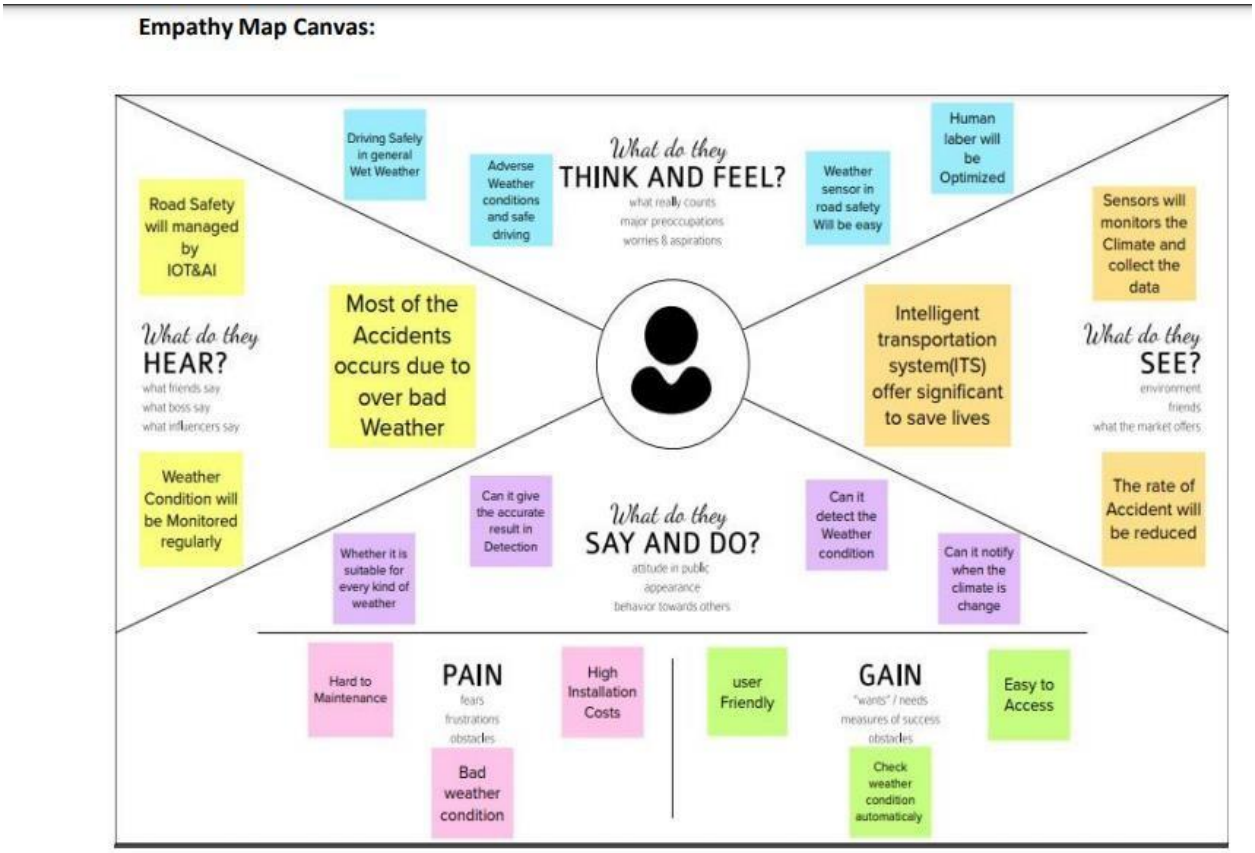

FIG 3.1 EMPATHY MAP CANVAS

3.2 Ideation & Brainstorming:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem-solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich number of creative solutions.

Step-1: Team Gathering, Collaboration and Select the Problem Statement

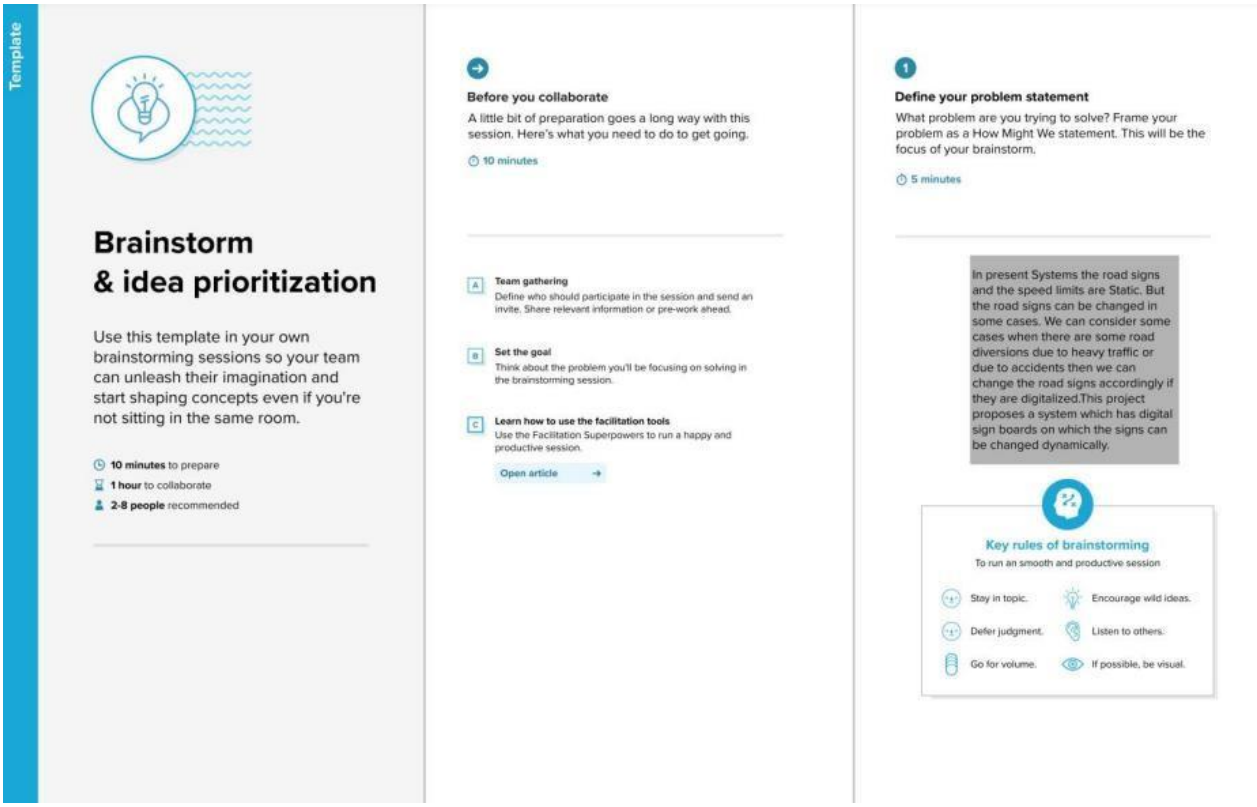

FIG 3.2 IDEATION & BRAINSTROMING

This step includes the formation of a team, collaborating with the team by collecting the problems of the domain we have taken and consolidating the collected information into a single problem statement.

Step 2: Brainstorm, Idea Listing and Grouping

This step of ideation includes the listing of individual ideas by teammates to help with the problem statement framed. All the individual ideas have been valued and made individual clusters.

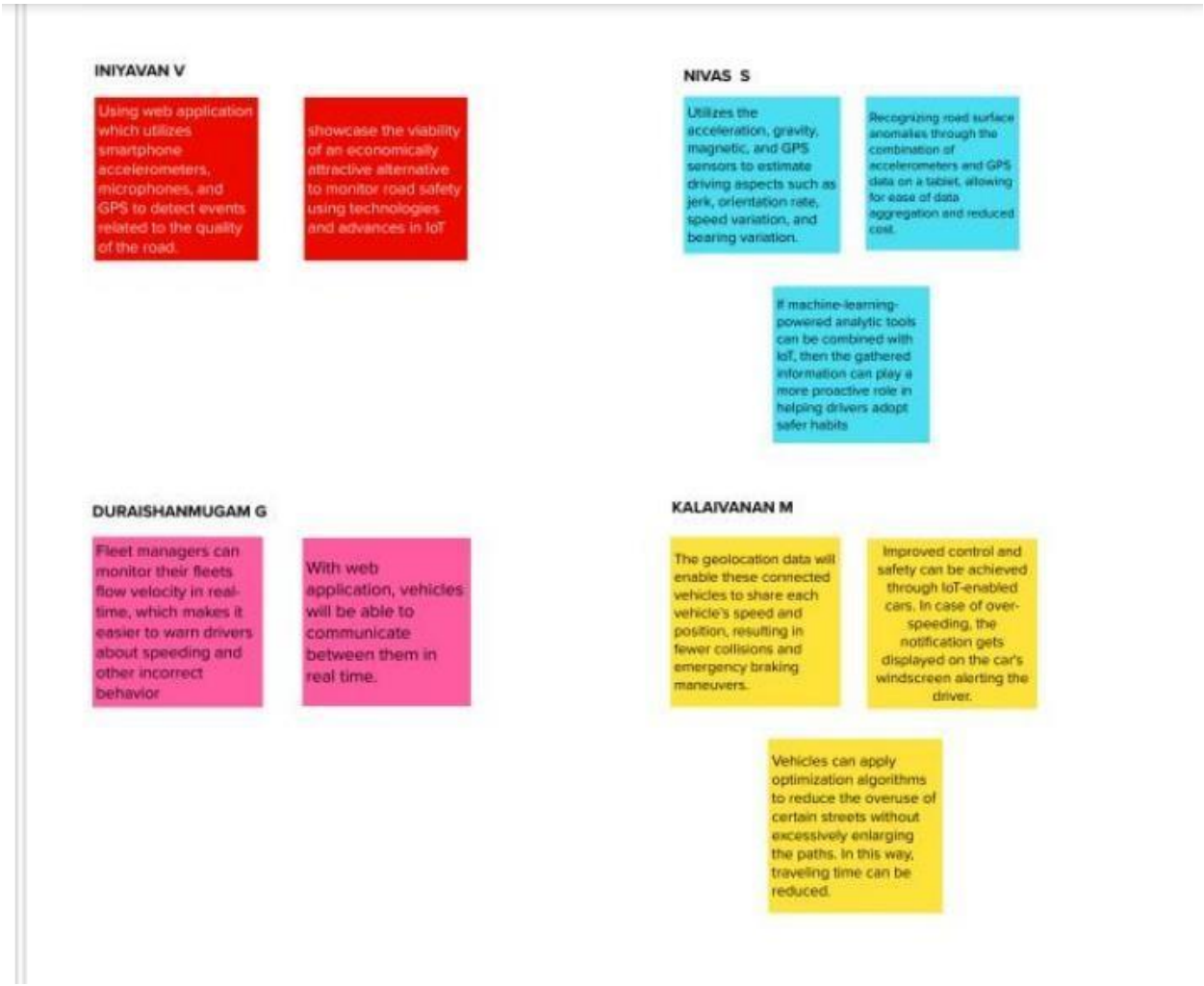

FIG 3.3 BRAINSTORM, IDEA LISTING AND GROUPING

Then discussed as a team and finally made an ideation Cluster A and concluded with the most voted ideas from all the clusters together and Cluster B with the least needed ideas.

Step 3: Idea Prioritization

This step includes the process of listing necessary components to come up with the working solution and making a hierarchy chart by prioritizing the components based on importance, say from the higher being backend and lower being the user interfacing components.

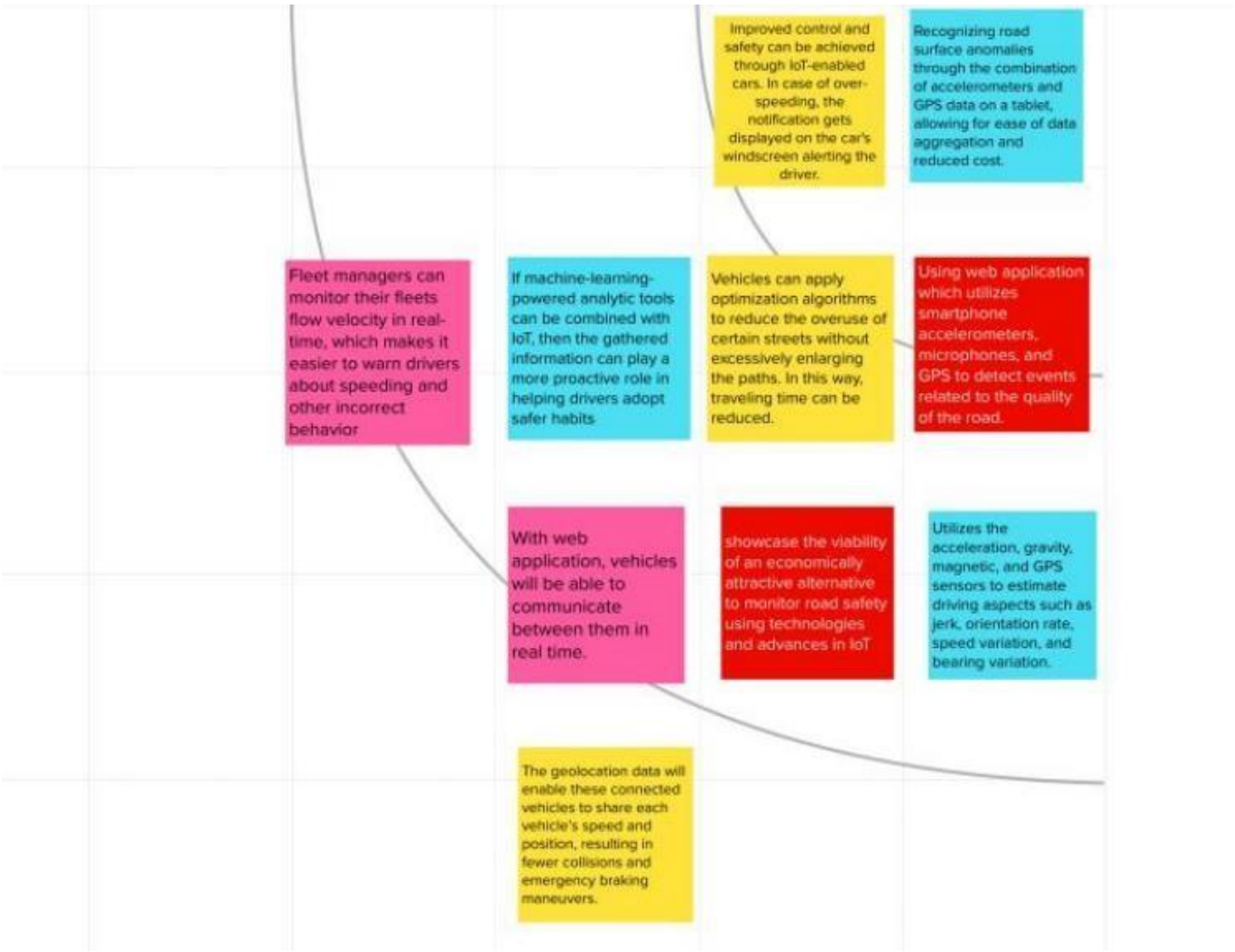

FIG 3.4 IDEA PRIORITIZATION

3.3 Proposed Solution:

S No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The problem in these curve roads is that the drivers are not able to see the vehicle or obstacles coming from another end of the curve. If the vehicle is in great speed then it is difficult to control and there are chances of falling off a cliff.
2.	Idea / Solution description	This problem can be overcome by using IOT. By implanting IOT, we are able to monitor the vehicles, as well as their environment.
3.	Novelty / Uniqueness	The uniqueness of our application is, by using our application we will get live updates of temperature, weather, their environment by using the IOT
4.	Social Impact / Customer Satisfaction	The social consequences of road traffic accidents include loss of productivity of the victims, the cost of the legal system, the cost of pain and suffering and loss of quality of life of the victim and their family. The loss of productivity represents a significant proportion of the total social costs.
5.	Scalability of the Solution	Our applications are used for Road safety techniques studied include distance sensing, improper driving detection and accident prevention, weather related events and negligent driving detection and accident avoidance.

Problem Statement (Problem to be solved)

Our project's main aim is to make an alert message when there is a change in weather condition immediately to the user to drive carefully based on the weather condition properly.

Idea / Solution description

A Weather api which remains us to take weather condition regularly and the information have been fed to the backend of the Cloud database by the user through a Mobile application that triggers the IOT device to take weather alert message report to user with a voice command and lights up.

Novelty / Uniqueness

A compact Device which can be carried out anywhere else and Emergency SOS System for the user.

Social Impact / Customer Satisfaction

A IOT sensor which is used to detect the temperature, humidity, visibility and location.

3.4 Problem Solution Fit:

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why

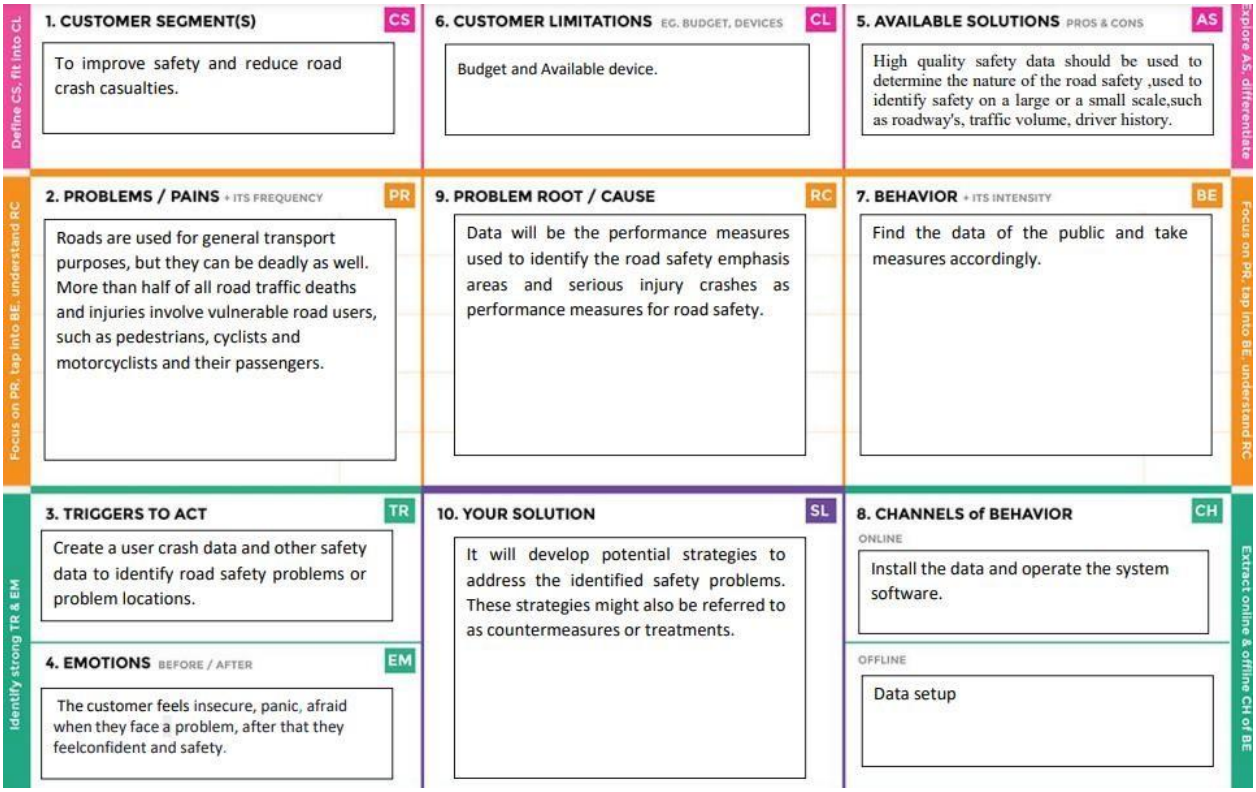

FIG 3.5 PROBLEM SOLUTION FIT

CHAPTER – 4
REQUIREMENT ANALYSIS

4.1 Functional Requirements:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story/Sub-Task)
FR-1	User Registration	• Registration through Form • Registration through Gmail • Registration through LinkedIn
FR-2	User Confirmation	• Confirmation via Email • Confirmation via OTP
FR-3	User Visibility	• Sign Boards should be made of bright colored LEDs capable of attracting driver's attention.
FR-4	User Understanding	• Display should be big enough to display all the signs correctly so that it is understand able even to far away drivers.
FR-5	Information delivering time	• The accident information should be delivered before certain distance then only the driver can change the route of destination.

4.2 Non-Functional Requirements:

Usability:

Product that is simple to use. It can be used and understandable by all people without any predefined training

Security:

A robust security system must be used so that no hackers can enter with authorization into the IOT based system

Reliability:

For high reliability correct and authorized signs should be displayed.

Performance:

Automatic updating should be done in case of sudden accidents and weather changes.

Availability:

Signs boards must work 24/7, so proper power supply or battery should be given to the sign boards.

Scalability:

It should be implemented through the entire highway system.

CHAPTER – 5

PROJECT DESIGN

5.1 Data Flow Diagrams:

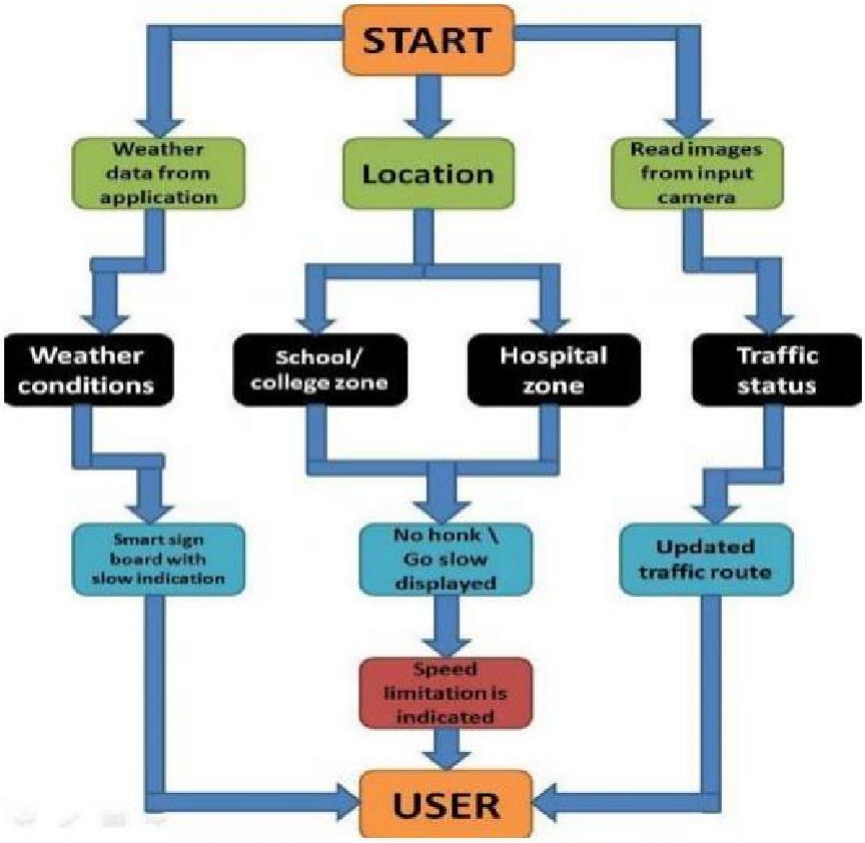

FIG 5.1 DATA FLOW DIAGRAMS

5.2 Solution and Technical Architecture:

The solution architecture includes the components and the flow we have designed to deliver the solution.

Here, the application is planned to be designed, where the driver of the vehicle will get an alert message of upcoming weather condition with the help of buzzer. Vehicle details are connected to the database with the help of python and Arduino to buzzer. By monitoring that information in the program, timely message alerts are given to the drivers to drive properly based on the weather.

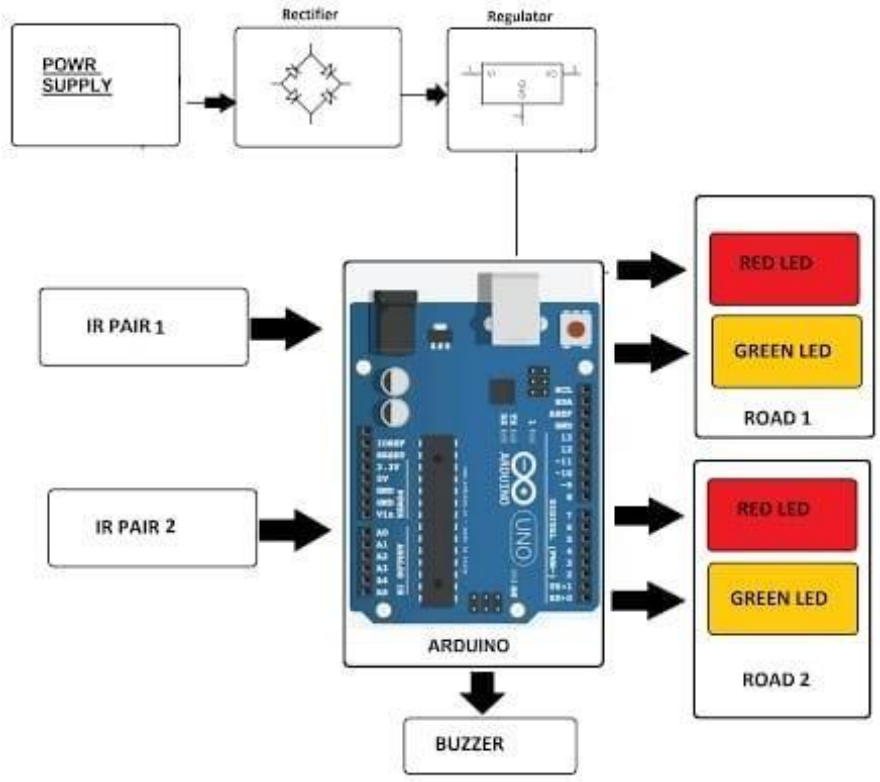

FIG5.2 SOLUTION AND TECHNICAL ARCHITECTURE

CHAPTER – 6
PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning & Estimation:

SPRINT 1:

In Sprint-1 we have initialize the resources user have to Create an account in Open Weather API designed the login and registration page for our website and then have to create a python script using the given input from the Open weather API In login page, the username and password are required. If the person is a new user, he/she can create an account using registration page. In this page the username, password, Email Id and mobile number is required. After the registration, the person can login to the website.

We use three types of coding in sprint-1 that is brain, main, weather code to be implemented. From this code we can determine the weather condition and it helps user to drive carefully.

SPRINT 2:

The second sprint includes the configuration of APIs, SMS, and Router Configurations. The API configuration involves the linking of frontend and backend development. API stands for Application Programming Interface. In the context of APIs, the word Application refers to any software with a distinct function.

From this sprint we used a python code to check weather which is linked to the cloud via the IBM cloud login. We connect a python code to the cloud login and then calculate the weather conditions such as humidity, temperature, visibility, location etc.

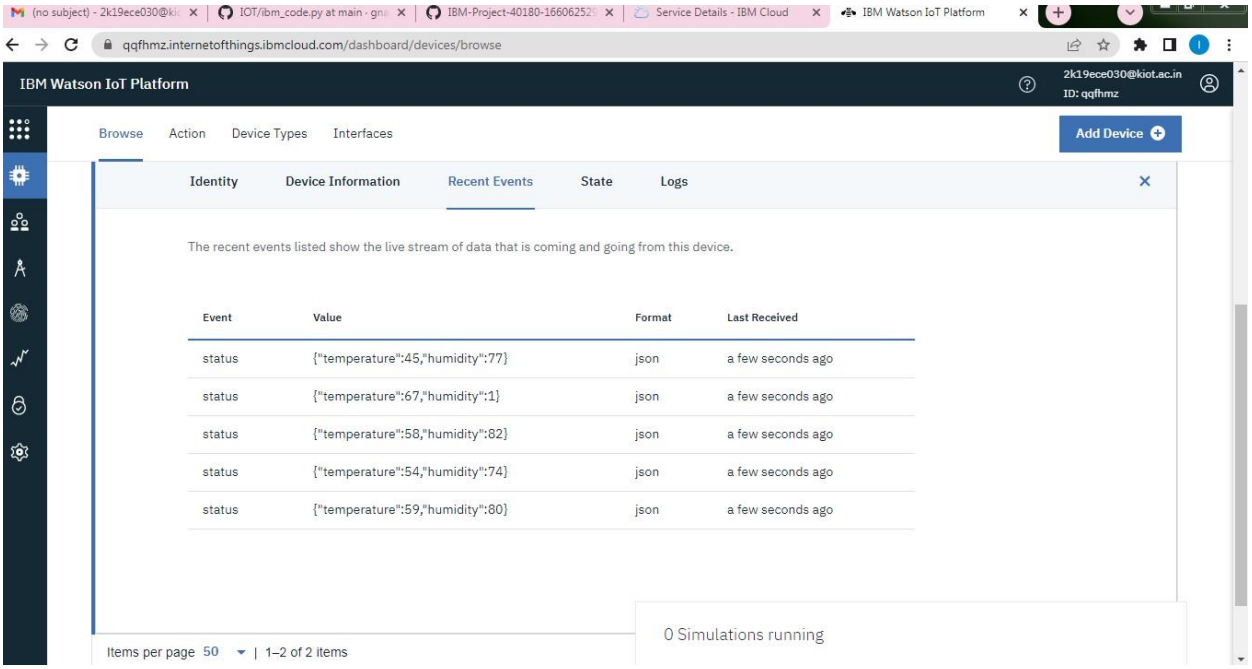

FIG 6.1 SPRINT 2

SPRINT 3:

The third sprint involves the work of establishing the sprint 1 code that is connected to the node-red and then determine the weather condition. All the nodes such as visibility, humidity, temperature, locations are connected with a IOT logger debug

Get speed in node-red gets the speed of vehicle and passing an alert message to the openweatherAPI and openweatherAPI have the decision maker step that is to drive or slow-down or stop message to the user. We have set-direction-in connected to the functions and then set-direction-out when there is a change of weather condition changes or the user gets an alert message.

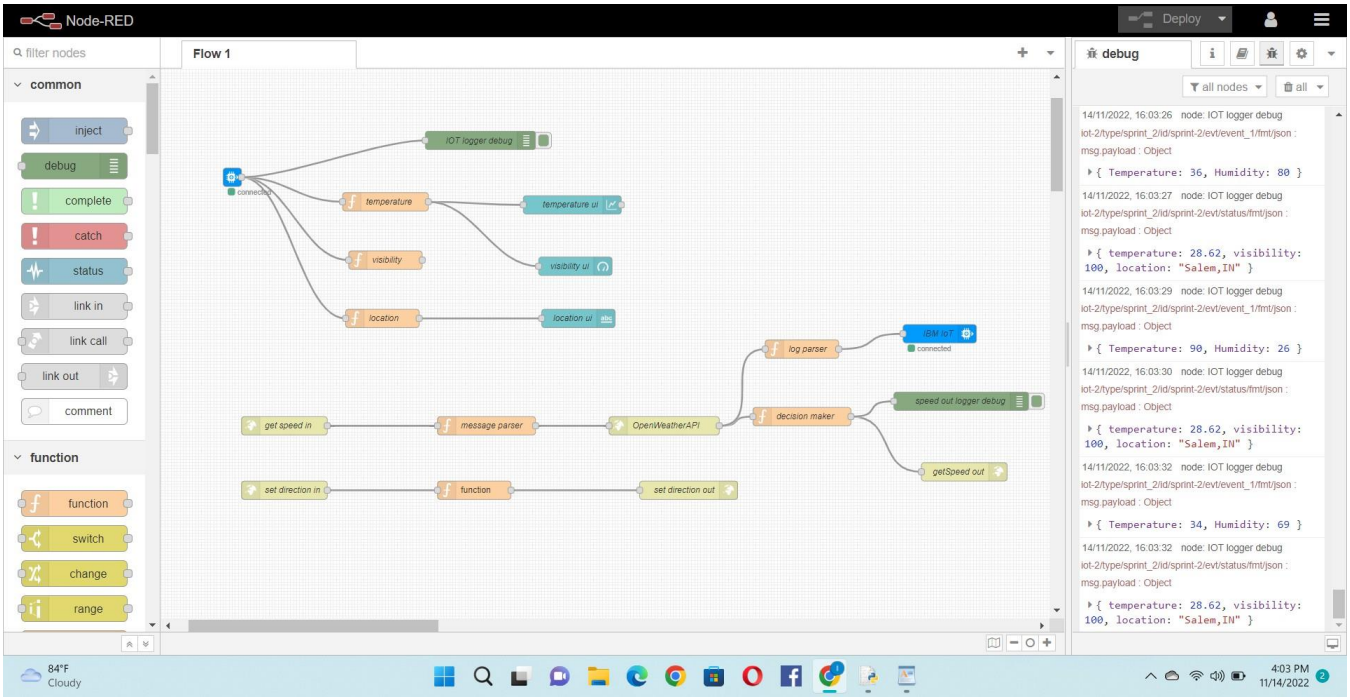

FIG 6.2 SPRINT 3

SPRINT 4:

The fourth sprint involves the work of setting up the backend components. We created a database to maintain the caretaker setting data and to retrieve the same information to process and send alert messages at the correct interval of time.

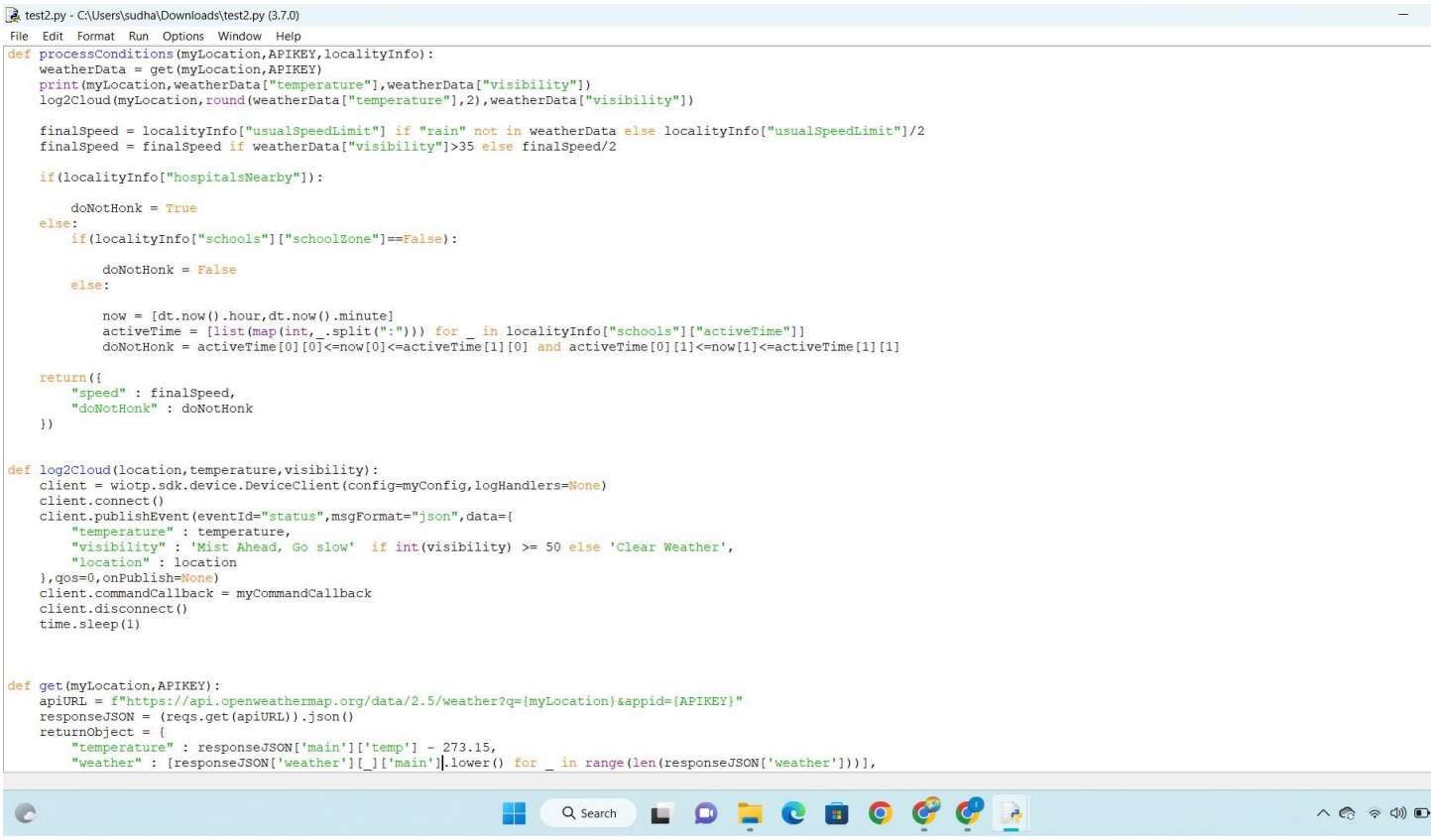

FIG 6.3 SPRINT 4

The above python code is used to detect the weather conditions, such as humidity, temperature and location. It is used to detect all the possible errors and rectify the error source to be get a clear zone.

6.2 Reports from JIRA:

Burndown Chart

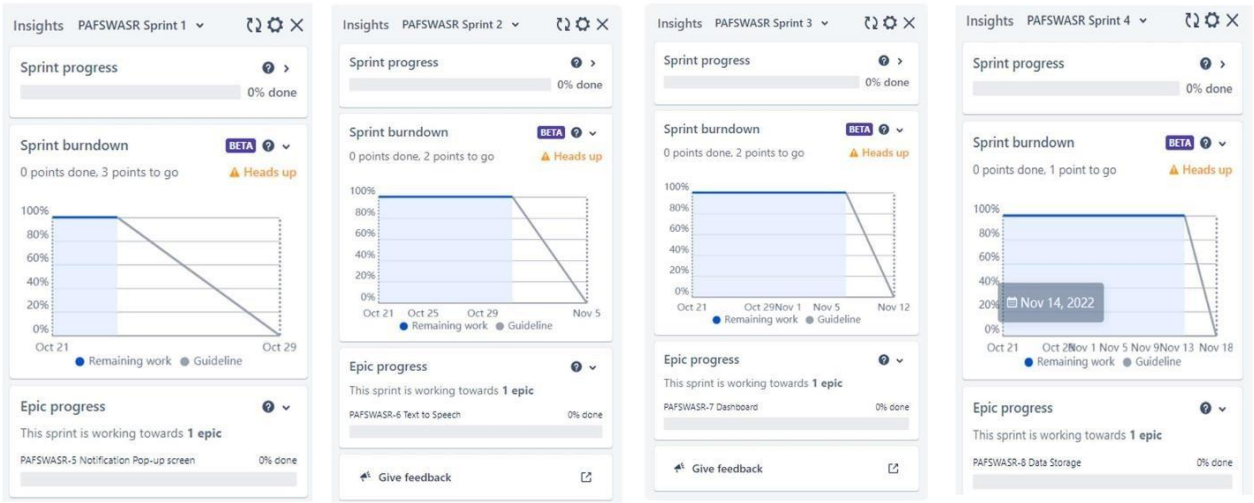

FIG 6.4 Burndown Chart

CHAPTER – 7

CODING AND SOLUTIONS

7.1 Feature 1:

A future trend in intelligent transportation systems is “smart road signs” that incorporate smart codes (e.g., visible at infrared) on their surface to provide more detailed information to smart vehicles.

Features of React:

PYTHON

WEATHER MAP

Code:

```
localityInfo = {
   "schools" : {
      "schoolZone" : True,
      "activeTime" : ["7:00","17:30"]
      },
   "hospitalsNearby" : False,
   "usualSpeedLimit" : 40
```

7.2 Feature 2:

Node.js comes with a large library of python modules, making it much easier to construct web applications with it. NodeJS facilitates the integration of programming languages with APIs, other languages, and a variety of third-party libraries. It is used exclusively in the 'Python everywhere' paradigm for web app development and can handle both server-side scripting and client-side programming.

Features of Node:

Collects data from forms.

Data in the database is added, deleted, and changed.

Renders dynamic content for web pages.

Files on the server are created, read, written, deleted, and closed.

Code:

```
def process Conditions(myLocation,APIKEY,localityInfo):

weatherData = get(myLocation,APIKEY)

print(myLocation,weatherData["temperature"],weatherData["visibility"]
```

CHAPTER – 8
TESTING

8.1 Test Cases:

A test case might be created as an automated script to verifythe functionality per the original acceptance criteria. After doing manual exploratory testing, QA testers might suggest other functionalities be added to the application as well as updated test casesbe incorporated in the automated test suite.

8.2 User Acceptance Testing:

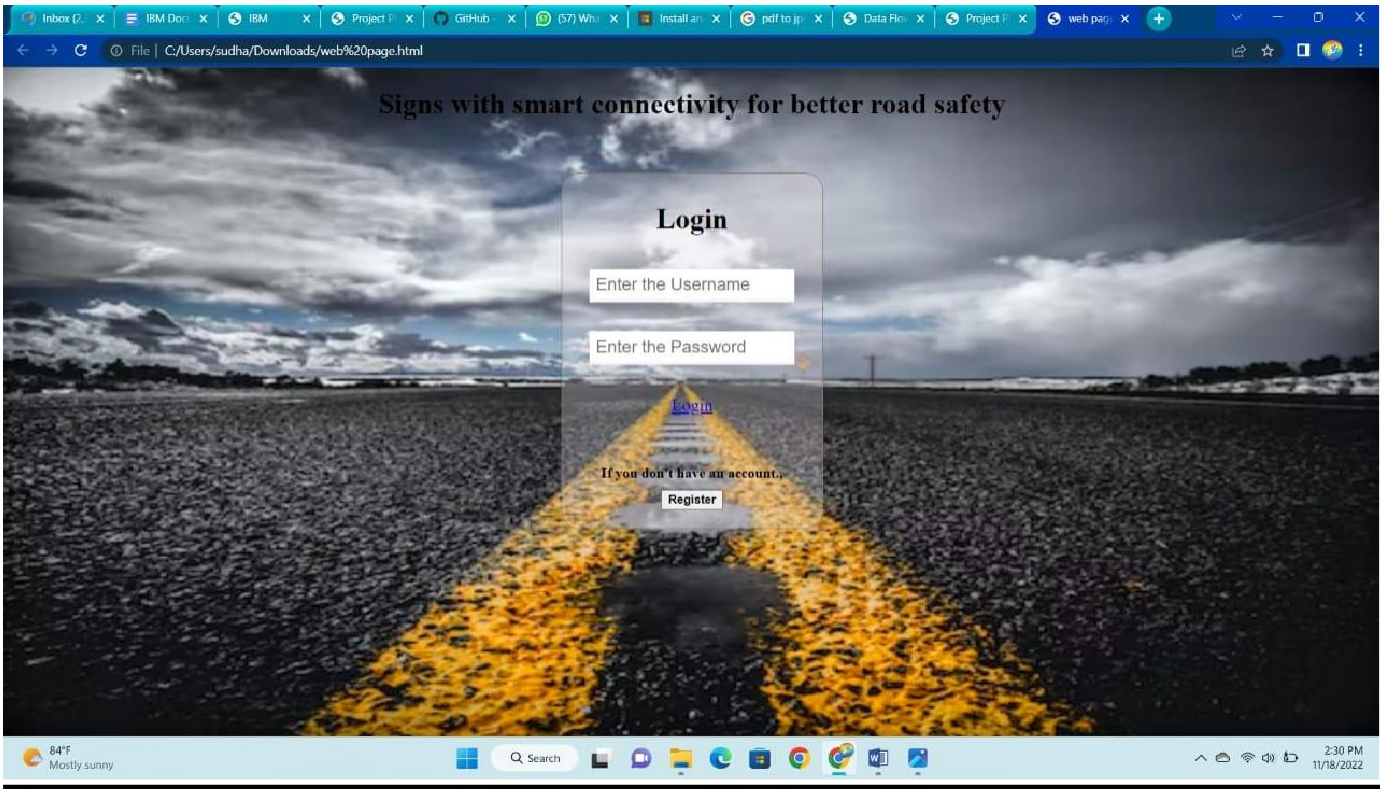

FIG 8.1 USER ACCEPTANCE TESTING

CHAPTER – 9
RESULTS

9.1 Performance Metrics:

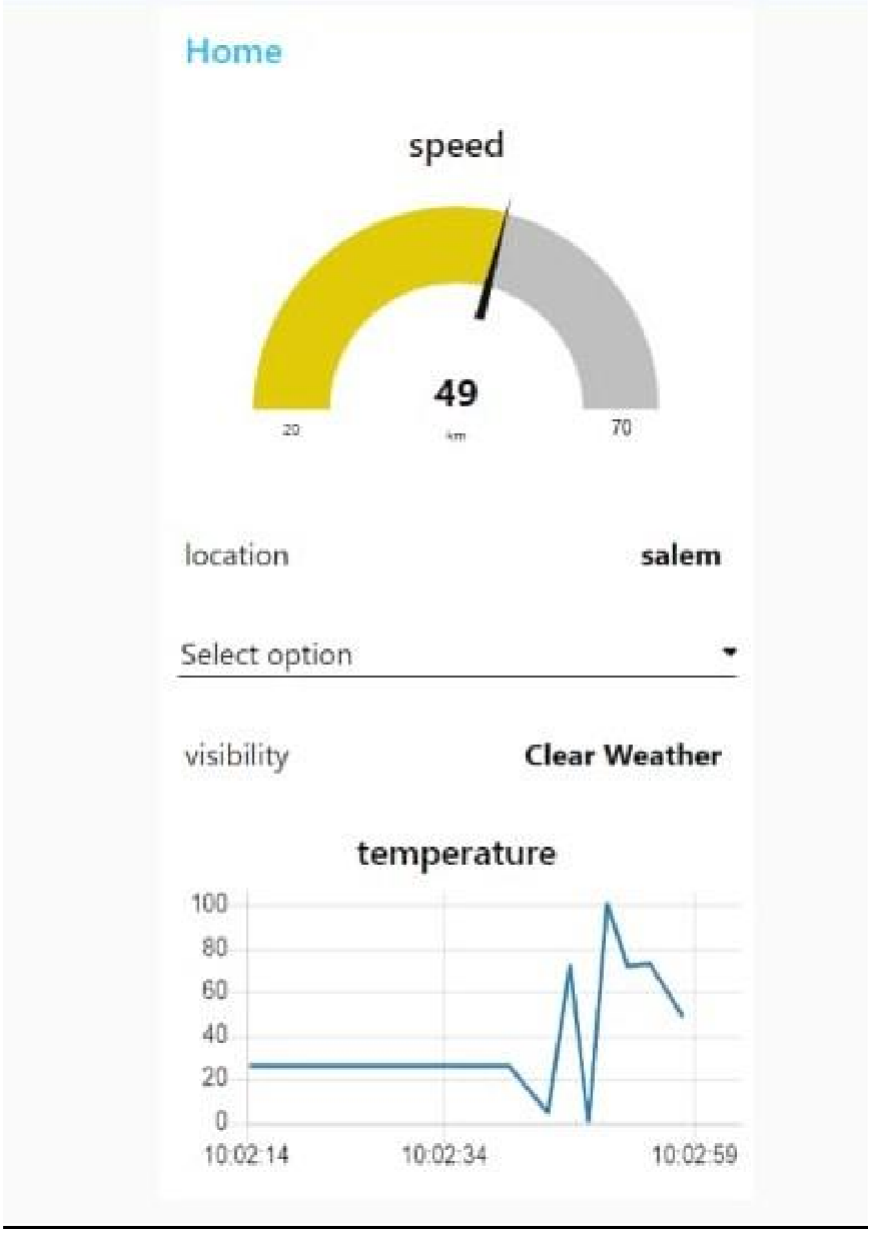

FIG 9.1 PERFORMANCE METRICS

CHAPTER – 10

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Multimodal sensors and edge computing help speed up the flow of traffic with real-time processing, reducing congestion and emissions.
- Smart road technology can assist in optimizing traffic flow and managing road conditions, creating a more sustainable environment within cities.
- Smart road technology using multi-access edge computing (MEC) edge servers leverages 4G/5G cellular networks to improve real-time safety and traffic data.
- There are many types of devices that enable smart road technology: speed sensors, acoustic sensors, IP CCTV cameras, smart traffic lights, condition and weather monitoring systems, and digital signage.
- Road condition monitoring solutions can help city planners analyze the rate of collisions and near misses as well as assess road and pavement conditions.

DISADVANTAGES:

- A lack of confidence is also a barrier.
- The software currently can only alert people with SMS, it cannot make phone calls to help the illiterate.
- They may cause a delay in the quick movement of traffic.

CHAPTER – 1 1
CONCLUSION

We have presented a system, to alert the driver about the speed limits in specific areas and reduce the speed of the vehicles in sensitive public zones without any interference of the drivers where controls are taken automatically by the use of a wireless local area network. In the initial phase, we designed the basic block and circuit diagram for the system. In the implementation phase, we executed the hardware with the help of IOT connecting technologies. Extensive experiments conducted on IOT and other connecting technologies.

The project helps private users and their connected caretakers by procuring the medication details from the caretaker and securely processing the data for the desired result of SMS alerts. Senior citizens are properly monitored by their caretakers and thus, caretakers can make sure that their patients are taking the right medicines at the right times without delay.

Smart connected Signs for Road Safety, These conclusions and guidelines are addressed to policy makers and private companies that are willing to use innovative solutions to decrease road-related fatalities and injuries amidst populations. Both chapters take into account the potential users of connected technologies: individual drivers, commercial drivers, pedestrians, cyclists and motorcyclists. The task force decided to study first the potential of connected technologies in high- and middle- income countries.

CHAPTER–12

FUTURE ENHANCEMENTS

The project can be enhanced with many other features that can serve senior citizens even better. The product currently is a simple basic version which can only send SMS alerts on time. Some other additional features that are planned to be incorporated with this existing product are listed below:

- The dashboard can be made more versatile for the user to manage user to intimate weather condition intake time and to monitor how it changes every day, by this a new or speculated time can be scheduled individually.

- The system can be enhanced with a smart watch or mobile devices so that the weather conditions can be continuously connected with the driver, and user to supervise and help them during emergencies.

- The system can relate to hardware product that stores and automatically opens the weather API and alerts with a voice message

- The system can further relate to the weather api so that the hardware system automatically senses the weather condition and alerts the weather report and alert message to deliver the safety signal.

CHAPTER – 13

APPENDIX

13.1 Source Code:

```
from datetime import datetime as dt

import wiotp.sdk.device

import time

import requests as reqs



myLocation = "Tiruchengode,IN"

APIKEY = "bbd532163d1fe31a0f4690d12d33b5ef"


localityInfo = {

    "schools" : {

        "schoolZone" : True,

        "activeTime" : ["7:00","17:30"]

        },
```

```
    "hospitalsNearby" : False,
    "usualSpeedLimit" : 40
}



myConfig = {
    "identity" : {
        "orgId" : "qqfhmz",
        "typeId" : "sprint_2",
        "deviceId" : "sprint-2"
    },
    "auth" : {
        "token" : "9600601435"
    }
}



def myCommandCallback(cmd):
```

```
    print("recieved cmd : ",cmd)


def processConditions(myLocation,APIKEY,localityInfo):
    weatherData = get(myLocation,APIKEY)
    print(myLocation,
weatherData["temperature"],weatherData["visibility"])…
```