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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 is to operate the vehicles in a safe speed at critical zones minimizing the possible risk of unwitting accidents and casualties.

1.2 PURPOSE

The purpose of this scenario is to improve vehicle safety by providing realtime 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 transport purposes, 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

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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.

Figure 2.1. Problem Statement

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. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

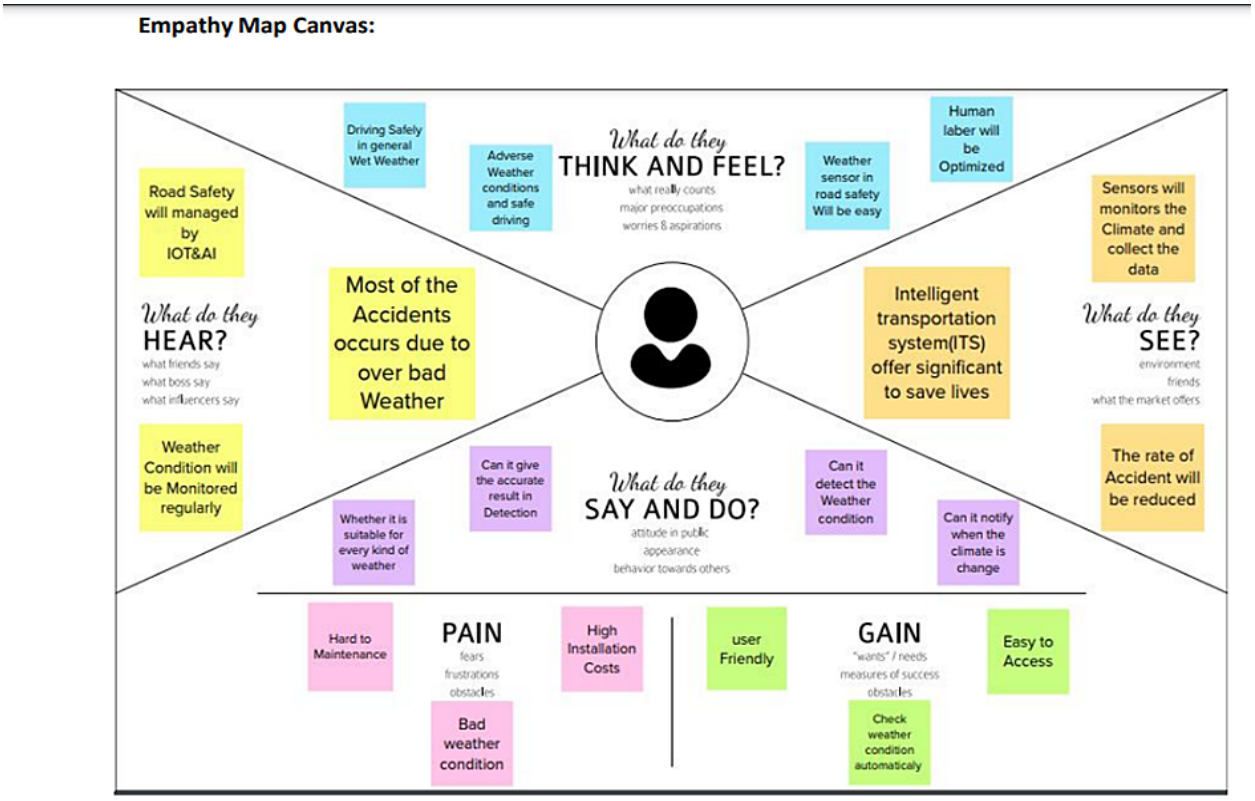


Figure 3.1. Empathy Map

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 SELECTING THE PROBLEM STATEMENT

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.

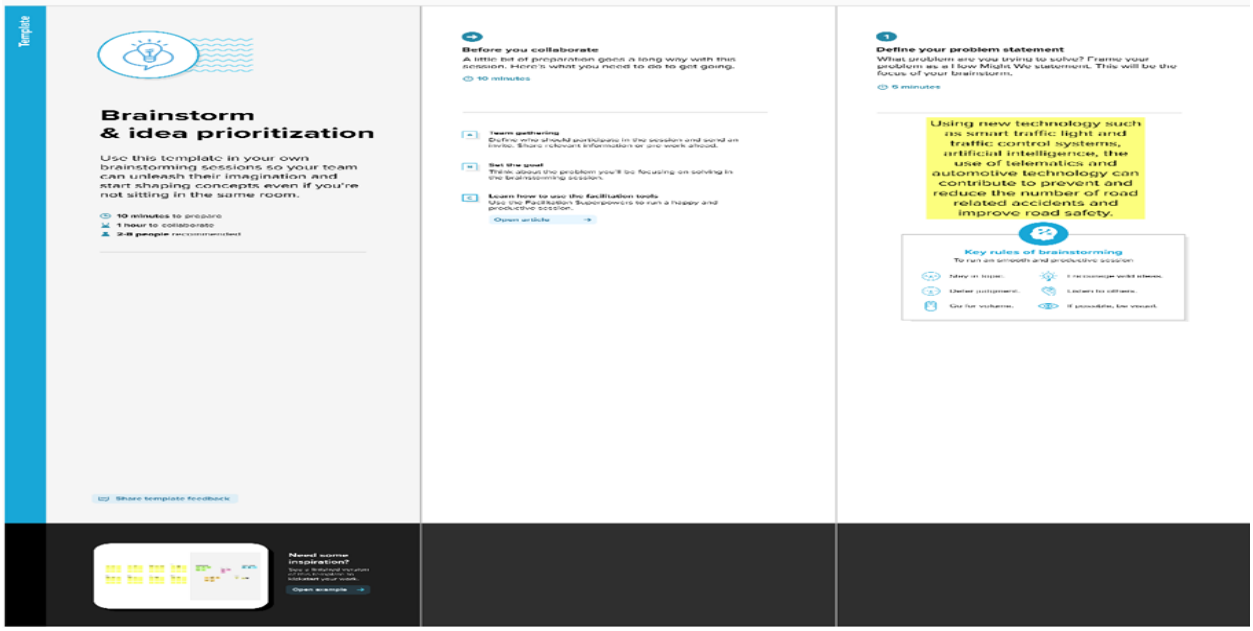


Figure 3.2. Ideation and Brainstorming

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.

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.

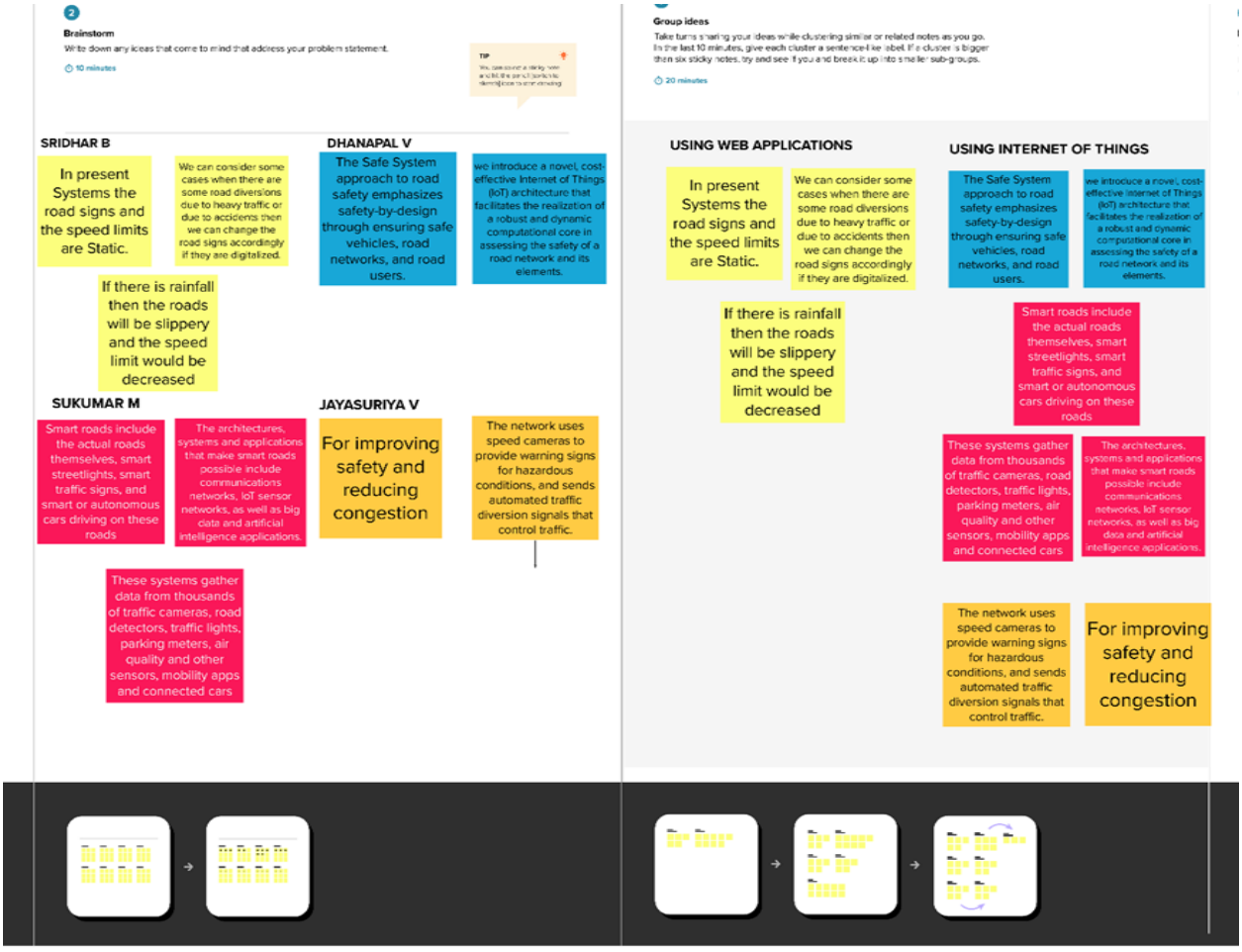


Figure 3.3. Brainstorm, Idea Listing and Grouping

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.

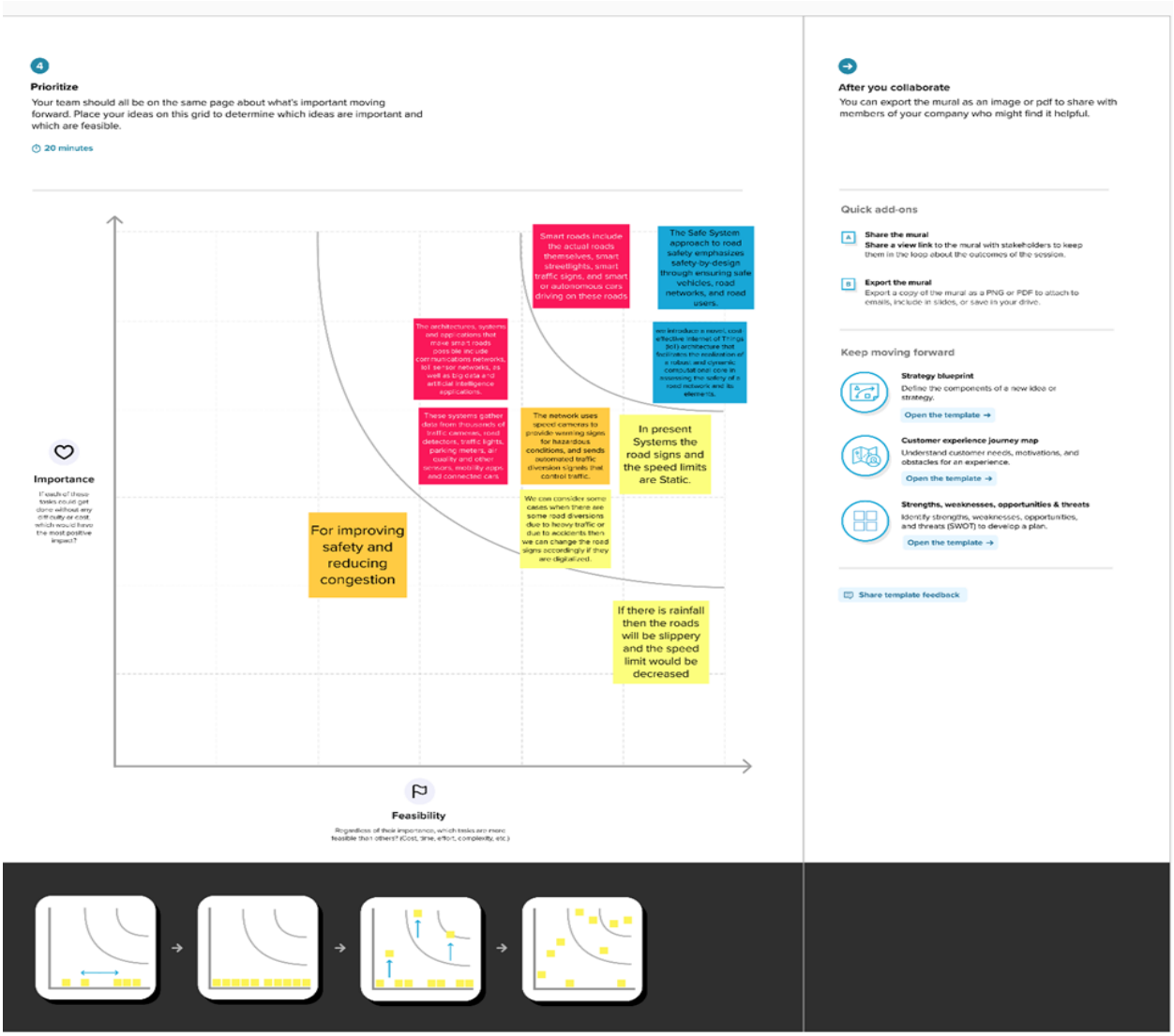


Figure 3.4. Idea Prioritization

3.3 PROPOSED SOLUTION

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 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 to user with a voice command and lights up.

Novelty / Uniqueness

One or more of the fundamental data to guarantee road safety of the connected cars is the geolocation. The connected cars can communicate with each other, so that, depending on the speed and position of each vehicle, collisions are avoided, like maneuvers involving emergency braking.

Social Impact / Customer Satisfaction

Ensuring safe driving experience with real-time assistance, navigation, and even monitoring driving patterns and any emergency situation. Additionally, along with the state of the traffic, IoT drivers can receive updated information on the state of the roads, potholes, grade changes, black spots, etc...

3.4 PROBLEM-SOLUTION FIT

The Problem-Solution Fit simply means that you have found a problem withyour 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

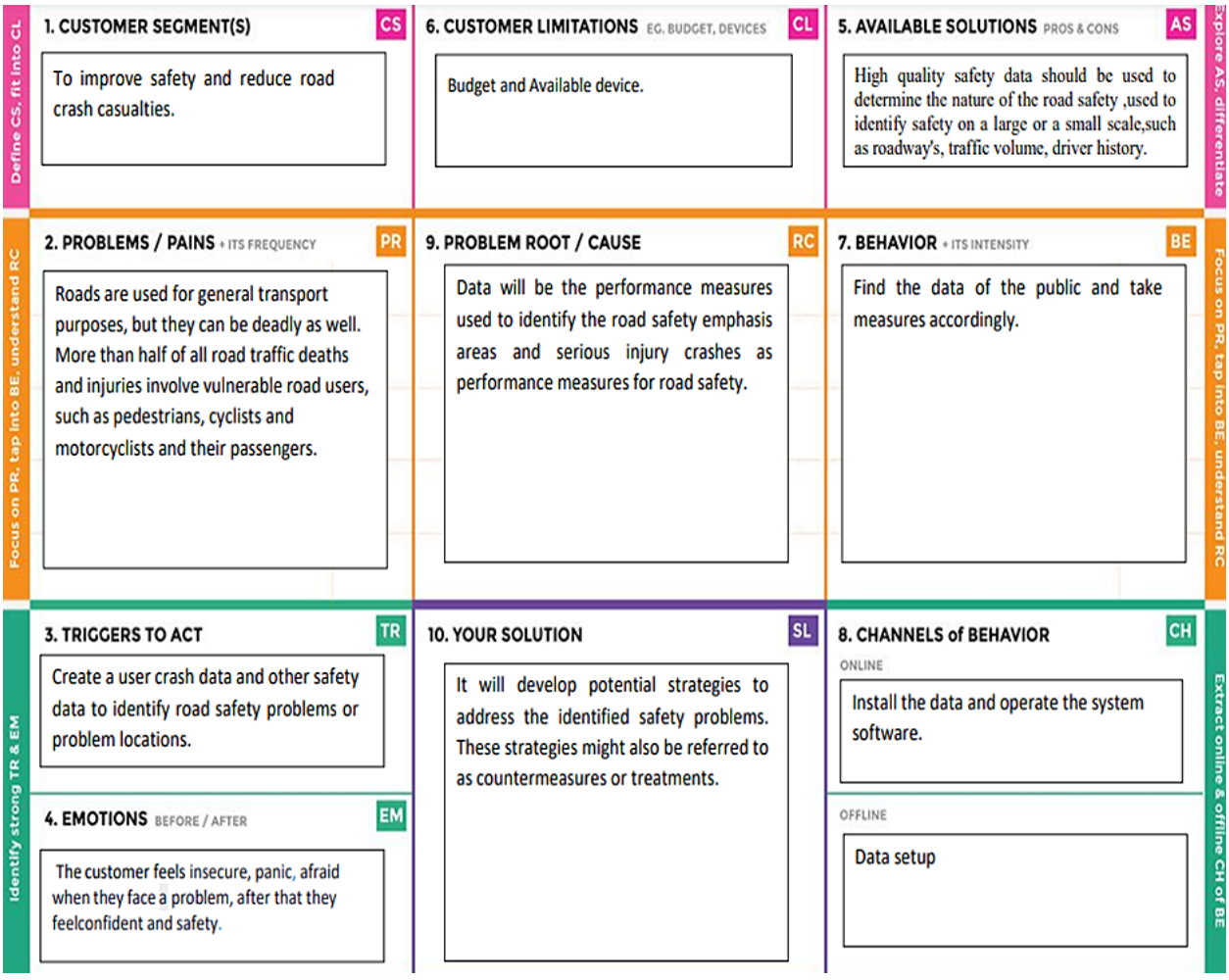


Figure 3.5. Solution Fit

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

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

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:

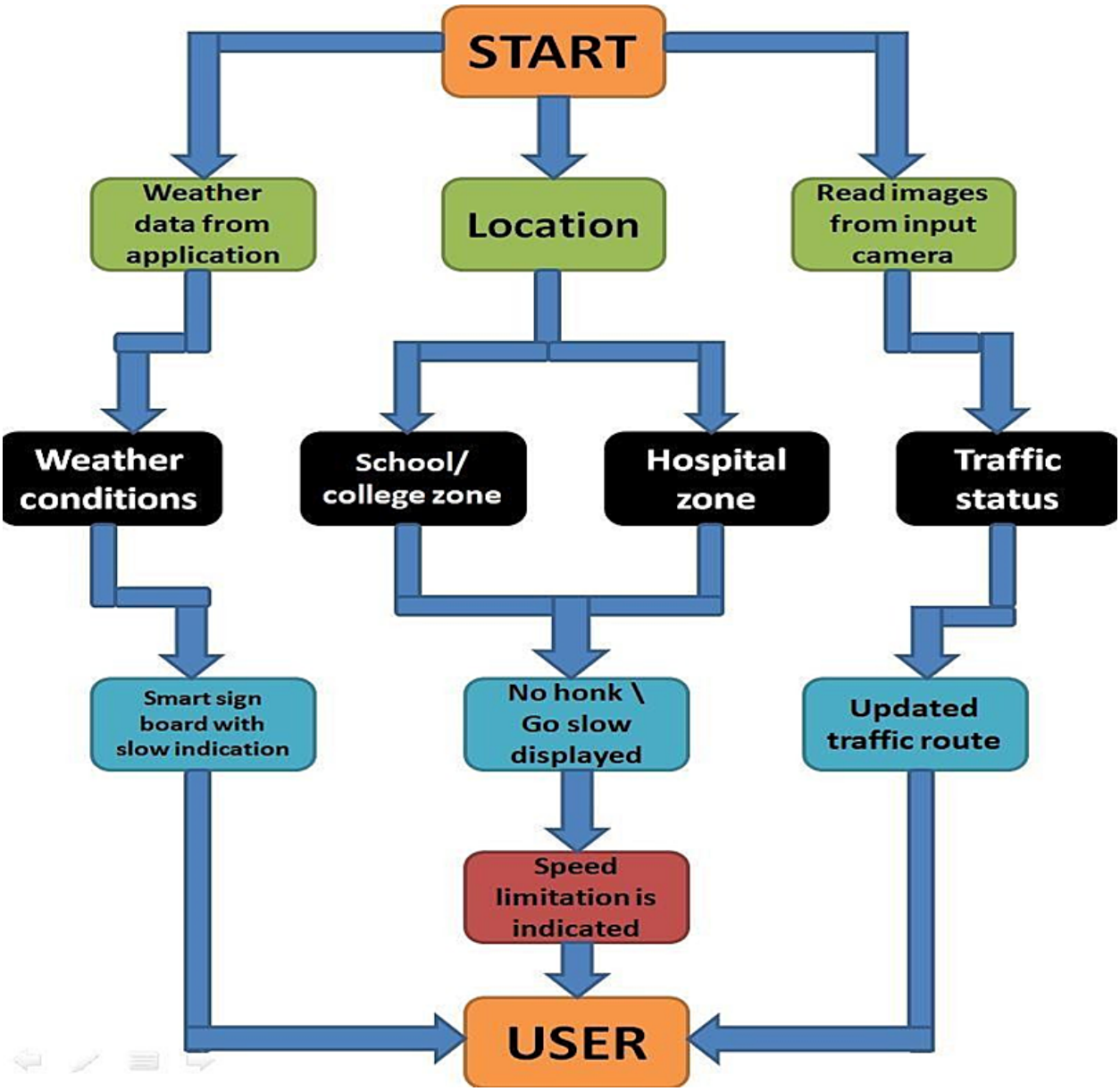


Figure 5.1. Data flow Diagram

5.2 SOLUTION AND TECHNICAL ARCHITECTURE

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

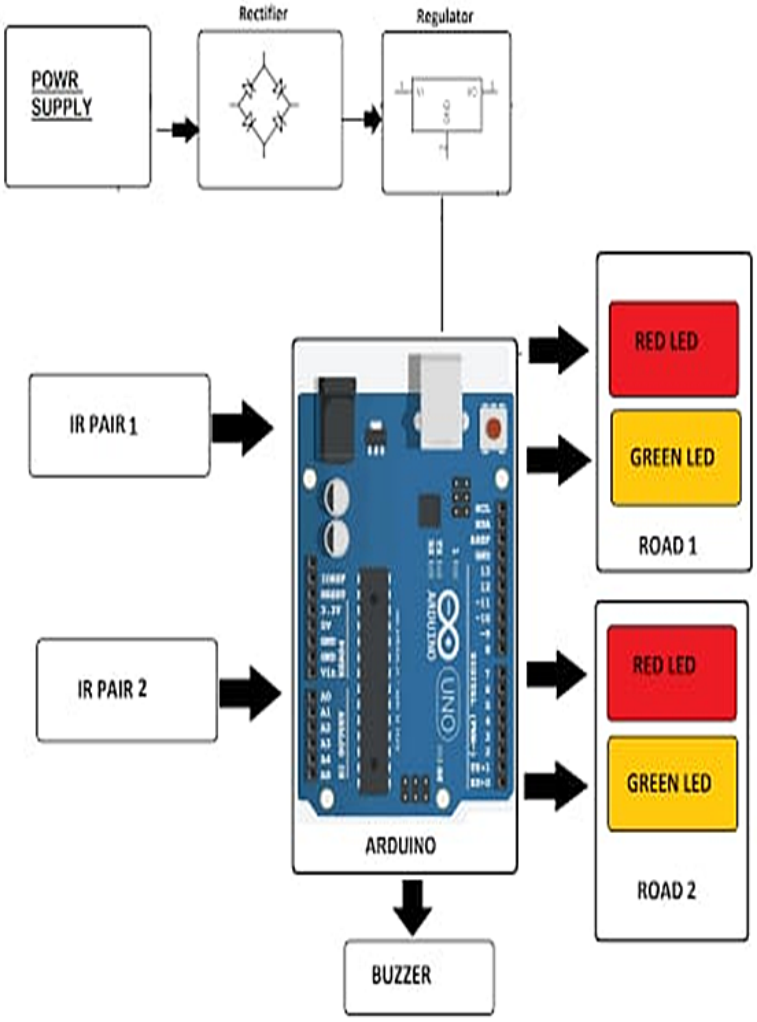


Figure 5.2. Technology Architecture

5.3 USER STORIES

Table 5.1. User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can receive confirmation email & click confirm	High	Sprint-1
		USN-2	As a user, I will receive email confirmation once I have registered for the application	I want to take my tablets on time by voice command	Medium	Sprint-2

		USN-3	As a user, I can identify the safety roads according to the weather condition	I can increase or decrease my speed	High	Sprint-1
	Security	USN-4	As a user, I feel the site is secure	I can access my account with my login credentials	Medi um	Sprint-1
	Login	USN-5	As a user, I can log into the open weather map by entering email & password	I can access the application through my Gmail login	High	Sprint-2
Customer (Web user)	Scalability	USN-6	As a user the interface should be simple and easily	I can access the Interface easily	High	Sprint-1

			accessible			
Admin	Maintain the application	USN-7	Maintaining details for users	I can access the data base	High	Sprint-1
Administrator (Officials	Problem solving/ Fault clearance	USN - 8	As an admin, the team has to focus on solving problems for real users	Officials can monitor the sign boards for proper functioning	Medium	Sprint-1

CHAPTER - 6

PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

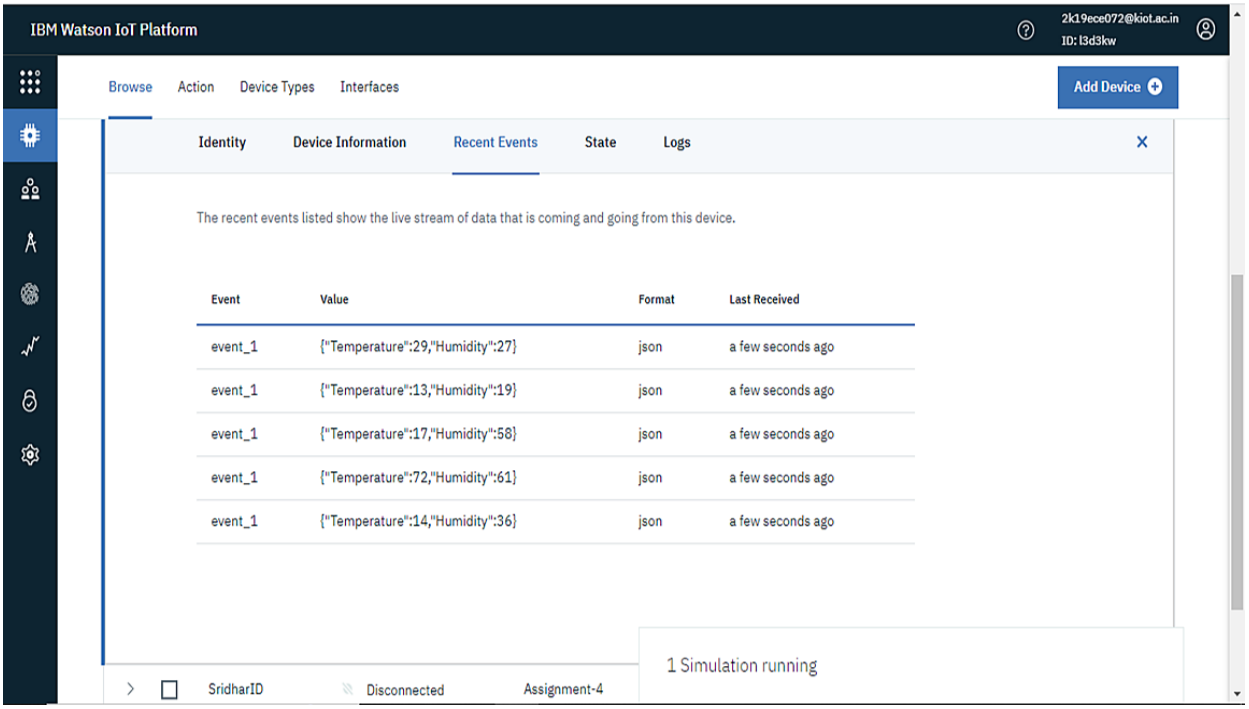
SPRINT 1

In Sprint-1 we have initialized 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.

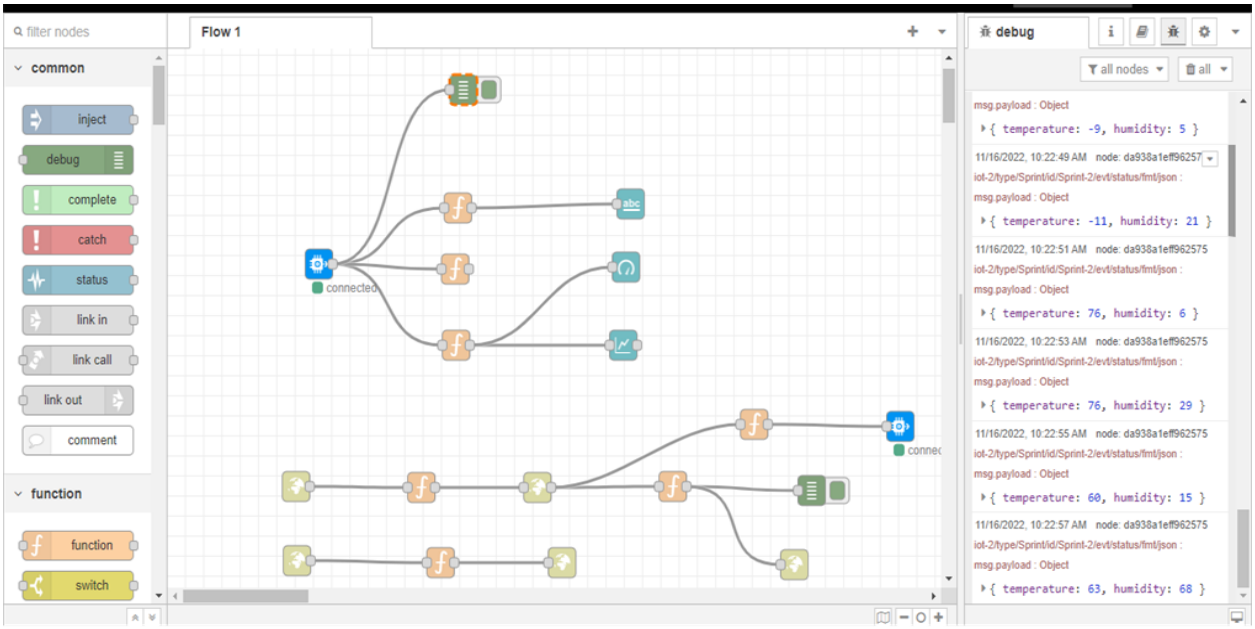


SPRINT 3

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 an IOT logger debug.

Get speed in node-red gets the speed of vehicle and passing an alert message

to the open weather API and open weather API 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.



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.

C: > Users > Admin > AppData > Local > Programs > Python > Python37 > sprint3.py > ...

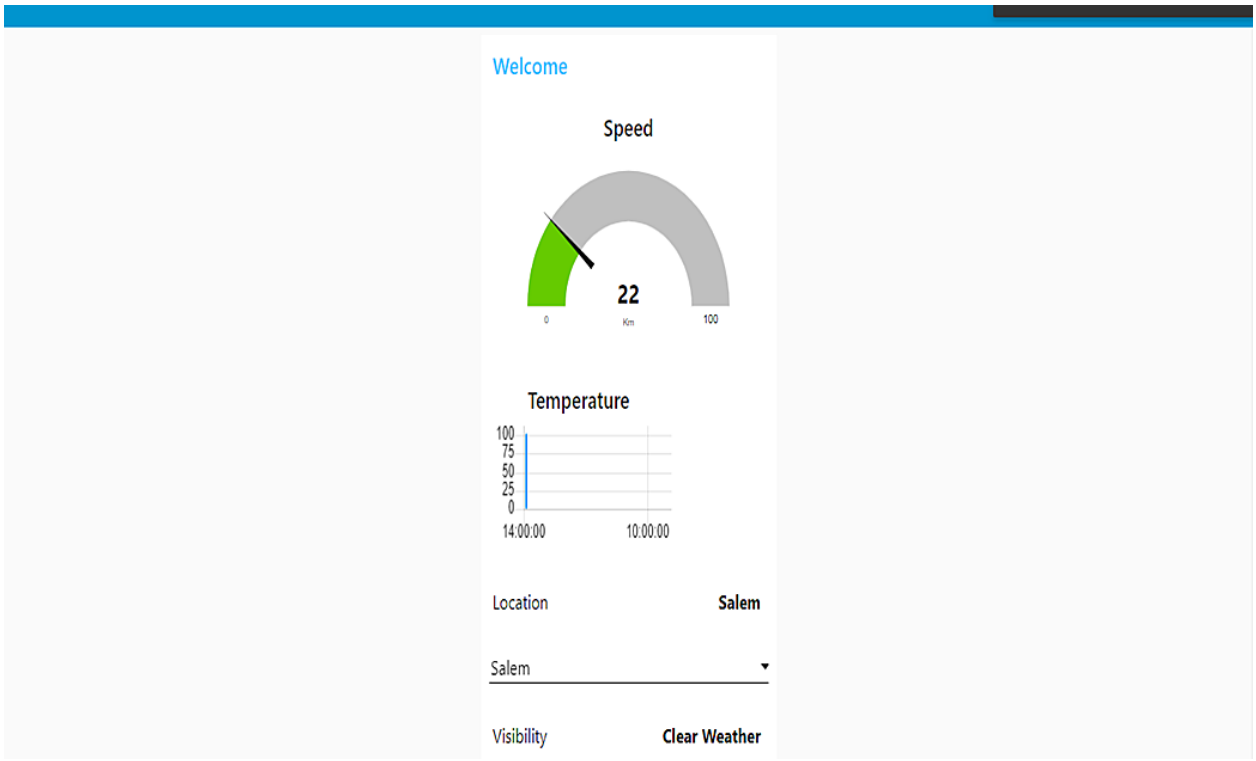
```
30
31
32  def myCommandCallback(cmd):
33      print("recieved cmd : ",cmd)
34
35  def processConditions(myLocation,APIKEY,localityInfo):
36      weatherData = get(myLocation,APIKEY)
37      print(myLocation,weatherData["temperature"],weatherData["visibility"])
38      log2Cloud(myLocation,round(weatherData["temperature"],2),weatherData["visibility"])
39
40      finalSpeed = localityInfo["usualSpeedLimit"] if "rain" not in weatherData else localityInfo["usualSpeedLimit
41      finalSpeed = finalSpeed if weatherData["temperature"]>35 else finalSpeed/2
42
43      if(localityInfo["hospitalsNearby"]):
44
45          doNotHonk = True
46      else:
47          if(localityInfo["schools"]["schoolZone"]==False):
48
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL JUPYTER

powershell

Python Deb..

```
File "c:\Users\Admin\AppData\Local\Programs\Python\Python37\sprint3.py", line 38, in processConditions
  log2Cloud(myLocation,round(weatherData["temperature"],2),weatherData["visibility"])
```



6.2 SPRINT DELIVERY SCHEDULE

Table 6.1. Sprint Delivery Schedule

Sprint	Functional Requirement (Epic)	Sprint Start Date	Sprint End Date	Story Points	Team Members
Sprint- 1	Open weather map API	24 Oct 2022	29 Oct 2022	1	SRIDHAR. B
Sprint- 2	Push the data cloud into the	31 Oct 2022	05 Nov 2022	1	SUKUMAR.M

	IBM				
Sprint- 3	Node- RED	07 Nov 2022	12 Nov 2022	2	DHANAPAL.V
Sprint- 4	Web UI	14 Nov 2022	12 Nov 2022	2	JAYASURIYA .V

6.3 REPORTS FROM JIRA

Burndown chart

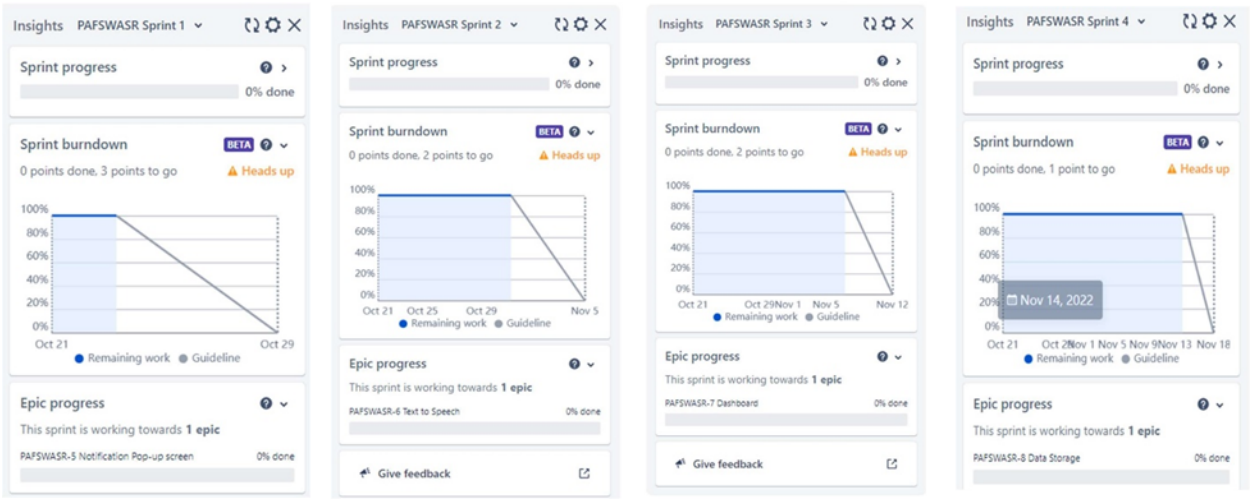


Figure 6.1. Burndown Chart

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

JSX (JavaScript Syntax Extension)

Virtual DOM

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 JavaScript 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 ‘JavaScript 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 verify the 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 updatedtest cases be incorporated in the automated test suite.

Steps To Execute	Test Data	Expected Result	Status	Executed By
We can get a current weather by login with our website at anywhere at any place	https://node-red-iguuf-2022-11-10.eu-gb.mybluemix.net/ui/#!/0?socketid=d2MLYJ8uDVtr4EKVAADg	The user shouldreceive an SMS Notification	Pass	SRIDHAR B

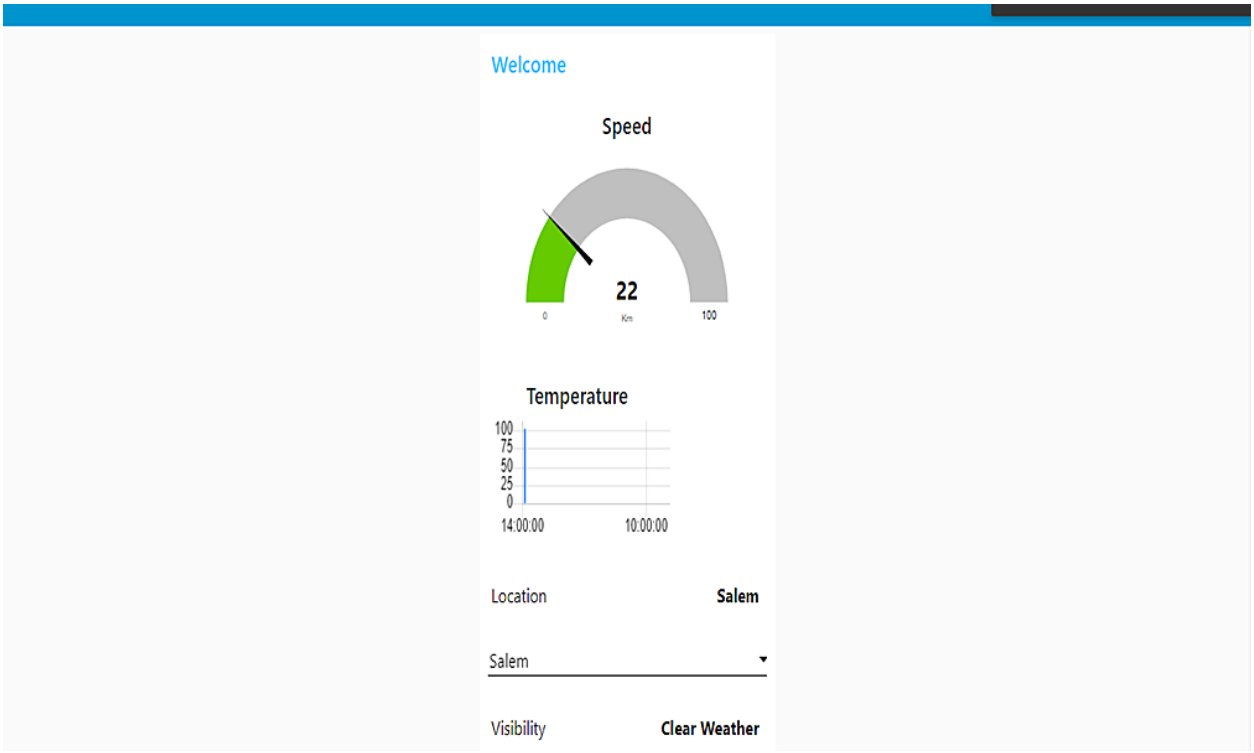
To find the current temperature	https://node-red-iguuf-2022-11-10.eu-gb.mybluemix.net/ui/#!/0?socketid=d2MLYJ8uDVtr4EKVAADg	User's data should process Inthe Backend it should get data from frontend details aboutthe medication details	Pass	SUKUMAR M
We can check the visibility using the node-red device	https://node-red-iguuf-2022-11-10.eu-gb.mybluemix.net/ui/#!/0?socketid=d2MLYJ8uDVtr4EKVAADg	The user shouldnavigate to the user account homepage	Pass	DHANAPAL V
We can detect all the error and rectify them to get a accident less zone.	https://node-red-iguuf-2022-11-10.eu-gb.mybluemix.net/ui/#!/0?socketid=d2MLYJ8uDVtr4EKVAADg	User data should be stored in cloud	Pass	JAYASURIYA V

8.2 USER ACCEPTANCE TESTING

CHAPTER - 9

RESULTS

9.1 Performance Metrics



CHAPTER - 10
ADVANTAGES AND DISADVANTAGES

ADVANTAGES

1. Cities are facing pressures to address environmental issues caused by traffic congestion and urban population growth while providing more equitable mobility and sustainable transportation.

2. Smart road technology helps city planners and governments address these challenges.

3. The Internet of Things (IoT) is making road transportation more connected, safe, sustainable, and efficient with traffic management, pedestrian and vehicle safety, environmental monitoring, smart and connected roadway corridors, and EV charging and parking networks.

4. 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.

5. When these devices collect and analyze data in near-real time, cities

can realize several benefits

DISADVANTAGES

1. It Request high bandwidth to find current weather condition
2. Increase traffic can increase carbon emission and other pollution
3. Land use for roads can damage build and natural environment, impose mortality on wildlife if habits are severed and conclusion has associated environmental coasts.
4. They may cause a delay in the quick movement of traffic.

CHAPTER - 11

CONCLUSION

Although they cannot be completely avoided, road accidents can be decreased by increasing driver safety. This research created an intelligent mobile app that leverages built-in sensors to notify drivers orally and visually. The programme uses a verbal alert to draw the driver's attention to a necessary action. The usage of the smartphone eliminates the requirement for onboard systems to detect and recognise traffic signs, sensors on the road infrastructure, and WLAN. We have calculated and estimated the distance between two pairs of coordinates using the Haversine formula. The results of the experiments show that the suggested methodology has advantages such as high accuracy within a user radius of 10 metres, minimal bandwidth, and low-cost application. Each notification is made available in a developing similar sys.

CHAPTER - 12

FUTURE SCOPE

We observe little change in asphalt roads despite the numerous technology advancements made to automobiles, smartphones, and other mobile gadgets. There are a lot of improvements we can make to the roads that will assist innovate and enhance the driving experience, especially in terms of traffic safety. Additionally, there are suggestions for using roads to store solar energy from the sun and convert it into electricity for homes.

1. Based on technology and innovation, know it has developed solutions that millions of people in the Nordic countries use every day says Christian Hartman, Head of Know it Insight in Norway.

2. Even though we have come a long way already, we believe that the biggest changes and opportunities still lie ahead of us.

3. Technology and digitalization are one of the most important mega trends of our time and a central driving force in this respect, we are moving towards exciting times.

4. The system can relate to hardware product that stores and automatically opens the weather API and alerts with a voicemessage.

CHAPTER - 13

APPENDIX

13.1 SOURCE CODE

CLIENT

```
from datetime import datetime as dt

import wiotp.sdk.device

import time

import requests as reqs


myLocation = "Salem,TN"

APIKEY = "e14826ccfb41a7423c775ab4f7c0a132
"

localityInfo = {

    "schools" : {

        "schoolZone" : True,

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

        },
```

```
    "hospitalsNearby" : False,
    "usualSpeedLimit" : 40
}
myConfig = {
    "identity" : {
        "orgId" : "l3d3kw",
        "typeId" : "Sprint",
        "deviceId" : "Sprint-2"
    },
    "auth" : {
        "token" : "9384330400"
    }
}


def myCommandCallback(cmd):
    print("recieved cmd : ",cmd)
def processConditions(myLocation,APIKEY,localityInfo):
    weatherData = get(myLocation,APIKEY)
```

print(myLocation,weatherData["temperature"],weatherData["visibility"])…

13.2 GitHub & Project Demo Link

Table 13.2. GitHub & Project Demo Link

Content	Link
GitHub	https://github.com/IBM-EPBL/IBM-Project-41249-1660640631
Project Demonstration Video	https://youtu.be/T0xkfoOyl-I

CHAPTER - 14

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