SIGNS WITH SMART CONNECTIVITY

FOR BETTER ROAD SAFETY

NALAIYA THIRAN PROJECT REPORT

Submitted by

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

The project aims to replace the static signboards with smart connected sign boards which can be changed frequently according to the purposes like weather, traffic condition, particular zones, etc., These smart connected sign boards get the speed limitations for a particular city from a web app using weather API and update automatically. Based on the weather changes the speed may increase or decrease .So, the signboards will display “slow down”, if the weather is bad. Based on the traffic and fatal situations the diversion signs are displayed. The driver can change the location pins in the map to their current location and destination location. The app shows the route and navigation instructions like “turn left on road”, “take U turn”. Using the location sensor, it can sense the speed of the vehicle. Sign boards near school zone, hospital zone, construction zone, uneven and narrow roads, animal zone should display appropriate signs according to the zone. Different modes of operations can be selected with the help of buttons.

1.2 PURPOSE

- To replace the static signboards, smart connected sign boards are used.
- Based on the weather changes the speed may increase or decrease.
- These smart connected sign boards get the speed limitations from a web app using weather API and update automatically.
- Based on the traffic and fatal situations the diversion signs are displayed.
- Guide (Schools), Warning and Service (Hospitals, Restaurant) signs are also displayed accordingly.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISITING PROBLEM

- Increased traffic can increase carbon emissions and other pollution.
- Land use for roads can damage built and natural environment, impose mortality on wildlife if habitats are severed.
- Construction has associated environmental costs.

2.2 REFERENCES

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2.3 PROBLEM STATEMENT DEFINITION

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 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 that has digital signboards 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 on road diversions, accident-prone areas, and information sign boards can be entered through the web app. This data is retrieved and displayed on the sign boards accordingly.

CHAPTER 3

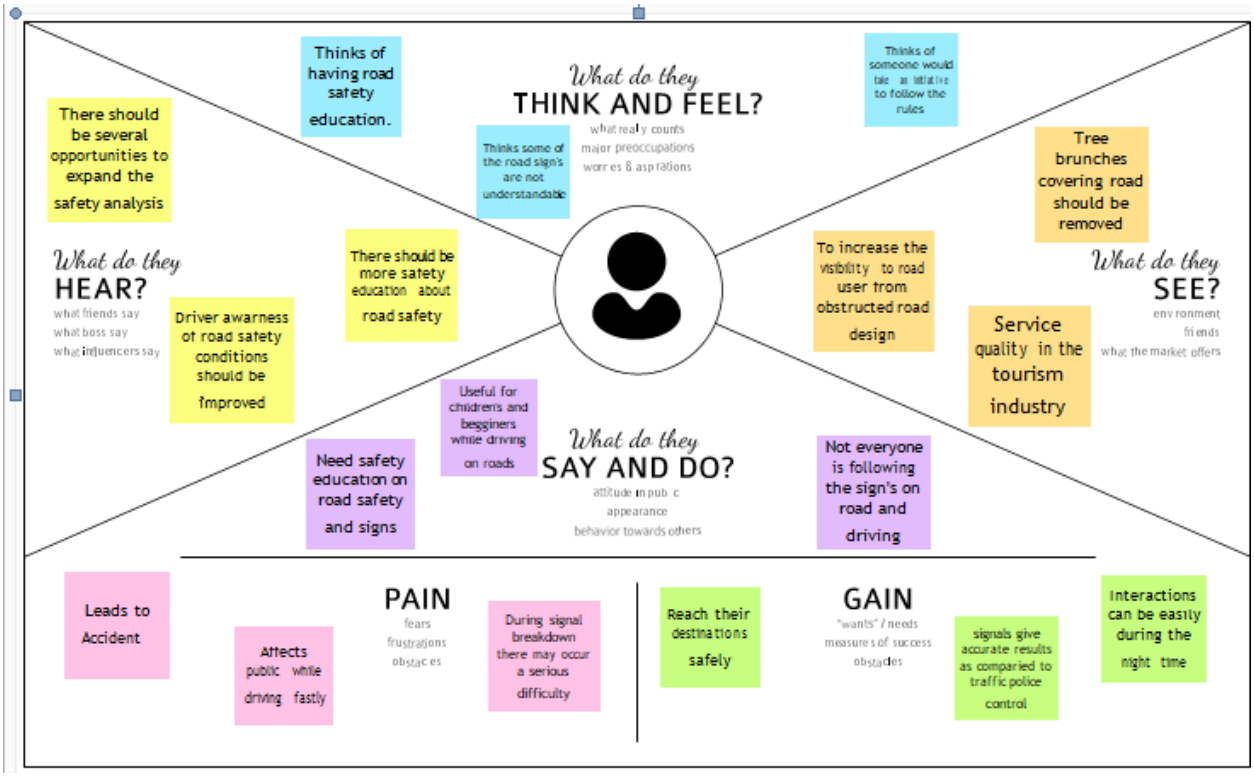
IDEATION & PROPOSED SOLUTION

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 helps 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.

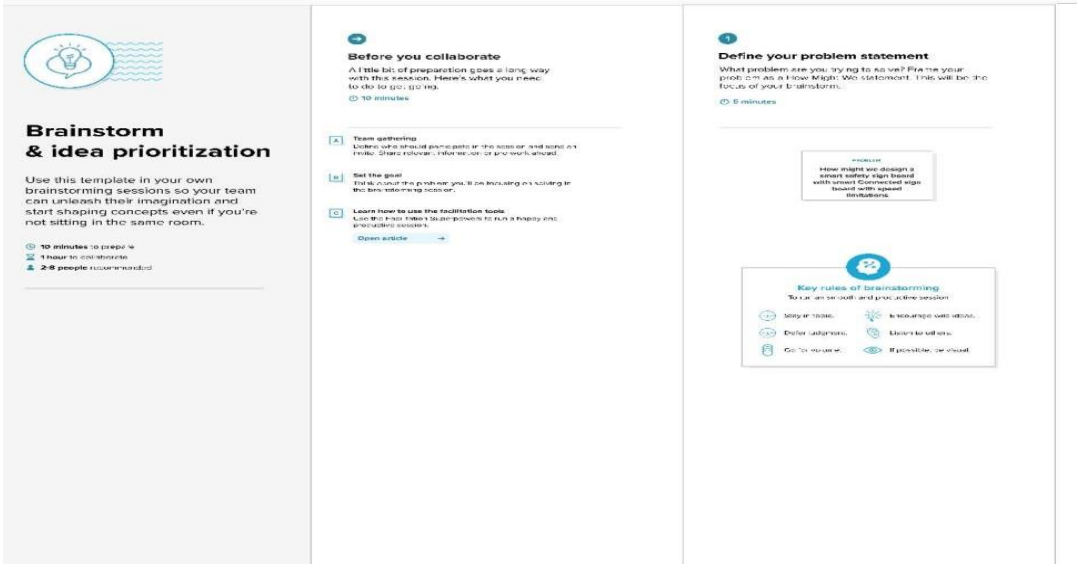


3.2 IDEATION & BRAINSTORMING

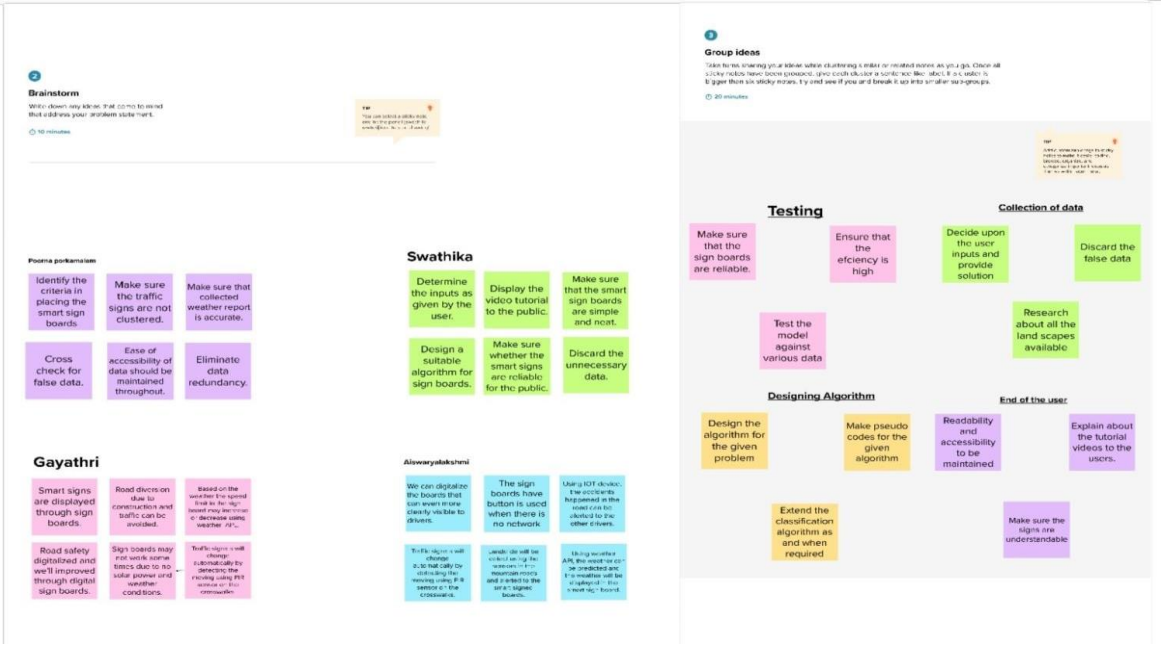
Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process

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 amount of creative solutions.

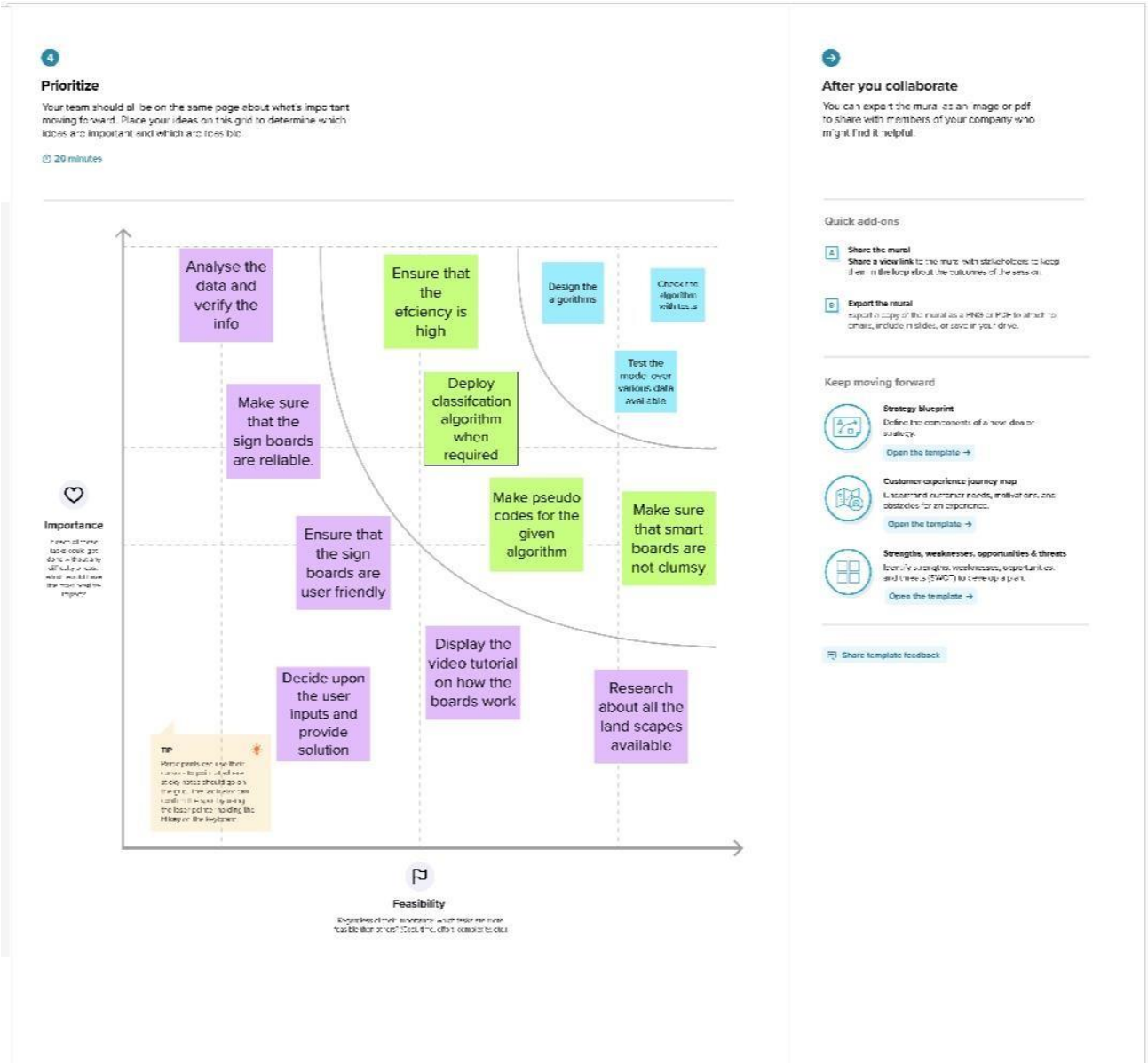
Step1: Team Gathering, Collaboration and select the problem statement



Step2: Brainstorm, Idea Listing and Grouping



Step3&4: Idea Prioritization, Prioritize

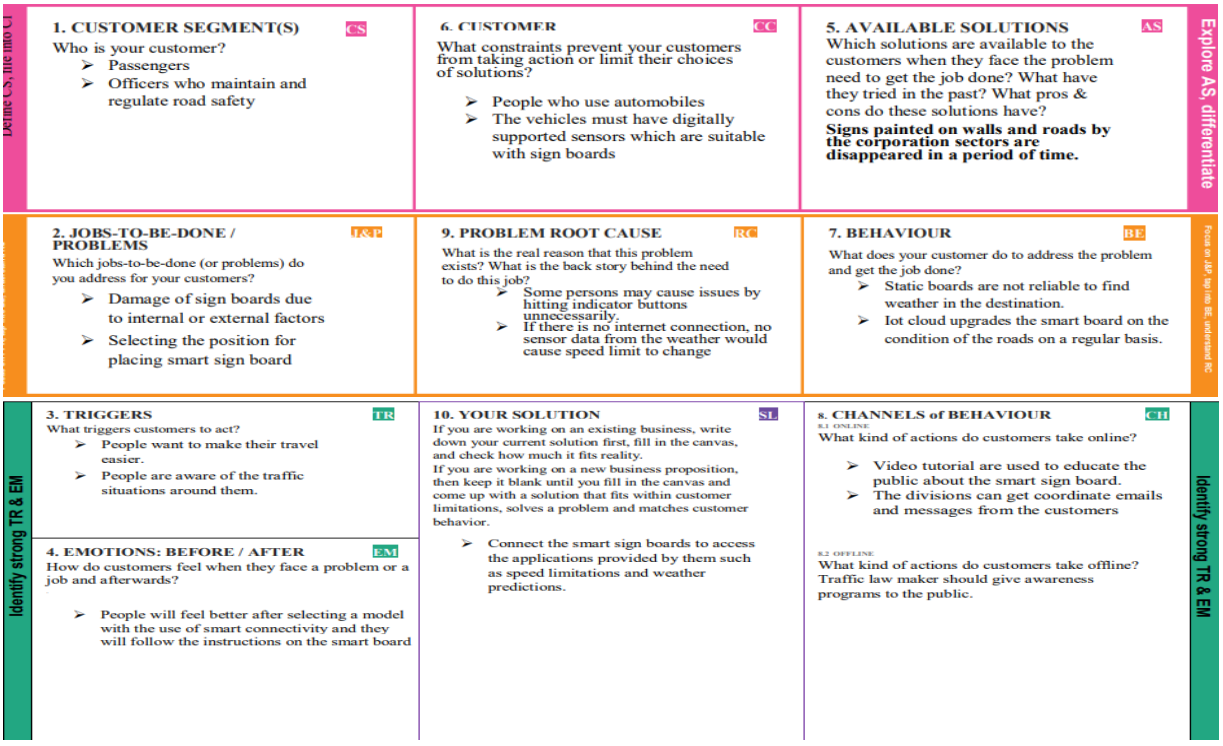


3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Sign with Smart connectivity for better road safety is used to educate the drivers using IoT who do not have knowledge about traffic signs and weather indications.

2.	Idea / Solution description	Replacing the man-made painted sign into digital as well as their name which is more visible compared to the current signs and also indicating weather in the same sign boards for drivers.
3.	Novelty / Uniqueness	Weather indication on sign boards is unique which will help mostly the two wheelers from unfortunate heavy rains and winds. Digital traffic signs also educates the drivers to follow traffic rules easily
4.	Social Impact / Customer Satisfaction	It makes the people to know about traffic signs. they don't know about it, then it shows the digital signs and weather indication to avoid the accidents
5.	Business Model (Revenue Model)	This project can make revenue by selling many equipment to the government sector and private sector
6.	Scalability of the Solution	To prevent and reduce the number of road related accidents and improve road safety

3.4 PROBLEM SOLUTION FIT



CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	User registration can be done through a web application
FR-2	User Need	It should be fixed in the places where it is needed and less in places where it is not needed
FR-3	User Visibility	Sign boards should be brighten and attractive to the drivers so they can't distract to made accidents
FR-4	User Understanding	It should display information with images and texts so that the user can understand the signs
FR-5	User Convenience	The display should be clear enough and should be visible from far distance
FR-6	User Requirements	The static signboards and can be replaced with smart sign boards that has all needs

4.2 NON- FUNCTIONAL REQUIREMENTS

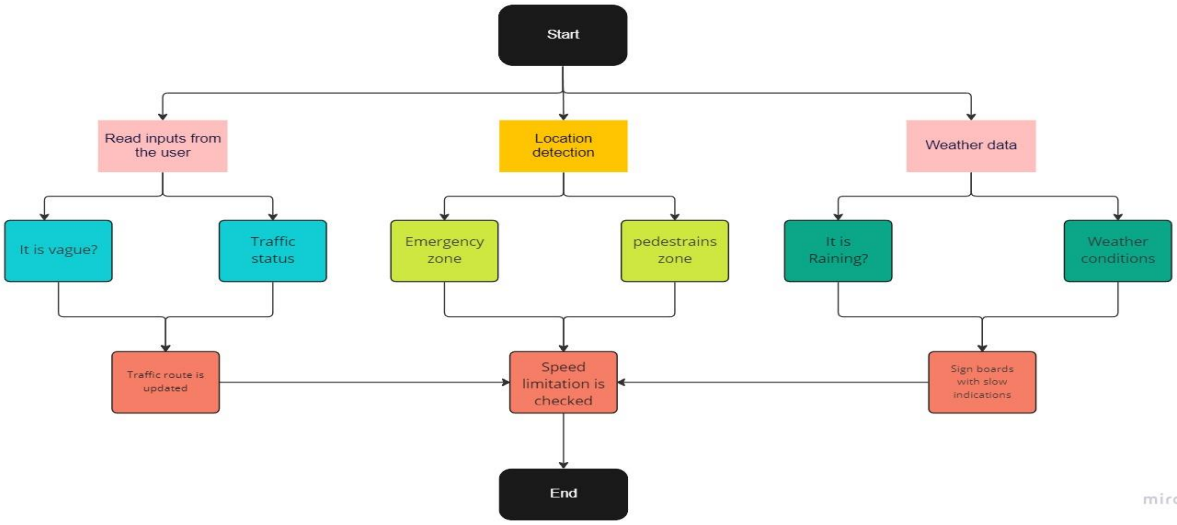
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	It should be able to update whenever required with respect to time
NFR-2	Security	It should be secure enough then only the intended messages are displayed properly
NFR-3	Reliability	It should be able to display the information correctly without making any errors
NFR-4	Performance	The smart board should provide a better experience and deliver the accuracy output
NFR-5	Availability	It should be available 24/7 so that it can be useful to the users

CHAPTER 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

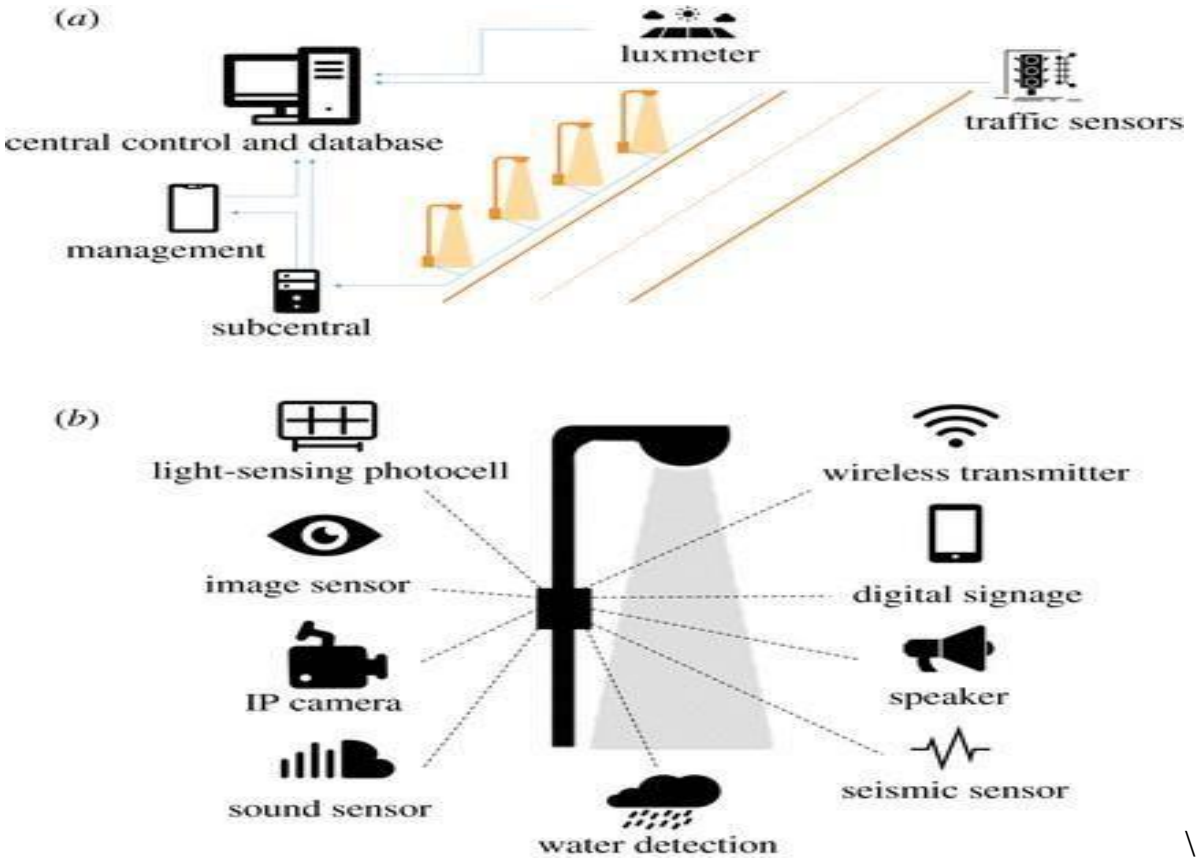
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enter and leaves the system, what changes the information, and where data is stored.



5.2 SOLUTION AND TECHNICAL ARCHITECTURE

A complicated process with numerous sub- processes, solution architecture connects business issues with technological solutions. Its objectives are to

- Find the best technological solution to address current company issues.
- Describe to the project & stakeholders the software's & structure, traits, behavior and other features.
- Define the solution's requirements, development stages, and features.
- Specifications on how the solution is defined, maintained, and delivered should be provided.



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5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	I can get my speed limitation using weather application .	I can receive speed limitations	High	Sprint-1
IoT devices	Automation	USN-2	As a user, I want to use IoT devices for automation purposes	Get the work done without manual effort	High	Sprint-2
Administrator	Problem solving	USN-3	As an official who is in charge for the proper functioning of the sign boards have to maintain it through periodic monitoring.	Officials can monitor the sign boards for functioning	Medium	Sprint-2

Weather	Web app	USN-4	As a user, I can increase or decrease my speed according to the weather change	Get the weather of that location	High	Sprint-1
User	Login	USN-5	As a user, I can log into the application by entering email & password	I can access the application	High	Sprint-1
Driver	Traffic status	USN-6	As a user, I can I get my traffic diversion signs depending on the traffic and the fatal situations.	I can access my traffic status ahead in my travel	Medium	Sprint-1
Customer (Web user)	Data generation	USN-7	As a user the interface should be simple and easily accessible	I can access the data regarding the weather through the application	High	Sprint-1
Web UI	Interaction	USN-8	As a user, I want to interact with the digital products	To interact with the users	Medium	Sprint-2
Data validation	Checking accuracy	USN-9	As a user, I can check the ability and accuracy of the model in obtaining the required information	Check the capability of the model	High	Sprint-2

CHAPTER 6

PROJECT PLANNING & SCHEDULING

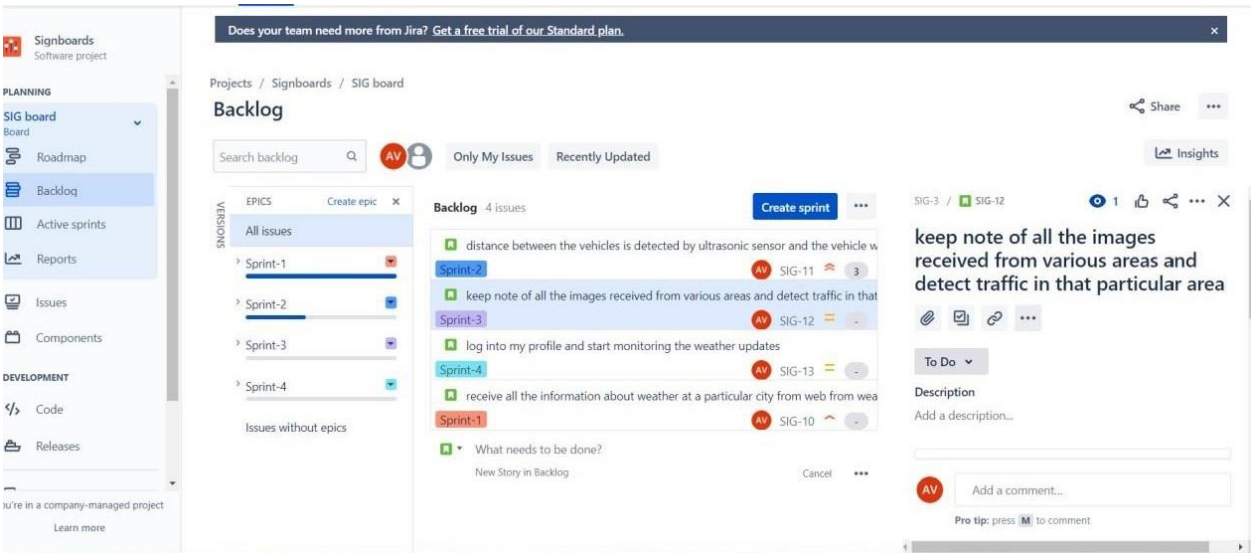
6.1 SPRINT PLANNING & ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Initialization and monitoring	USN-1	Initialize and create accounts in API and I log into theprofile and start monitoring the weather updates	1	Low	Poorna Porkamalam Aiswaryalakshmi Swathika Gayathri
Sprint-1	Software run	USN-2	Get the information about weather from API and runthe code that results for the inputs given about the weather and location	1	Medium	Poorna Porkamalam Aiswaryalakshmi Swathika Gayathri
Sprint-2	Sprint to cloud	USN-3	Update if any changes occurs in the status of signboard and move the code from Sprint1 to cloud	2	Medium	Poorna Porkamalam Aiswaryalakshmi Gayathri
Sprint-3	Initialization of hardware	USN-4	Initialize the hardware to access the functions like to slow down near schools and near hospitals to display no horn	2	High	Poorna Porkamalam Aiswaryalakshmi Swathika
Sprint-4	Debugging	USN-5	Debug the code and ensure the accuracy to provide better results	2	Low	Poorna Porkamalam Swathika

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	31 Oct 2022
Sprint-3	20	6 Days	07 Nov2022	12 Nov 2022	20	07 Oct 2022
Sprint-4	20	6 Days	14 Nov2022	19 Nov 2022	20	14 Nov 2022

6.3 REPORTS FROM JIRA



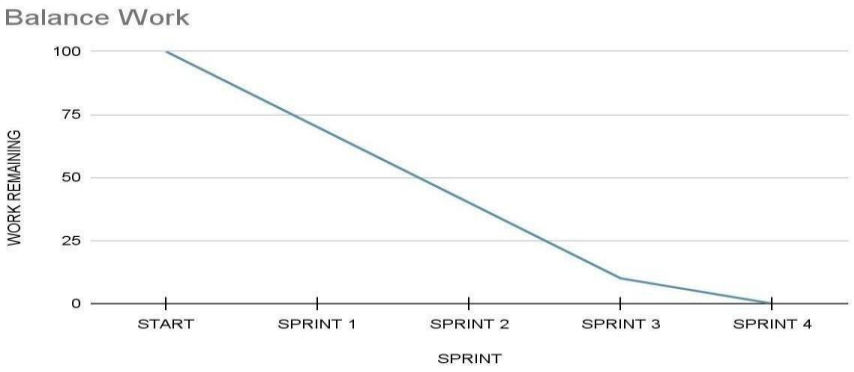
Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



CHAPTER 7

CODING & SOLUTIONING

7.1 FEATURE 1 – CODING AND RESULT

```
import wiotp.sdk.device
import time
import random
import ibmiotf.application
import ibmiotf.device
import requests, json


myConfig = {
  #Configuration
  "identity": {
    "orgId": "q536ty",
    "typeId": "Sample_one",
    "deviceId":"4054"
},
  #API Key
  "auth": {
     "token": "953719104054"
   }
}
```

```
def myCommandCallback(cmd):
  print("Message received from IBM IoT Platform: %s"%
cmd.data['command'])
  m=cmd.data['command']

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

#OpenWeatherMap Credentials
BASE_URL ="https://api.openweathermap.org/data/2.5/weather?"
CITY = "Bengaluru, IN"
URL = BASE_URL + "q=" + CITY + "&units=metric"+"&appid="
+"76d24dec9915b133df9bdef90b7c215a"

while True:
    response = requests.get(URL)
    if response.status_code == 200:
      data = response.json()
      main = data['main']
      temperature = main['temp']
      humidity = main['humidity']
      pressure = main['pressure']
      report = data['visibility']
```

```
#messge part
msg=random.randint(0,5)
if msg==1:
  message="GO SLOW, SCHOOL ZONE AHEAD"
elif msg==2:
  message="NEED HELP, POLICE STATION AHEAD"
elif msg==3:
  message="EMERGENCY, HOSPITAL NEARBY"
elif msg==4:
  message="DINE IN, RESTAURENT AVAILABLE"
elif msg==5:
  message="PETROL BUNK NEARBY"
else:
  message=""

#Speed Limit part
speed=random.randint(0,150)
if speed>=100:
    speedMsg=" Limit Exceeded"
elif speed>=60 and speed<100:
    speedMsg="Moderate"
else:
```

```
        speedMsg="Slow"


#Diversion part
    sign=random.randint(0,5)
    if sign==1:
        signMsg="Right Diversion"
    elif sign==2:
        signMsg="Speed Breaker"
    elif sign==3:
        signMsg="Left Diversion"
    elif sign==4:
        signmsg="U Turn"
    else:
        signMsg=""


#Visibility
    if temperature < 24:
        visibility="Fog Ahead, Drive Slow"
    else:
        visibility="Clear Weather"


    myData={'Temperature':temperature, 'Message':message, 'Speed':speedMsg,
'Visibility':visibility}
```

client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None) #PUBLISHING TO IOT WATSON

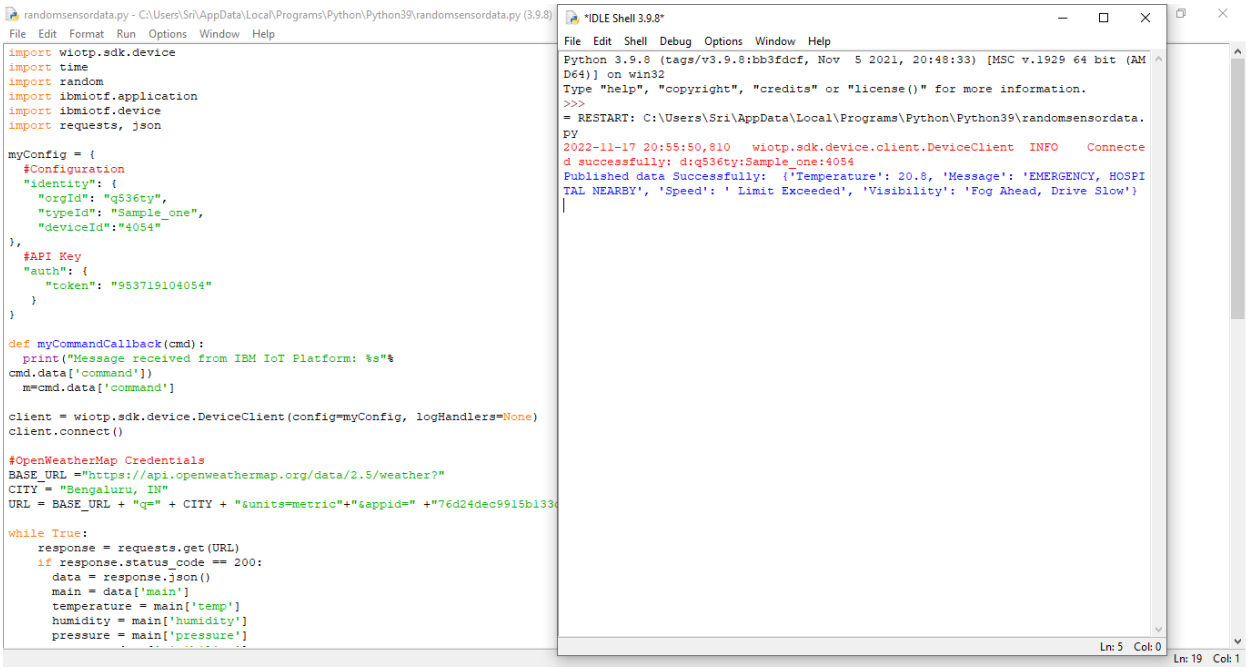
print("Published data Successfully: ", myData)

client.commandCallback = myCommandCallback

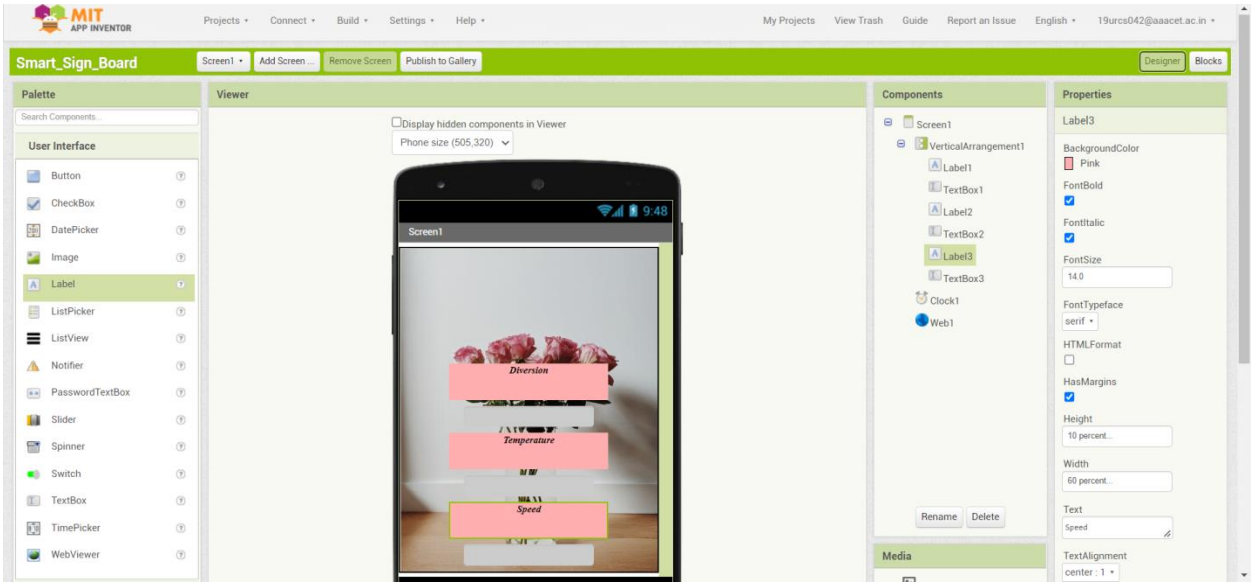
time.sleep(5)

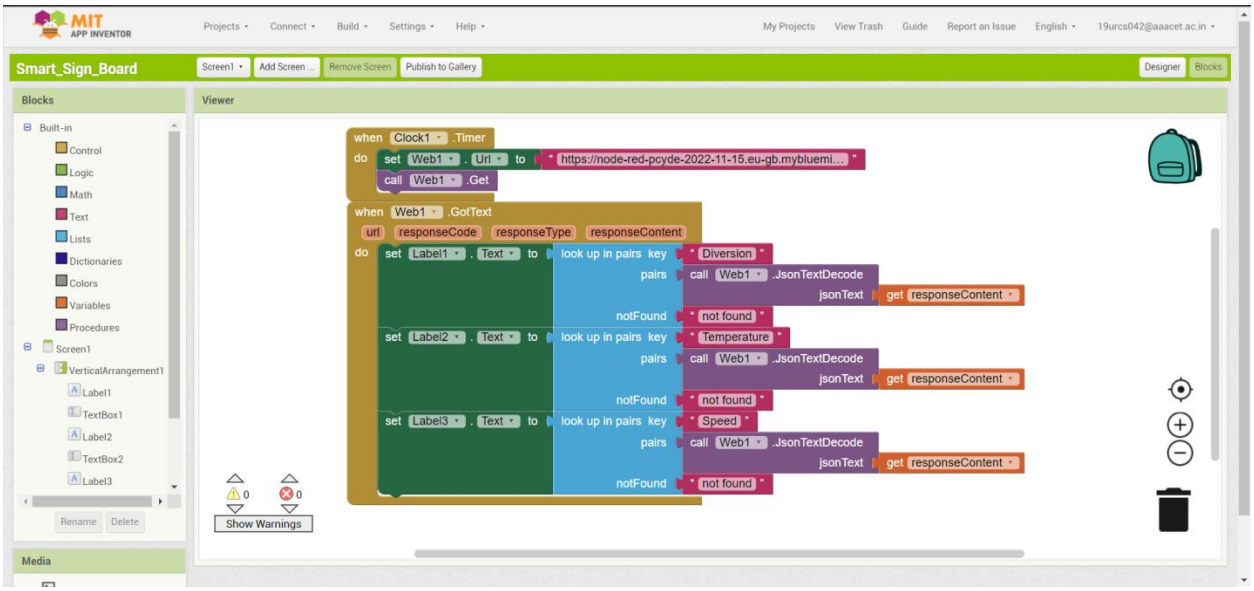
client.disconnect()

OUTPUT:



FEATURE 2 – MIT APP INVENTOR



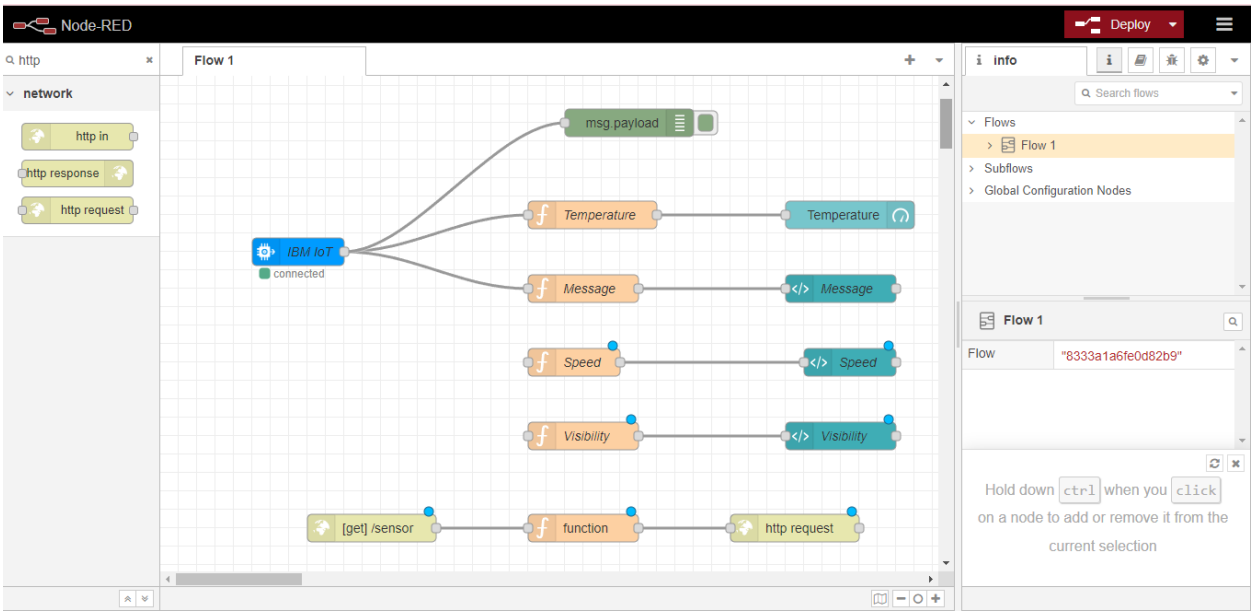


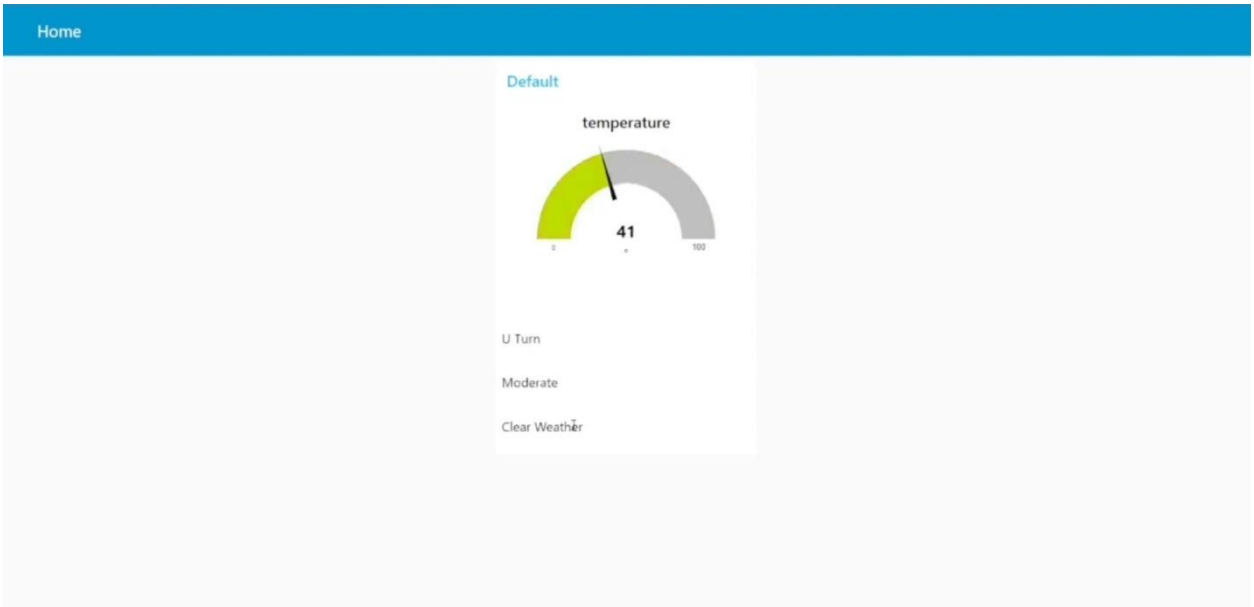
CHAPTER 8

TESTING

8.1 TEST CASES

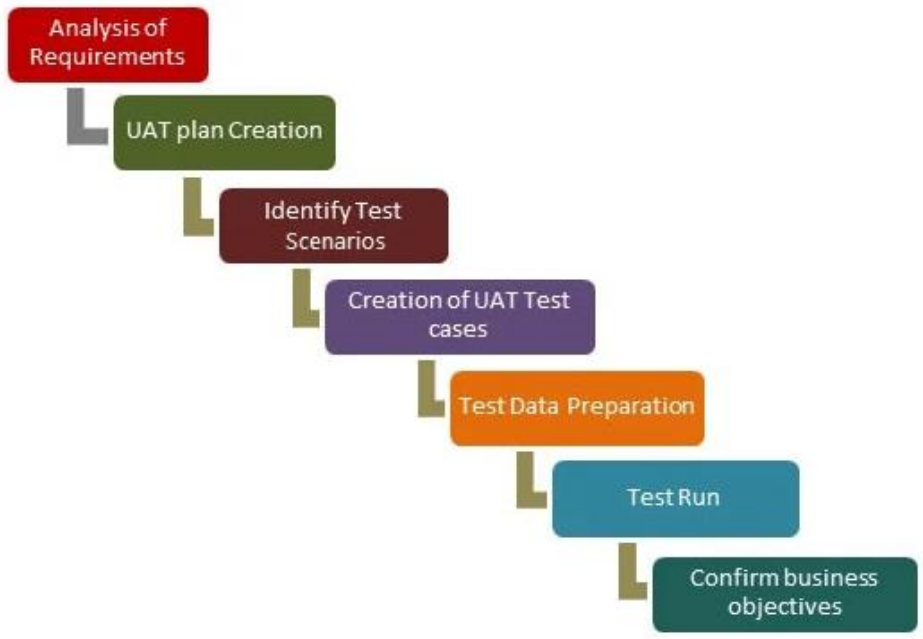
Test cases help guide the tester through a sequence of steps to validate whether a software application is free of bugs, and working as required by the end-user. Learning how to write test cases for software requires basic writing skills, attention to detail, and a good understanding of the application under test (AUT).





8.2 USER ACCEPTANCE TESTING

UAT is done by the intended users of the system or software. This type of Software Testing usually happens at the client location which is known as Beta Testing. Once Entry criteria for UAT are satisfied, following are the tasks need to be performed by the testers:



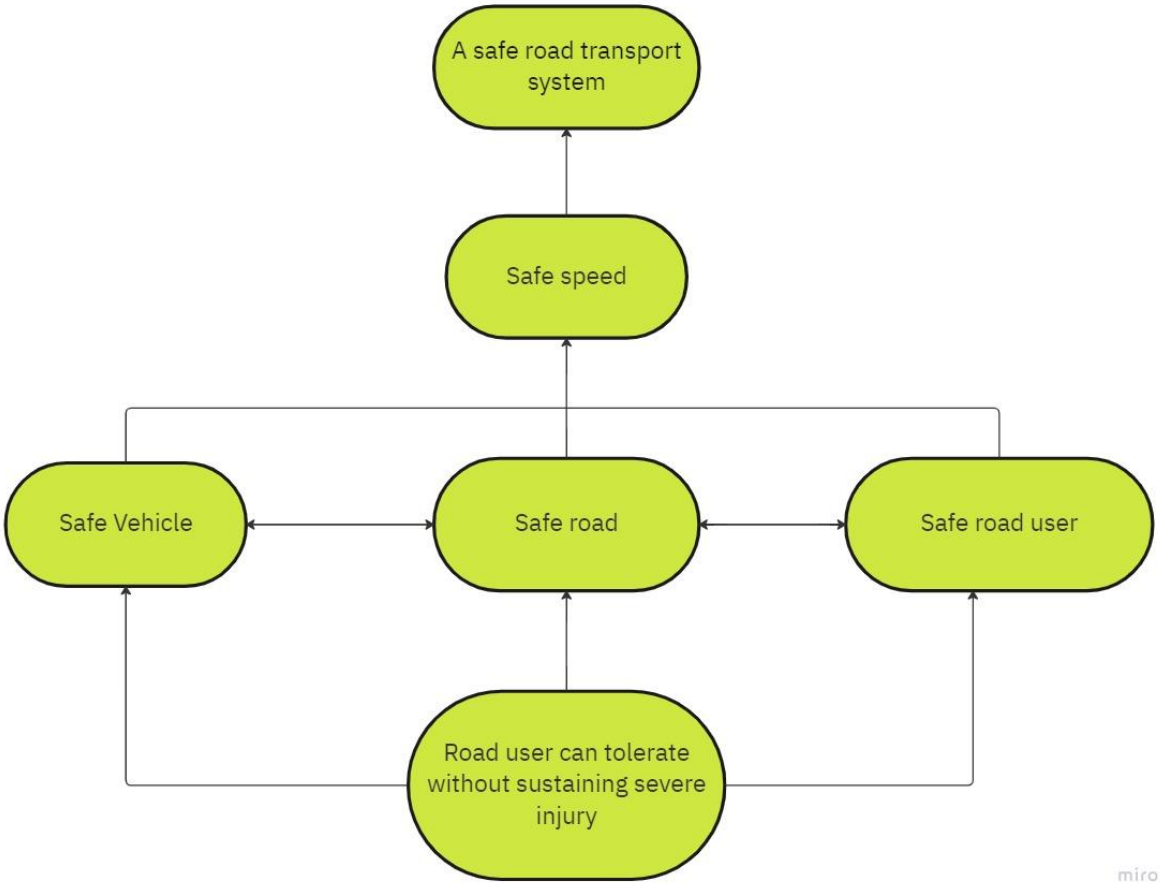
UAT Process

CHAPTER 9

RESULTS

9.1 PERFORMANCE METRICES

Based on the IBM pack we chose, the performance of the website varies. Built upon NodeJS, a light and high performance engine, NodeRED is capable of handling upto 10,000 requests per second. Moreover, since the system is horizontally scalable, a even higher demand of customers can be served.



CHAPTER 10

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Signs with smart connectivity are an inexpensive and flexible medium that can help transmit information according to particular situation and entertain passengers.
- It will manage road conditions, creating a more sustainable environment within cities
- Ensuring a safe driving experience with real-time assistance, navigation, and even monitoring driving patterns and any emergency. Additionally, along with the state of the traffic, IoT drivers can receive updated information on the state of the roads, i.e., potholes, ice, grade changes, black spots,etc.
- The driver can easily find the route and navigation instructions to reach the destination
- Improved control and safety can be achieved through IoT-enabled cars. In case of over-speeding, the notification gets displayed.
- The digital signboards helps in reducing the air pollution due theemission of vehicles in heavy traffic area.

DISADVANTAGES:

- The digital signboards involves high Installation Costs.
- While digital sign boards require power and therefore can't claim tobe green, there is high energy use in the printing, erecting and replacement of traditional print media.
- If the people managing the screens are not graphic designers, it can bedifficult to update the content regularly on the screen.
- The digital signboards are still new and developing technology in theroad safety sector,
- Getting digital signboards up and running is a far more involvedprocess than print media

CHAPTER 11

CONCLUSION

Our project is capable of serving as a replacement for static signs for a comparatively lower cost and can be implemented in the very near future. This will help reduce a lot of accidents and maintain a more peaceful traffic atmosphere in the country.

Digital road signs are an important part of modern infrastructure and are becoming increasingly common. Digital road signs are becoming more common as technology improves and more states adopt them. The use of digital road signs is expected to continue to grow in the future as it would be observed user-friendly, economic, environment friendly, profitable promoting road safety. Digital road signs are designed to improve road safety and efficiency by providing real-time information to drivers. These signs can display a variety of information, including speed limits, traffic conditions, and weather warnings. Digital road signs can help drivers by providing information that is not always available from traditionalsigns.

CHAPTETR 12

FUTURE SCOPE

Introduction of intelligent road sign groups in real life scenarios could have great impact on increasing the driving safety by providing the end-user (car driver) with the most accurate information regarding the current road and traffic conditions. Even displaying the information of a suggested driving speed and road surface condition (temperature, icy, wet or dry surface) could result in smoother traffic flows and, what is more important, in increasing a driver's awareness of the road situation.

One of the benefits of digital road signs is that they can be updated in real-time, which means that they can be used to provide motorists with up-to-the-minute information about conditions on the road ahead. Finally, digital road signs could be used to provide motorists with information about the best times to travel in order to avoid traffic congestion. This could be particularly useful in areas wherethere is a lot of traffic.

CHAPTER 13

APPENDIX

SOURCE CODE:

randomData.py:

```
import wiotp.sdk.device
import time
import random
import ibmiotf.application
import ibmiotf.device
import requests, json
myConfig = {
  #Configuration
  "identity": {
    "orgId": "q536ty",
    "typeId": "Sample_one",
    "deviceId":"4054"
},
  #API Key
  "auth": {
     "token": "953719104054"
   }
}
```

```
def myCommandCallback(cmd):
  print("Message received from IBM IoT Platform: %s"%
cmd.data['command'])
  m=cmd.data['command']
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()
 #OpenWeatherMap Credentials
BASE_URL ="https://api.openweathermap.org/data/2.5/weather?"
CITY = "Bengaluru, IN"
URL = BASE_URL + "q=" + CITY + "&units=metric"+"&appid="
+"76d24dec9915b133df9bdef90b7c215a"
while True:
    response = requests.get(URL)
    if response.status_code == 200:
      data = response.json()
      main = data['main']
      temperature = main['temp']
      humidity = main['humidity']
      pressure = main['pressure']
      report = data['visibility']
 #messge part
      msg=random.randint(0,5)
      if msg==1:
```

```
        message="GO SLOW, SCHOOL ZONE AHEAD"
    elif msg==2:
        message="NEED HELP, POLICE STATION AHEAD"
    elif msg==3:
        message="EMERGENCY, HOSPITAL NEARBY"
    elif msg==4:
        message="DINE IN, RESTAURENT AVAILABLE"
    elif msg==5:
        message="PETROL BUNK NEARBY"
    else:
        message=""
#Speed Limit part
    speed=random.randint(0,150)
    if speed>=100:
        speedMsg=" Limit Exceeded"
    elif speed>=60 and speed<100:
        speedMsg="Moderate"
    else:
        speedMsg="Slow"
#Diversion part
    sign=random.randint(0,5)
    if sign==1:
        signMsg="Right Diversion"
```

```
    elif sign==2:
        signMsg="Speed Breaker"
    elif sign==3:
        signMsg="Left Diversion"
    elif sign==4:
        signmsg="U Turn"
    else:
        signMsg=""

#Visibility
    if temperature < 24:
        visibility="Fog Ahead, Drive Slow"
    else:
        visibility="Clear Weather"

    myData={'Temperature':temperature, 'Message':message, 'Speed':speedMsg, 'Visibility':visibility}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None) #PUBLISHING TO IOT WATSON
    print("Published data Successfully: ", myData)
    client.commandCallback = myCommandCallback
    time.sleep(5)
    client.disconnect()
```

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-6513-1658830701

PROJECT DEMO LINK:

https://drive.google.com/file/d/1c4zPB8qS293vCbdPI2r64QoahB7Ae3Hm/view?usp=drivesdk