PROJECT DOCUMENTATION

Date	17 November 2022
Team ID	PNT2022TMID48721
Project Name	Signs with Smart Connectivity for Better Road Safety

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

2. LITERATURE SURVEY

2.1 Existing Problem:

- The static signboards which are used to show the speed limits and zones cannot be changed.
- They should be changed from time to time because of the paint deterioration, folded sheet, dullness caused by weather damage.

- Some drivers disobey these signals.

2.2 References:

Sunghee Lee, Ilhong Shin, Namkyung Lee(2018): Development of IoT based Smart Signage Platform

Digital signage is evolving to smart signage which provides personalized service by adaptively changing contents according to the user context. However, previous smart signage services have difficulty to expend their service because it is not easy to connect additional sensing devices. Furthermore, previous smart signage systems only consider single signage for a service. In this paper, we propose IoT based smart signage platform. The proposed platform provides IoT based connectivity between sensors and signage platform for flexible service extension. Also, we suggest IoT based signage connection, status sensing, and controlling. Therefore, our platform can make a service group of signages dynamically and enables signages to collaborate for a service in wide area. To show the performance of proposed platform, we implemented smart nursing home service. The service shows that IoT devices and signages can be connected to the platform dynamically and collaborate together for a service in wide area.

REFERENCE:https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8539356&isnumber=8539346

W. H. D. Fernando, S. Sotheeswaran (2021): Automatic road traffic signs detection and recognition using 'You Only Look Once' version 4 (YOLOv4)

his paper presents an approach to detect traffic signs using You Only Look Once version 4 (YOLOv4) model. The traffic sign detection and recognition system (TSDR) play an essential role in the intelligent transportation system (ITS). TSDR can be utilized for driver assistance and, eventually, driverless cars to reduce accidents. When driving an automobile, the driver's attention is usually drawn to the road. On the other hand, most traffic signs are situated on the side of the road, which may have contributed to the collision. TSDR allows drivers to view traffic sign information without having to divert their attention. Due to the existence of a large background, clutter, fluctuating degrees of illumination, varying sizes of traffic signs, and changing weather conditions, TSDR is an important but difficult process in intelligent transport systems. Many efforts have been made to find answers to the major issues that they face. The objective of this study addresses road traffic sign detection and recognition using a technique that initially detects the bounding box of a traffic sign. Then the detected traffic sign will be recognized for usage in a speeded-up process. Since safe driving necessitates real-time traffic sign detection, the YOLOv4 network was employed in this research. YOLOv4 was evaluated on our dataset, which consisted of manual annotations to identify 43 distinctive traffic signs classes. It was able to achieve an average recognition accuracy of 84.7%. Overall, the work adds by presenting a basic yet effective model for realtime detection and recognition of traffic signs.

REFERENCE:https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9568285&isnumber=9568277

Devershi Pallavi Bhatt, Manish Tiwari (2020): Smart traffic sign boards (STSB) for smart cities

Ubiquitous nature of smart cities requires multiple technologies to be implemented in this area. To develop the smart cities in practice, there is huge need of "Smart Traffic Management". Smart Traffic Management is a system to monitor and control the traffic signals using sensors to regulate the flow of traffic and to avoid the congestion for smooth flow of traffic. Prioritizing the traffic like ambulance, police etc. is also one application comes under smart traffic management. Traffic sign board plays important role to make the traffic in shape and to control and manage the traffic on roads. Many at times the driver misses the sign boards while driving due to various reasons like insufficient light, fog, rain, traffic etc. In this paper, a framework of the Smart Traffic Sign Boards (STSB) is proposed, which can communicate with the system deployed in all the vehicles to make the drivers of those vehicles aware of speed breakers, speed limits, schools, or 'U' turn ahead, etc. beforehand, to avoid the mishap due to sudden appearing of such unusual features of the road during the road journey.

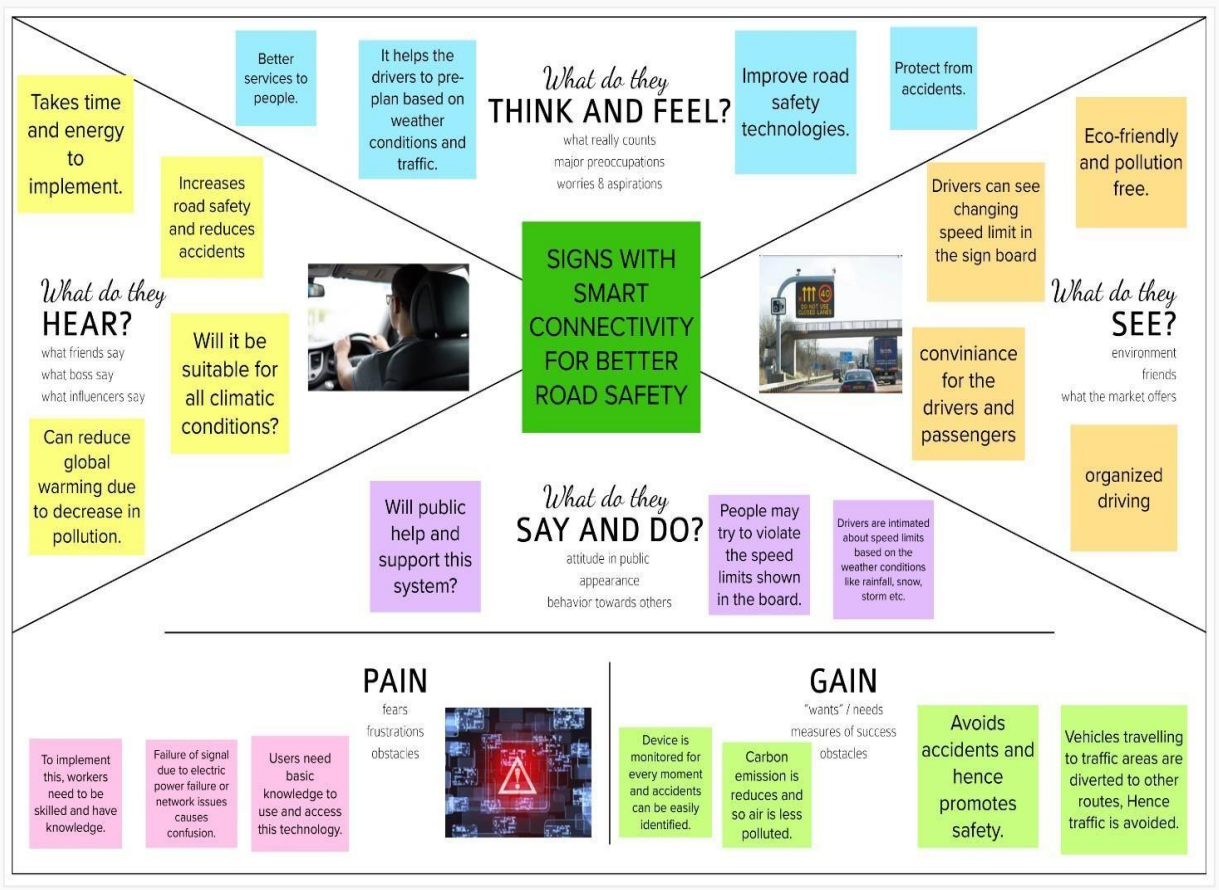
REFERENCE:https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9124950&isnumber=9124929

2.3 Problem Statement Definition:

- A driver who wants to drive safely on road but there are many obstacles because of heavy traffic, weather condition, etc..,
- A driver who wants to avoid the heavy traffic roads but they are unpredictable because they change from time to time.
- A passenger who wants to travel safely but there are many road accidents because of some drivers who drive very fast and carelessly.
- A driver who wants to reach the destination but unable to choose the route and turn in wrong direction because there are no navigation instructions.

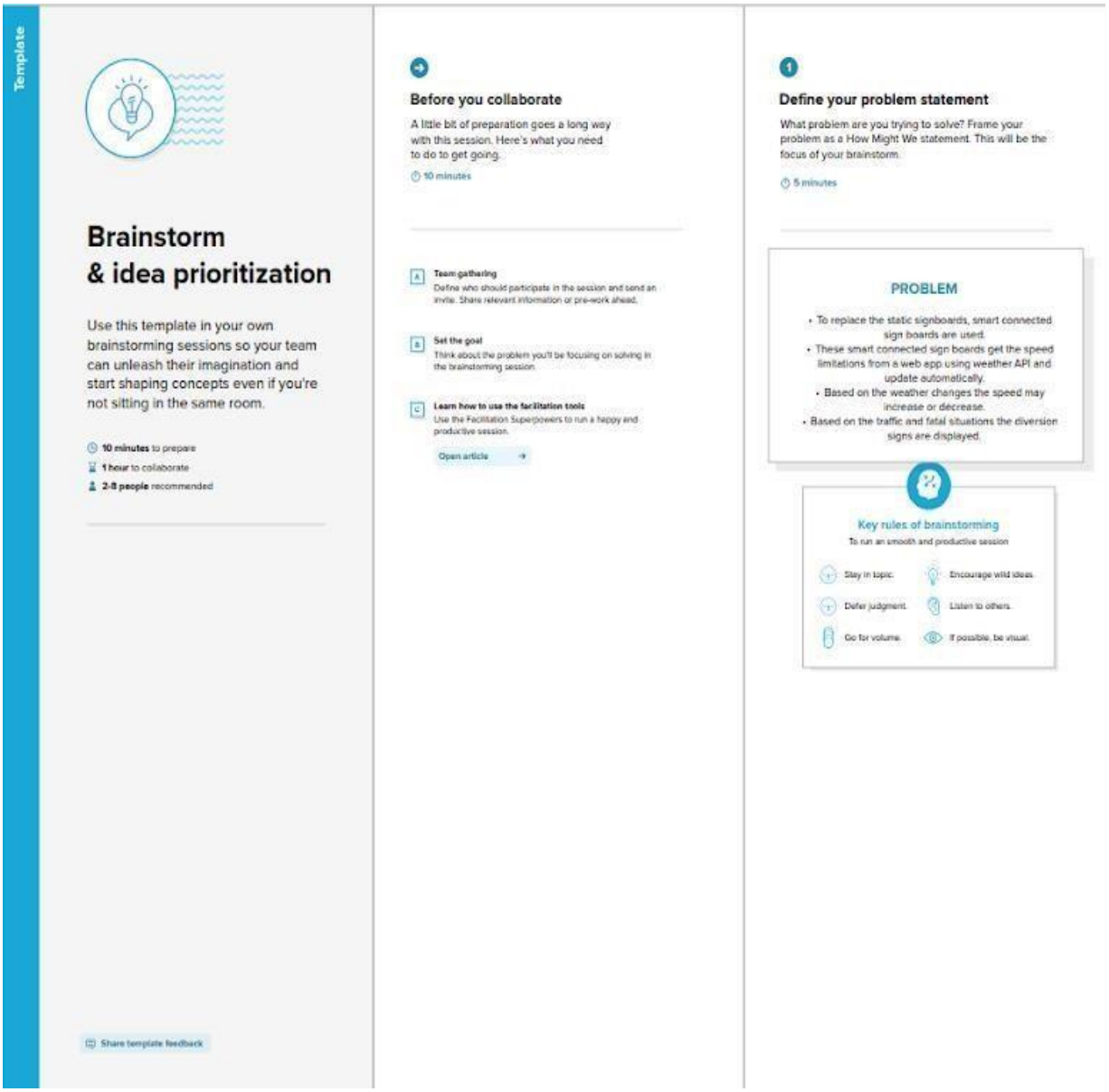
3. IDEATION AND PROPOSED SOLUTION:

3.1 Empathy Map Canvas:

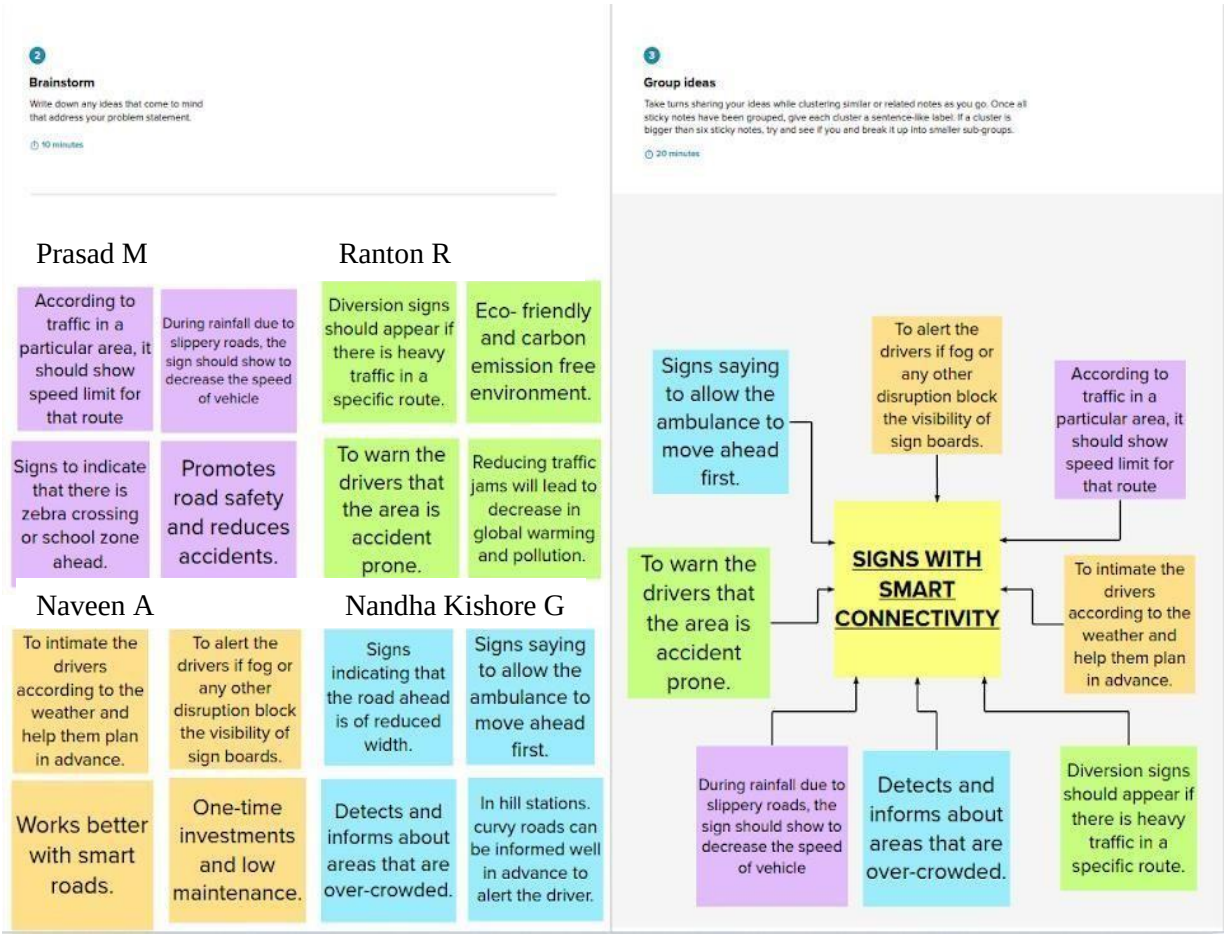


3.2 Ideation & Brainstorming:

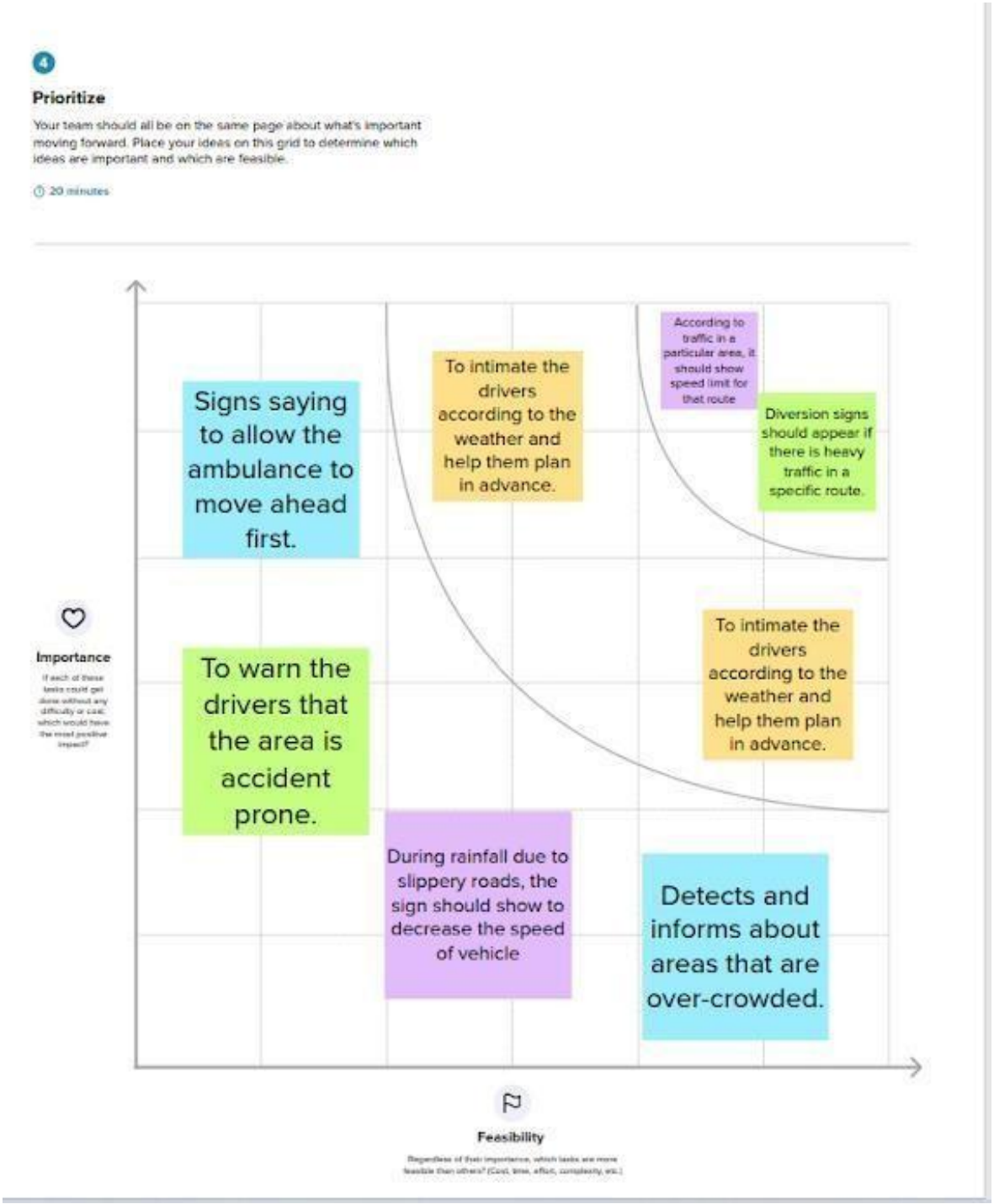
Step-1 : Team Gathering, Collaboration and Select the Problem Statement



Step-2 : Brainstorm, Idea Listing and Grouping



Step-3: Idea Prioritization



3.3 Proposed Solution:

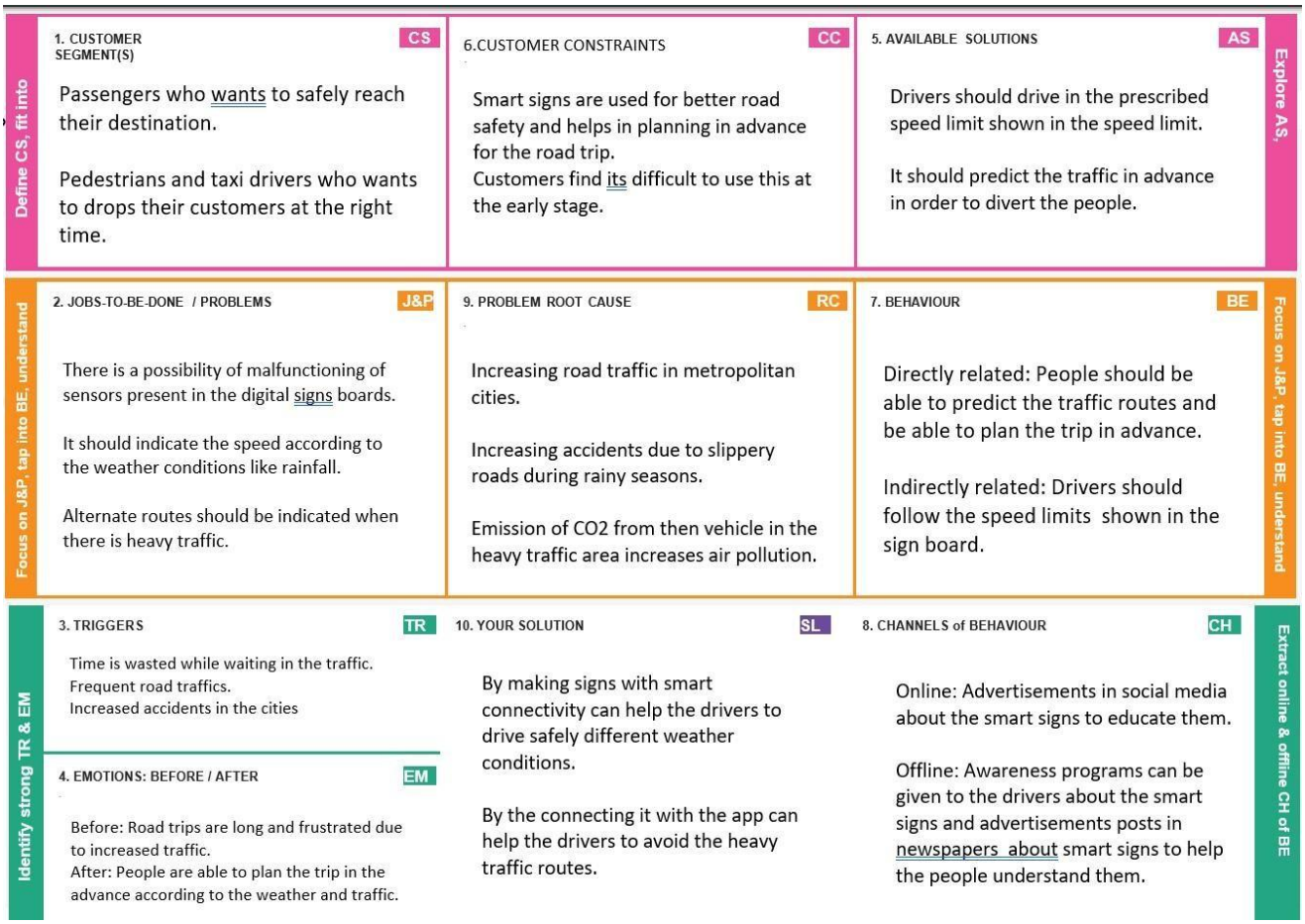
S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	• In static signboard, the road sign and the speed limits are stated but they cannot be changed, but if they are digitalized by using API app, they can be changed accordingly due to some cases like accidents, heavy traffic, weather. • Signs with smart connectivity for better road safety is designed for speed control, safety improvements and indicate the weather update.
2.	Idea / Solution description	• The weather details are obtained from the API app. Using these details, the speed limit will be updated automatically in accordance with the weather conditions. If there is rainfall then the roads will be slippery, so the signs will show reduced speed limit in order to avoid accidents. • In order to avoid heavy traffic routes, the drivers will be intimated in advance so that they can take diversion and change the route.

3.	Novelty / Uniqueness	• The unique light enhancing and antiglare lens frameworks offer maximum visibility even under very low light conditions. • It gives more detailed information to the road drivers about the traffic, accidents, weather, etc.., • It reduces the collision risks due to heavy traffic and results in reduced air pollution which is caused by the CO2 emission by vehicles.
4.	Social Impact / Customer Satisfaction	• Alternate routes will be displayed if there is heavy traffic, so the customer can reach the destination before the expected time. • Smart signs can assist in optimizing traffic flow and can create a sustainable environment within the cities.

5.	Business Model (Revenue Model)	• It can be used in cities in where heavy traffic occurs frequently and accident zones in order to avoid road blocks. • Selling this product to the government at a low cost, so there will be less accidents and the public will be aware of the traffic or accidents.

6.	Scalability of the Solution	□ Smart signs adapts to changing traffic conditions in real time. □ In the future, if any update is required either on the hardwar e or software side, it can be easily implemented. □ It can be used along with driverless cars in the future.

3.4 Problem Solution Fit:



4. REQUIREMENT ANALYSIS:

4.1 Functional Requirements:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	USER REGISTRATION	• Through google forms • Through mail • Through linkedin • Through facebook
FR-2	USER CONFIRMATION	• Through verification mails • Through OTP
FR-3	USER APPROVAL	• Through mails • Through phone calls • Through SMS
FR-4	USER TRANSACTION	• Through net banking • Through UPI
FR-5	TESTING	• Testing through components • Testing through API and UI
FR-6	END RESULT	• End result through product features • By using the technology

4.2 Non-Functional Requirements:

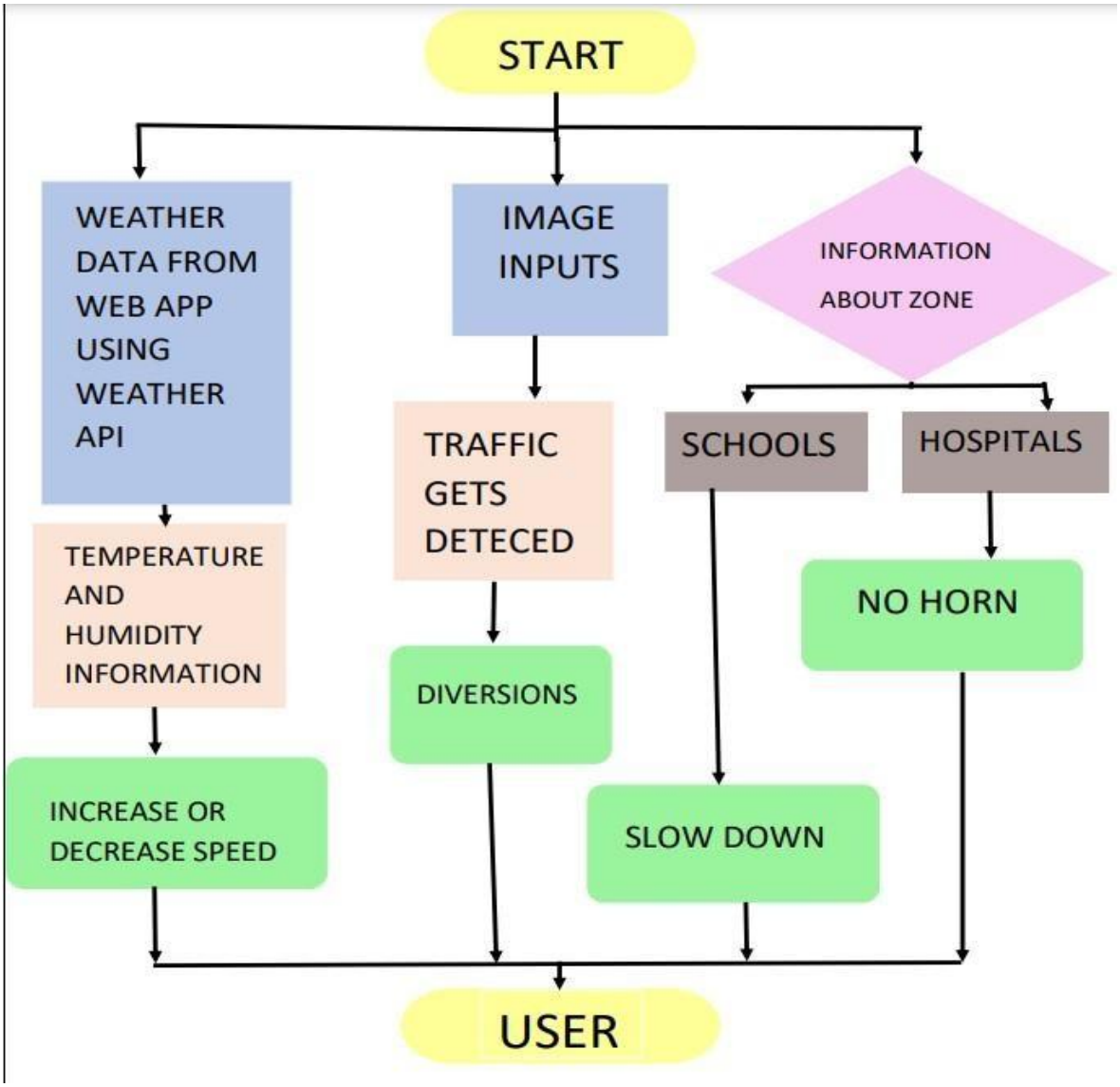
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	• Situations never remain the same. Therefore there must be a constant check of the conditions prevailing and accordingly there must be changes made in these boards. • Sign boards with caution or alerts must be placed well in advance so that the drivers could be more alert with the journey. • The text content must be available in different languages to help the drivers.

		Boards must be large and clear for better visibility. Sign boards should be bright coloured so that it catches the drivers' sight. The illustrations or the symbols used in the boards must be easily understandable.
NFR-2	Security	The security system should be strong enough that no one can modify it other than the authority. No one should be able to enter into the network to change, delete or manage the intimations or messages delivered through the sign boards.
NFR-3	Reliability	There should not be any miscommunications or confusions regarding the messages displayed. Maximum accuracy must be ensured. All the information displayed must be checked periodically and updated if any changes are needed for error-free intimation.
NFR-4	Performance	The efficiency and the accuracy of the information hence calculated should be maximum. It should be ensured that minimum amount of energy, time and cost is required for the operation.
NFR-5	Availability	These should be available anytime and everywhere that is 24/7. Sign boards should be located in places which has direct view from the road. It should not present amidst bushes, trees, building etc It should be properly monitored that no sign boards are damaged, repaired or malfunctioning at any time.

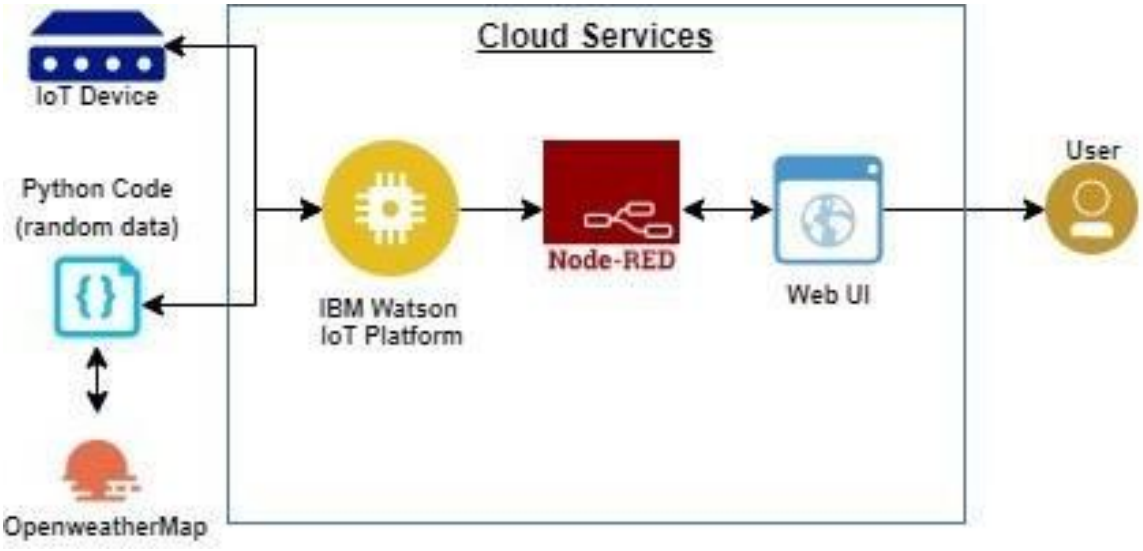
		The sign boards should be made available only in places where they are required the most. Frequent availability of boards may lead to confusion and mistakes.
NFR-6	Scalability	It should be easy to scale according to the requirement. It should be in such a way that the network at any time of period should be ready to be expanded and implemented on a wider scale.

5. PROJECT DESIGN:

5.1 Data Flow Diagrams:



5.2 Solution & Technical Architecture:



5.3 User Stories:

User Story Number	User Story / Task	Story Points	Priority
USN-1	As a weather data controller, I log into my profile and start monitoring the weather updates	3	High
USN-2	I receive all the information about weather at a particular city from web from weather API. Whenever there is change in weather, corresponding updates about speed limits are made on sign boards.	2	High
USN-3	As a image controller, I keep note of all the images received from various areas and detect traffic in that particular area.	3	High
USN-4	With traffic, distance between the vehicles is detected by ultrasonic sensor and the vehicle will be automatically stopped if the distance is below the limit.	2	Medium

User Story Number	User Story / Task	Story Points	Priority
USN-5	As a traffic controller, I keep note of all the vehicle's speed received from various areas using location sensor.	2	High
USN-6	I ensure that the boards display "slow down" if high speed is detected.	2	Medium
USN-7	As a user, I move the marker to my current location and the destination location.	1	Medium
USN-8	I receive the fastest route to the destination and navigation instructions like "Turn left", "Turn right" will be displayed.	1	Medium
USN-9	As a zonal officer, I ensure that boards near school display "slow down" and near hospitals display "no horn".	3	High
USN-10	As an administrator, I ensure that the boards display "drive carefully" near construction site, narrow and uneven roads.	2	Medium

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	Login	USN-1	As a weather data controller, I log into my profile and start monitoring the weather updates	3	High	PRASAD.M
Sprint-1	dashboard	USN-2	I receive all the information about weather at a particular city from web from	2	High	RANTON.R

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
			weather API. Whenever there is change in weather, corresponding updates about speed limits are made on sign boards.			
Sprint-2	Login	USN-1	As a image controller, I keep note of all the images received from various areas and detect traffic in that particular area.	3	High	NAVEEN.A
Sprint-2	Dashboard	USN-2	With traffic, distance between the vehicles is detected by ultrasonic sensor and the vehicle will be automatically stopped if the distance is below the limit.	2	Medium	NANDHA KISHORE.G
Sprint-3	Login	USN-1	As a traffic controller, I keep note of all the vehicle's speed received from various areas using location sensor.	2	High	PRASAD.M
Sprint-3	Dashboard	USN-2	I ensure that the boards display "slow down" if high speed is detected.	2	Medium	RANTON.R
Sprint-3	Login	USN-3	As a user, I move the marker to my current location and the destination location.	1	Medium	NAVEEN.A
Sprint-3	Dashboard	USN-4	I receive the fastest route to the destination and navigation instructions like "Turn left", "Turn right" will be displayed.	1	Medium	NANDHA KISHORE.G

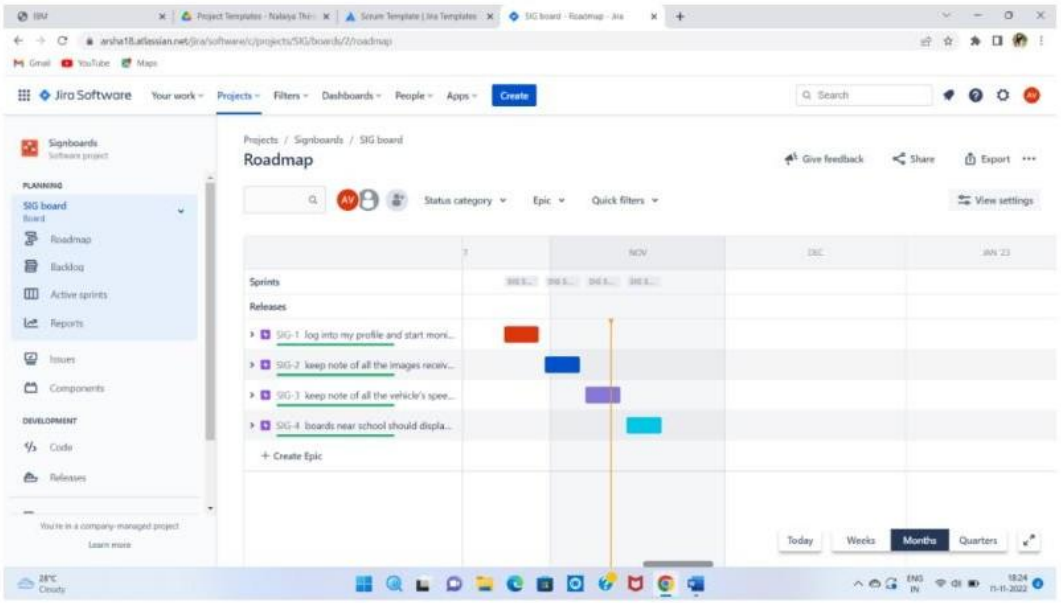
Sprint-4	Login	USN-1	As a zonal officer, I ensure that boards near school display “slow down” and near hospitals display “no horn”.	3	High	PRASAD.M

6.2 Sprint Delivery Schedule:

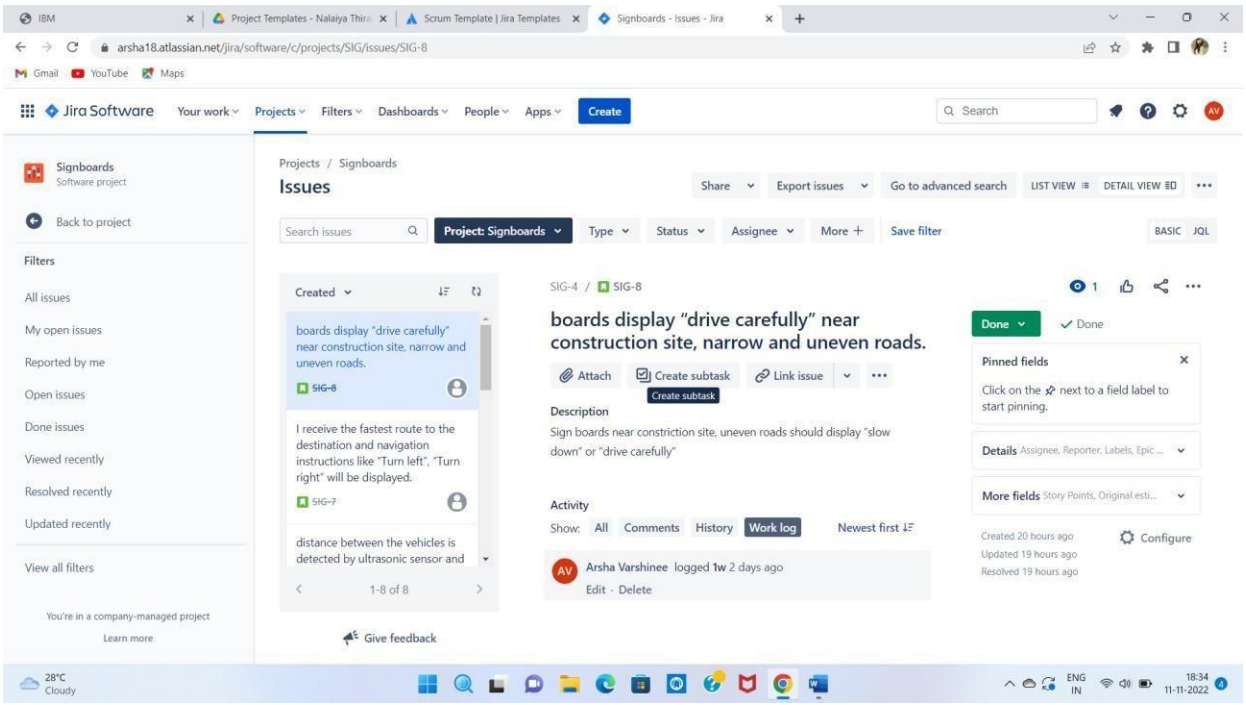
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022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

6.3 Reports From JIRA:

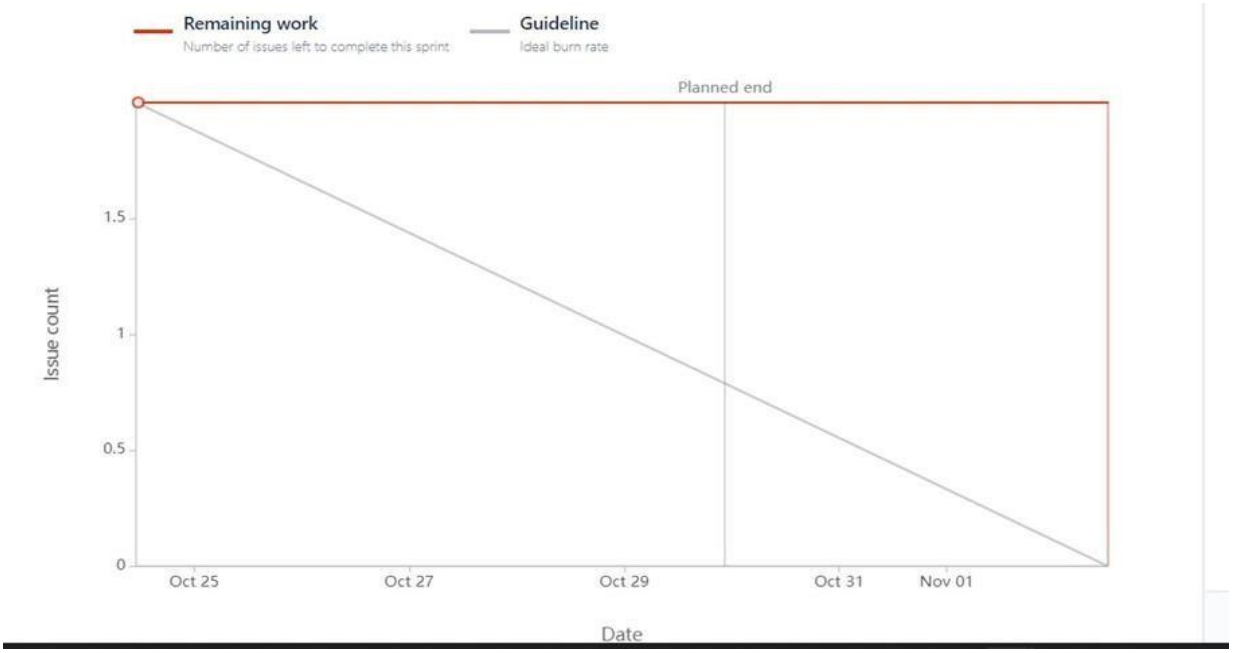
ROADMAP:



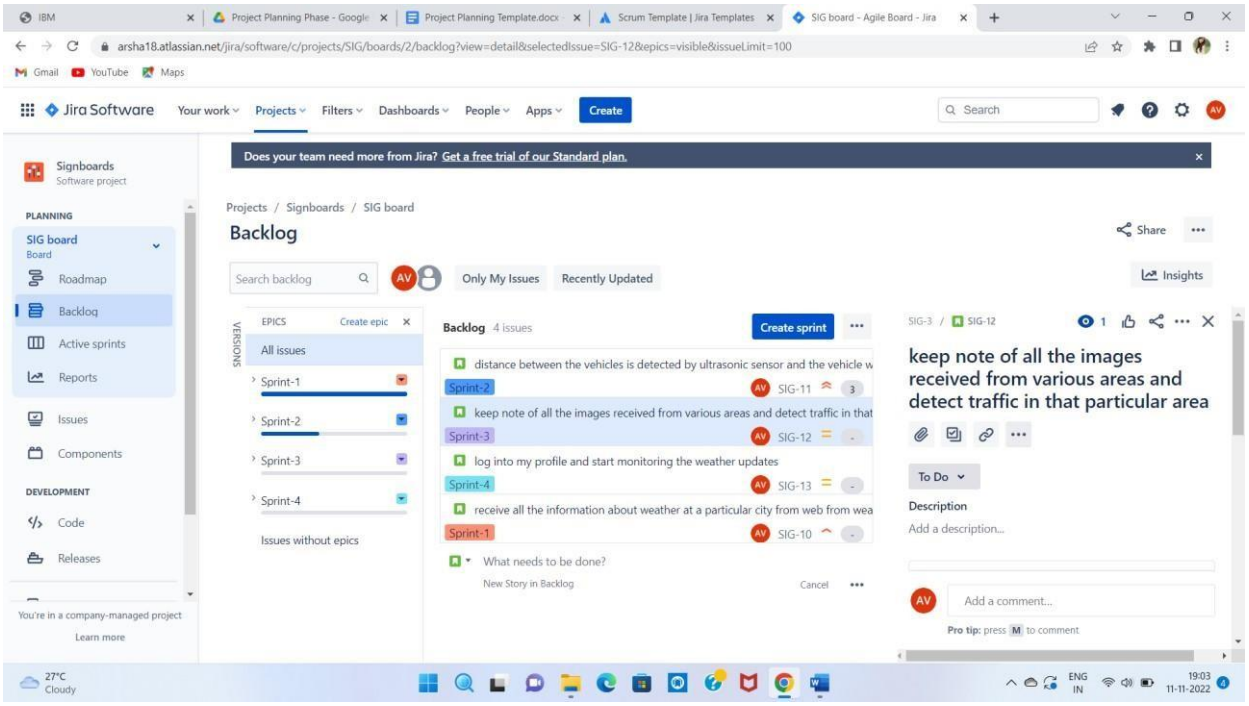
ISSUE:



BURNDOWN CHART:



BACKLOG:

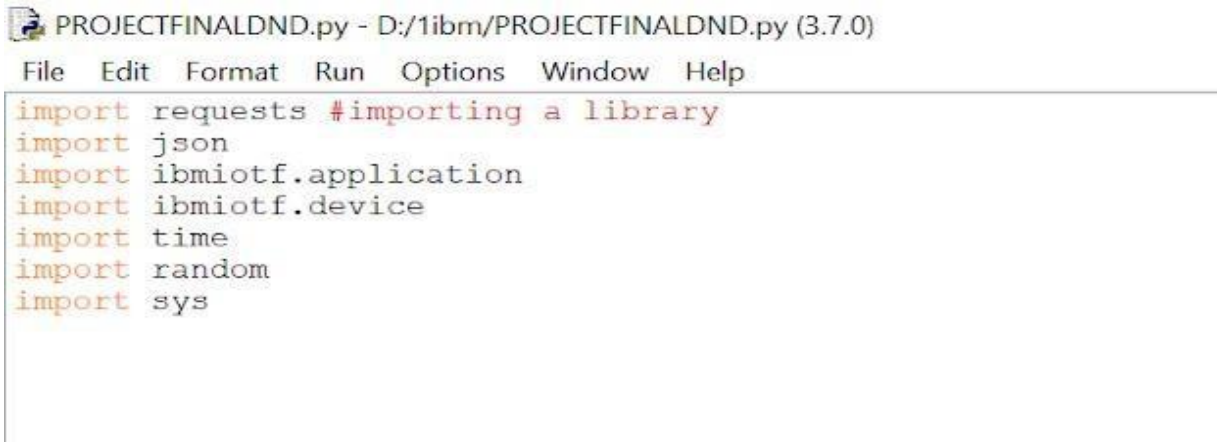


7. CODING & SOLUTIONING:

Code Explanation:

Libraries:

Including all libraries like json, random, time, sys, ibmiotf etc.



Credentials:

Entering all the credentials corresponding to IoT watson device in order to publish data to it.

```
# watson device details

organization = "2s7yy7"
devicType =  "project"
deviceId = "projectid"
authMethod= "token"
authToken= "projecttoken"
```

MIT Inventor Interruption:

Receiving commands as inputs when buttons are pressed in MIT inventor in order to perform separate functions.

```
def myCommandCallback(cmd):
    global a
    #print("command recieved:%s" %cmd.data['command'])
    #status=cmd.data['command']
    print("command recieved:%s" %cmd.data['command'])
    control=cmd.data['command']
    print(control)


try:
        deviceOptions={"org": organization, "type": devicType,"id": deviceId,"auth-method":authMethod,"auth-token":authToken}
        deviceCli = ibmiotf.device.Client(deviceOptions)
except Exception as e:
        print("caught exception connecting device %s" %str(e))
        sys.exit()
```

Exception Handling:

To handle exception if occurs while connecting with IBM IOT WATSON device

```
try:
        deviceOptions={"org": organization, "type": devicType,"id": deviceId,"auth-method":authMethod,"auth-token":authToken}
        deviceCli = ibmiotf.device.Client(deviceOptions)
except Exception as e:
        print("caught exception connecting device %s" %str(e))
        sys.exit()
```

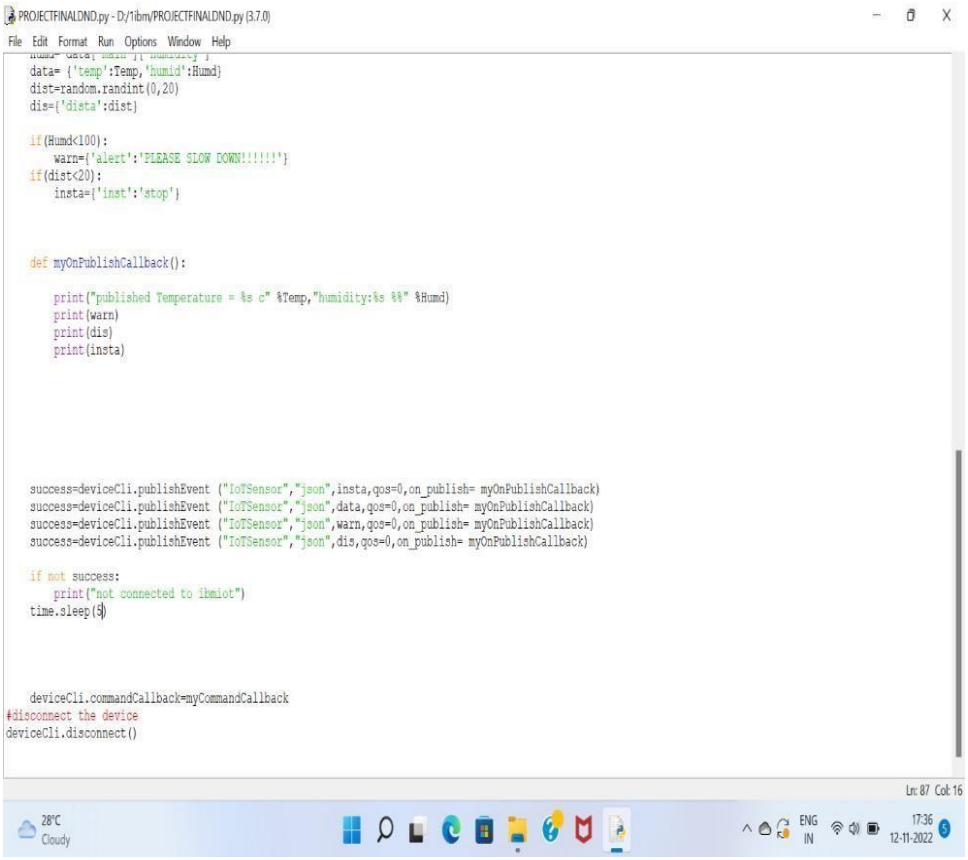
Main Body:

- Connecting to IBM IoT device.
- Getting temperature and humidity values in json format from openweathermap as inputs.
- Accessing the values using their corresponding keys.
- Generating random values for distance since hardware sensors are not implemented.
- Passing a warning “stating please slow down” when humidity is less than 100 in order to promote safe driving experience.
- Passing instruction when distance is less than 20 in order to avoid accidents and clashes.

Publish Data To IBM IOT WATSON Platform:

Passing all the data(temperature, humidity, warning, instruction) to ibm iotwatson.

Disconnecting the connection established with IoT Watson device.



7.1 Feature 1:

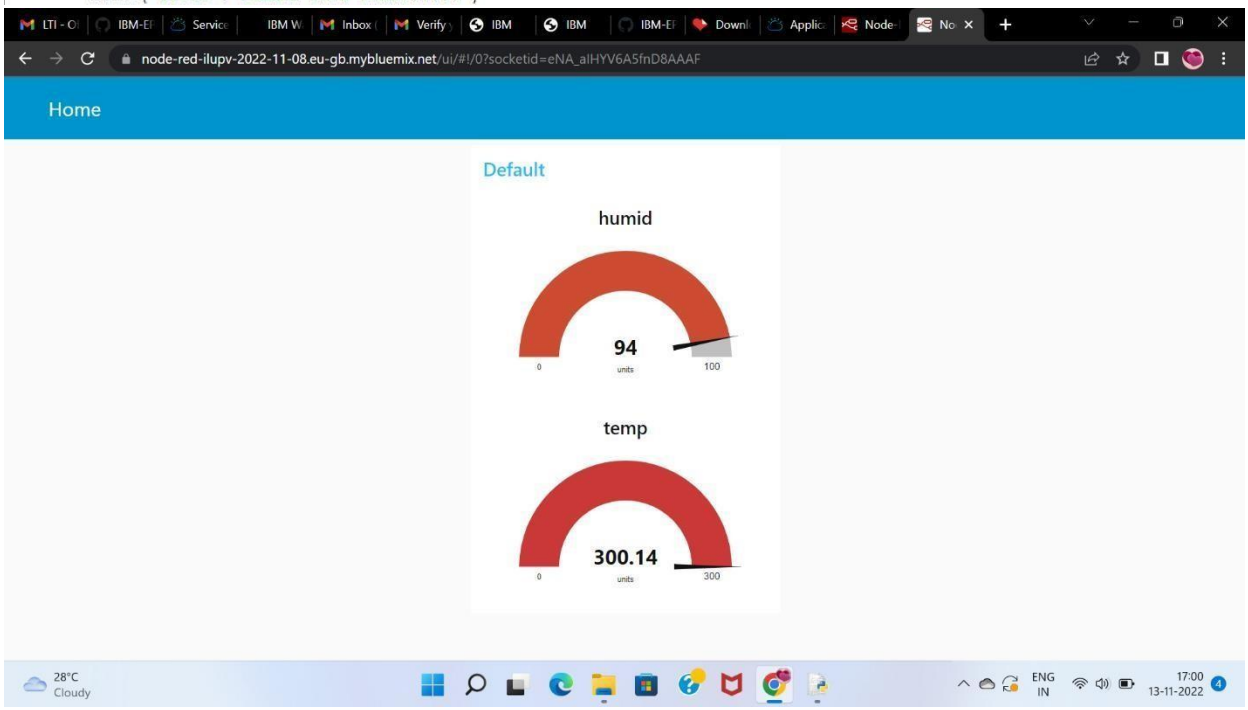
WEATHER UPDATE AND CORRESPONDING COMMAND:

Getting temperature and humidity from OpenWeatherMap for a particular city and displaying warning regarding the speed when humidity is below 100.

PROJECTFINALDND.py - D:/1ibm/PROJECTFINALDND.py (3.7.0)

File Edit Format Run Options Window Help

```
#connect and send a datapoint "temp" with value integer value into the cloud as a type of event for every 10 seconds
deviceCli.connect()

while True:

#get sensor data from DHT11



    a = "https://api.openweathermap.org/data/2.5/weather?q=Chennai,%20IN&appid=e2bea247ed9ad643a04d9a8e55499d5f"
    r=requests.get(url=a)
    data=r.json()

    Temp= data['main']['temp']
    Humd= data['main']['humidity']
    data= {'temp':Temp,'humid':Humd}
    dist=random.randint(0,50)
    dis={'dista':dist}

    if(Humd<100):
        warn={'alert':'PLEASE SLOW DOWN!!!!!!'}
```

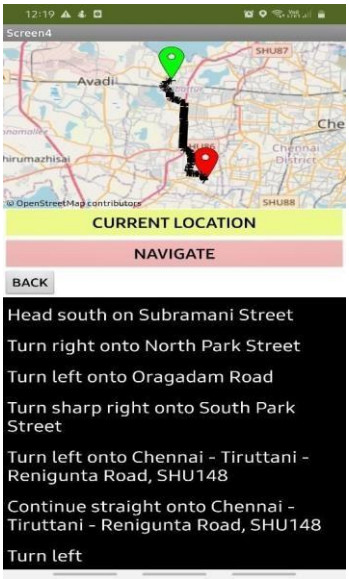


7.2 Feature 2:

SPEED DETECTION:

- By implementing a location sensor in MIT APP INVENTOR, with changes in the location with respect to time, speed can easily be detected and displayed in the app to the user.
- This requires location settings from user's phone to be active.

- An image of normal speed limit is also displayed which means that, travelling within that range would be safe.

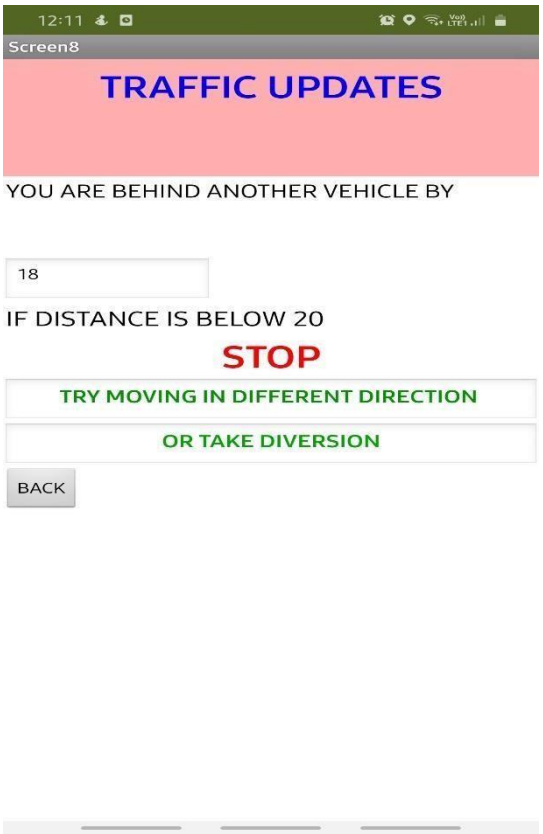


7.3 Feature 3:
MAP AND NAVIGATION:

- By implementing same location sensor, current location can be detected. This also requires location settings in user's phone to be active.
- By dragging the green marker to start location and red marker to the destination location to be reached and clicking on the navigate button, displays the street path that connects the start and end point specified.
- In addition to this, it also displays the directions to be followed to reach the destination.
- This helps the user by providing necessary details like current location and the best route to reach the destination.

7.4 Feature 4:
ZONAL CLASSIFICATION:

- Here, displays few sign boards indicating different zones like school zone, hospital zone, railway track etc. By clicking on the button below the sign displays the meaning and instruction to be followed in the particular region.



- This provides the user with better understanding about the sign boards and to act accordingly.

7.5 Feature 5:
DETERMINING TRAFFIC:

- Since hardware sensors are not implemented, we have used random function to generate values for the distance between the user and the vehicle ahead.

- If the distance is below 20, it instructs the driver or the user to stop immediately and try moving forward with different direction or to take diversion.

- This helps in avoiding accidents and clashes while driving.


```
dist=random.randint(0,50)
dis={'dista':dist}
```

```
if(dist<20):
    insta={'inst':'stop'}
```

8. ADVANTAGES:

- Signs with smart connectivity are an inexpensive and flexible medium that can help transmit information according to particular situation and entertain passengers.
- The digital signboards helps in reducing the air pollution due the emission of vehicles in heavy traffic area.
- The drivers can able to know about the weather condition and accordingly follow the speed limit displayed on the sign boards.
- The increased flexibility of these digital sign boards makes it easy for any private or government department to change the message as per the need of the hour.
- The driver can easily find the route and navigation instructions to reach the destination.
- The speed of the vehicle can be identified using location sensor.
- The digitals sign boards and the app are user-friendly.

DISADVANTAGES:

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

9. CONCLUSION:

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 traditional signs.

10. FUTURE SCOPE:

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. This can be particularly useful in the case of accidents or other incidents that might cause delays. In the future, digital road signs could also be used to provide information about alternative routes that might be available in the event of a problem on the road. This could be particularly useful in the case of major incidents, such as road closures due to bad weather. 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 where there is a lot of traffic.

11. APPENDIX:

Source Code:

```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt


void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);

//-------credentials of IBM Accounts------

#define ORG "k0y7f8"//IBM ORGANITION ID
#define DEVICE_TYPE "ESP32_CONTROLLER"//Device type mentioned in ibm watson IOT
Platform
#define DEVICE_ID "BME280_SENSOR"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "Md22fj*aovUH7gy6Ox"      //Token
String data3;
float dist;


//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event
perform and format in which data to be send
char subscribetopic[] = "iot-2/cmd/test/fmt/String";// cmd  REPRESENT command type
AND COMMAND IS TEST OF FORMAT STRING
char authMethod[] = "use-token-auth";// authentication method
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;//client id


//-----------------------------------------
WiFiClient wifiClient; // creating the instance for wificlient
PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined
client id by passing parameter like server id,portand wificredential

int LED = 4;
int trig = 5;
int echo = 18;
void setup()
{
Serial.begin(115200);
pinMode(trig,OUTPUT);
pinMode(echo,INPUT);
pinMode(LED, OUTPUT);
delay(10);
```

```
wificonnect();
mqttconnect();
}
void loop()// Recursive Function
{

 digitalWrite(trig,LOW);
  digitalWrite(trig,HIGH);
  delayMicroseconds(10);
  digitalWrite(trig,LOW);
  float dur = pulseIn(echo,HIGH);
  float dist = (dur * 0.0343)/2;
  Serial.print ("Distancein cm");
  Serial.println(dist);


  PublishData(dist);
  delay(1000);
  if (!client.loop()) {
    mqttconnect();
  }
}



/*.....................................retrieving to
Cloud.............................*/

void PublishData(float dist) {
  mqttconnect();//function call for connecting to ibm
  /*
     creating the String in in form JSon to update the data to ibm cloud
  */
  String object;
  if (dist <100)
  {
    digitalWrite(LED,HIGH);
    Serial.println("object is near");
    object = "Near";
  }
  else
  {
    digitalWrite(LED,LOW);
    Serial.println("no object found");
    object = "No";
  }

  String payload = "{\"distance\":";
```

```
  payload += dist;
  payload += "," "\"object\":\"";
  payload += object;
  payload += "\"}";


  Serial.print("Sending payload: ");
  Serial.println(payload);




  if (client.publish(publishTopic, (char*) payload.c_str())) {
    Serial.println("Publish ok");// if it sucessfully upload data on the cloud then
it will print publish ok in Serial monitor or else it will print publish failed
  } else {
    Serial.println("Publish failed");
  }

}
void mqttconnect() {
  if (!client.connected()) {
    Serial.print("Reconnecting client to ");
    Serial.println(server);
    while (!!!client.connect(clientId, authMethod, token)) {
      Serial.print(".");
      delay(500);
    }

     initManagedDevice();
     Serial.println();
  }
}
void wificonnect() //function defination for wificonnect
{
  Serial.println();
  Serial.print("Connecting to ");

  WiFi.begin("Wokwi-GUEST", "", 6);//passing the wifi credentials to establish the
connection
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");
  Serial.println("IP address: ");
```

```
  Serial.println(WiFi.localIP());
}

void initManagedDevice() {
  if (client.subscribe(subscribetopic)) {
    Serial.println((subscribetopic));
    Serial.println("subscribe to cmd OK");
  } else {
    Serial.println("subscribe to cmd FAILED");
  }
}

void callback(char* subscribetopic, byte* payload, unsigned int payloadLength)
{

  Serial.print("callback invoked for topic: ");
  Serial.println(subscribetopic);
  for (int i = 0; i < payloadLength; i++) {
    //Serial.print((char)payload[i]);
    data3 += (char)payload[i];
  }

//   Serial.println("data: "+ data3);
//   if(data3=="Near")
//   {
// Serial.println(data3);
// digitalWrite(LED,HIGH);

//   }

//   else
//   {
// Serial.println(data3);
// digitalWrite(LED,LOW);

//   }
data3="";


}
```

Github & Project Demo Link:

GITHUB LINK:
https://github.com/IBM-EPBL/IBM-Project-43614-1660718461

PROJECT DEMO LINK:

https://drive.google.com/file/d/1dO7OSWTe7JiGDwXrmuRUO2TnkLYc6_Jb/view?usp=drivesdk