# Signs with Smart Connectivity for Better Road Safety

**Team ID: PNT2022TMID08719**

SUBMITTED BY

| | |
|---|---|
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**In partial fulfilment for the award of the degree of**
**BACHELOR OF ENGINEERING**
**in**
**ELECTRONICS AND COMMUNICATION ENGINEERING**
**Dr. MAHALINGAM COLLEGE OF ENGINEERING AND TECHNOLOGY**
**An Autonomous Institution Affiliated to ANNAUNIVERSITY**
**CHENNAI – 600 025**

# Project Report

| | |
|---|---|
| **Date** | 18 Nov 2022 |
| **Team ID** | PNT2022TMID08719 |
| **Project** | Signs with Smart Connectivity for Better Road Safety |

## 1. INTRODUCTION:

### 1.1 Project Overview:

- The Objective of this is to replace the static signboards. Instead, 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 (for Schools), Warning, and Service (Hospitals, Restaurants) signs are also displayed accordingly.

### 1.2 Purpose:

The Purpose of this project is to develop a digital sign board system where the normal signs are displayed with their actual names. And also, to create awareness of the road safety to everyone and obey the traffic rules. To create a better view and warn in the night time.

## 2. Literature Survey:

### 2.1 : Existing Problem:

- Damage criteria in static sign boards:
  - Paint deterioration ○ Folded Sheets ○ Pole Bent

  - Concealment by Vegetation

- Drivers can face confusing road signs at certain circumstances.

- The National Crime Records Bureau (NCRB) 2022 report states that there were 155,622 fatalities, highest since 2014, out of which 69,240 deaths were due to two-wheelers.

- A study by IIT Delhi points out that the national highways constitute only 2% of the length of roads in India, but they account for 30.3% of total road accidents and 36% of deaths.

- Deaths by accidents on roads increased by almost 17 per cent in 2021, indicating an increase in the rate of deaths per 1,000 vehicles.

| S.No. | Title and Author | Year and Publication | Inferences |
|---|---|---|---|
| 1. | **Wireless digital traffic signs of the future.**<br>Chai K. Toh, Juan-Carlos Cano, Carlos Fernandez-Laguia, Pietro Manzoni, Carlos T. Calafate. | 2018, Institution of Engineering and Technology (IET). | The issues and challenges facing current traffic signs, and how it will evolve into a next-generation traffic sign architecture using advanced wireless communications technologies. |
| 2. | **Traffic Sign Board Detection and Recognition using Augmented** | 2020, International Research Journal of | Real-time approach for fast and accurate |

|  |  |  |  |
|---|---|---|---|
|  | **Reality.**<br>Akshata Anant Prabhu, Deepika V.D. , Muralikrishna .N, P. Vaishnavi Acharya, A.R.Manjula | Engineering and Technology (IRJET). | framework for traffic sign recognition Which superimposes virtual objects onto a real scene under all types of driving situations, including unfavorable weather conditions and gives a voice alert with the help of speakers. |
| 3. | **Automatic Signboard Detection System by the Vehicles**<br>Anushree. A.S, Himanshu Kumar, Idah Iram, Kumar Divyam, Rajeshwari. J | 2019, IJESC. | Signboard detection system in the vehicle which will detect the signboard and warn the driver about it. It displays the alert message or information on provided LCD and voice alert through speakers. |
| 4. | **Development and Testing of Road Signs Alert System Using a Smart Mobile Phone**<br>Eric M. Masatu, Ramadhani Sinde, and Anael Sam | 2022, Hindawi Journal of Advanced Transportation). | The paper is based on the research about Advanced Driver Assistance system which is one of the salient features of intelligent system in transportation. |
| 5. | **A Wi-Fi based Electronic Road Sign for Enhancing the Awareness of Vehicle.**<br>A Bhawiyuga, R A Sabriansyah, W Yahya, R E Putra. | 2016, IOP Publishing Ltd. | Employment of vehicular network concept in which a vehicle can communicate with other vehicles or with the infrastructure installed along the road. |
| 6. | **Automatic Detection of Road Signs to Control Vehicle Speed**<br>Anuja Nanal, Pooja Motwani, | 2019, International Journal of Computer Applications. | Electronic Display controller meant for controlling vehicle speed and monitors the zones, |

| | | | |
|---|---|---|---|
| | Pragati Pawar, Rajat Nirhale, Rahul Patil. | | and which can also display the speed to the rf reader with the help of unit attached in the car. |

## 2.2 References

1. Torralba, J. P. García-Martín, J. M. González-Romo, M. García-Castellano, J. Peral-López and V. Pérez-Mira, "An Autonomous, Intelligent Sign Control System Using Wireless Communication and LED Signs for Rural and Suburban Roads," in IEEE Intelligent Transportation Systems Magazine, vol. 14, no. 2, pp. 115-128, March-April 2022, doi: 10.1109/MITS.2021.3049375.

2. Toh, C.K., Cano, J.-C., Fernandez-Laguia, C., Manzoni, P. and Calafate, C.T. (2019), Wireless digital traffic signs of the future. IET Netw., 8: 74-78. https://doi.org/10.1049/iet-net.2018.5127

3. A., Aparna & Shiravale, Sankirti. (2016). Real Time Traffic Signboard Detection and Recognition from Street Level Imagery for Smart Vehicle. International Journal of Computer Applications. 135. 18-22. 10.5120/ijca2016908267.

4. A Bhawiyuga R A Sabriansyah, W Yahya and R E Putra *et al* “A Wi-Fi based Electronic Road Sign for Enhancing the Awareness of Vehicle Driver”, in IOP Publishing Ltd 2017 *J. Phys.: Conf. Ser.* 801 012085

5. Karthikeyan D, Enitha C, Bharathi S, Durkadevi K, 2020, Traffic Sign Detection and Recognition using Image Processing, INTERNATIONAL

JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) NCICCT – 2020

(Volume 8 – Issue 08)

6. Bhawna Saini 1, Rachna Devi 2, Shilpi Dhankhar 3, Mohammad-ziaul-Haque 4, Jagandeep Kaur 5, Smart LED Display Boards, International Journal of Electronic and Electrical Engineering. ISSN 0974-2174 Volume 7, Number 10 (2014), pp. 1057-1067.

7. Ramalingam, Mritha & chandrasegar, & gowrishankar,. (2014). A survey of light emitting diode (LED) Display Board. Indian Journal of Science and Technology. 7. 185-188. 10.17485/ijst/2014/v7i2.3.

8. Eric M. Masatu, Ramadhani Sinde, Anael Sam, Development and Testing of Road Signs Alert System Using a Smart Mobile Phone, Journal of Advanced Transportation, 10.1155/2022/5829607, **2022**, (1-14), (2022).

9. Zoltán Fazekas, Gábor Balázs, Csaba Gyulai, Péter Potyondi, Péter Gáspár, Road-Type Detection Based on Traffic Sign and Lane Data, Journal of Advanced Transportation, 10.1155/2022/6766455, **2022**, (1-19), (2022).

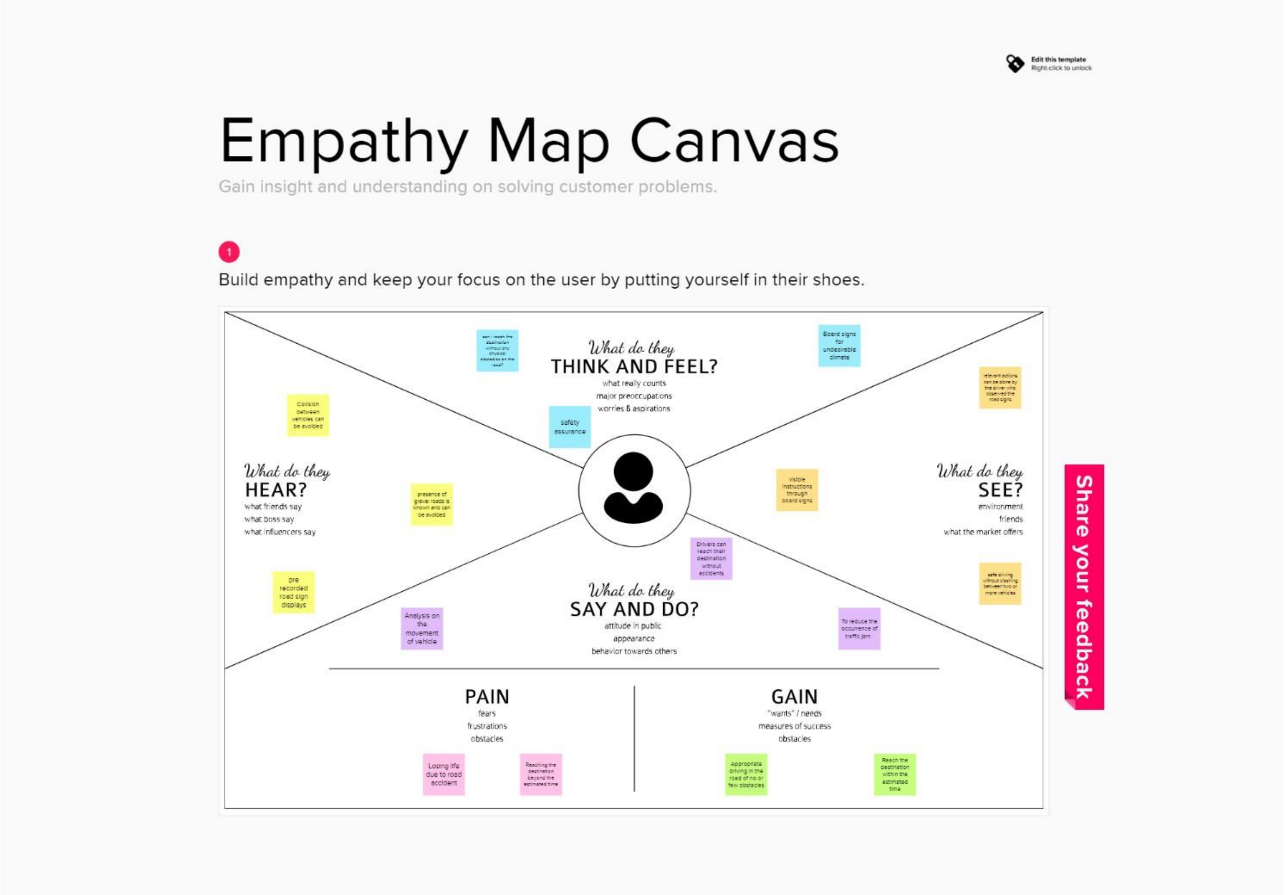
10. Juanhong Xie, Guojian Shi, Weizhi Zhu, Intelligent Recognition Technology for the Segmentation of Traffic Indication Images Concerning Different Pavement Materials, Applied Bionics and Biomechanics, 10.1155/2022/6278240, **2022**, (1-7), (2022).

## 2.3. Problem Statement Definition:

To replace the static signboards, with smart connected digital sign boards. These smart connected sign boards get the speed limitations from weather API and update automatically. Based on the weather changes the speed may increase or decrease. It will display the normal signs in necessary places with wordings to be aware of the signs. Based on the traffic and fatal situations the diversion signs are displayed. Guide (Schools), Warning and Service (Hospitals, Restaurant) signs are also displayed accordingly. Change of modes will take place automatically.

# 3. Ideation and Proposed Solution:

## 3.1. Empathy Map Canvas:



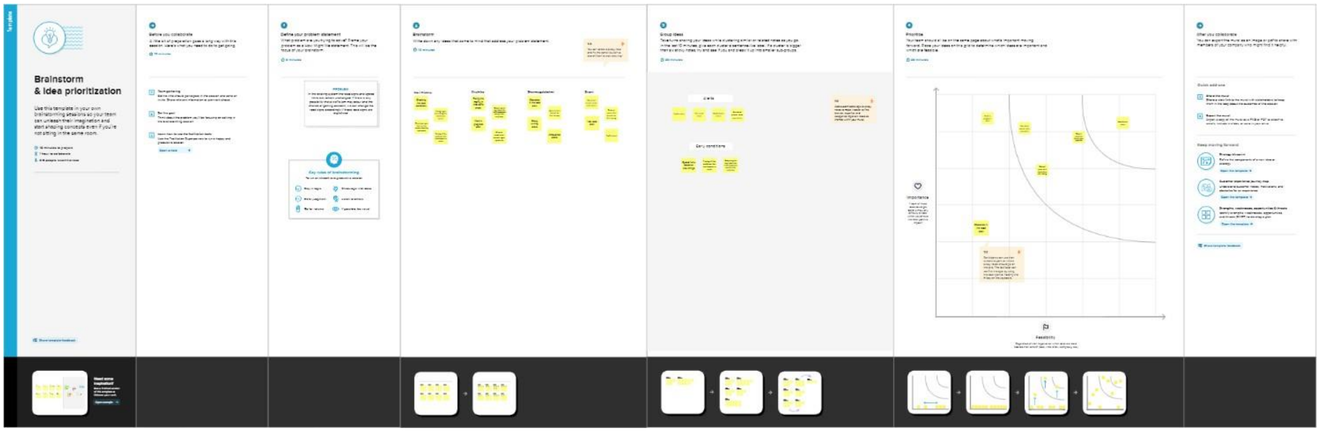
Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1 Build empathy and keep your focus on the user by putting yourself in their shoes.

Edit this template
Right-click to unlock
What do they THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
can i reach the destination without any physical obstacles on the road?
safety assurance
Board signs for undesirable climate
What do they HEAR?
what friends say
what boss say
what influencers say
Collision between vehicles can be avoided
presence of gravel roads is known and can be avoided
pre recorded road sign displays
What do they SEE?
environment
friends
what the market offers
relevant actions can be done by the driver who observed the road signs
visible instructions through board signs
safe driving without clashing between two or more vehicles
What do they SAY AND DO?
attitude in public
appearance
behavior towards others
Analysis on the movement of vehicle
Drivers can reach their destination without accidents
To reduce the occurrence of traffic jam
PAIN
fears
frustrations
obstacles
Losing life due to road accident
Reaching the destination beyond the estimated time
GAIN
"wants" / needs
measures of success
obstacles
Appropriate driving in the road of no or few obstacles
Reach the destination within the estimated time
Share your feedback

## 3.2. Ideation & Brainstorming:



Brainstorm
& idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Before you collaborate

Define your problem statement

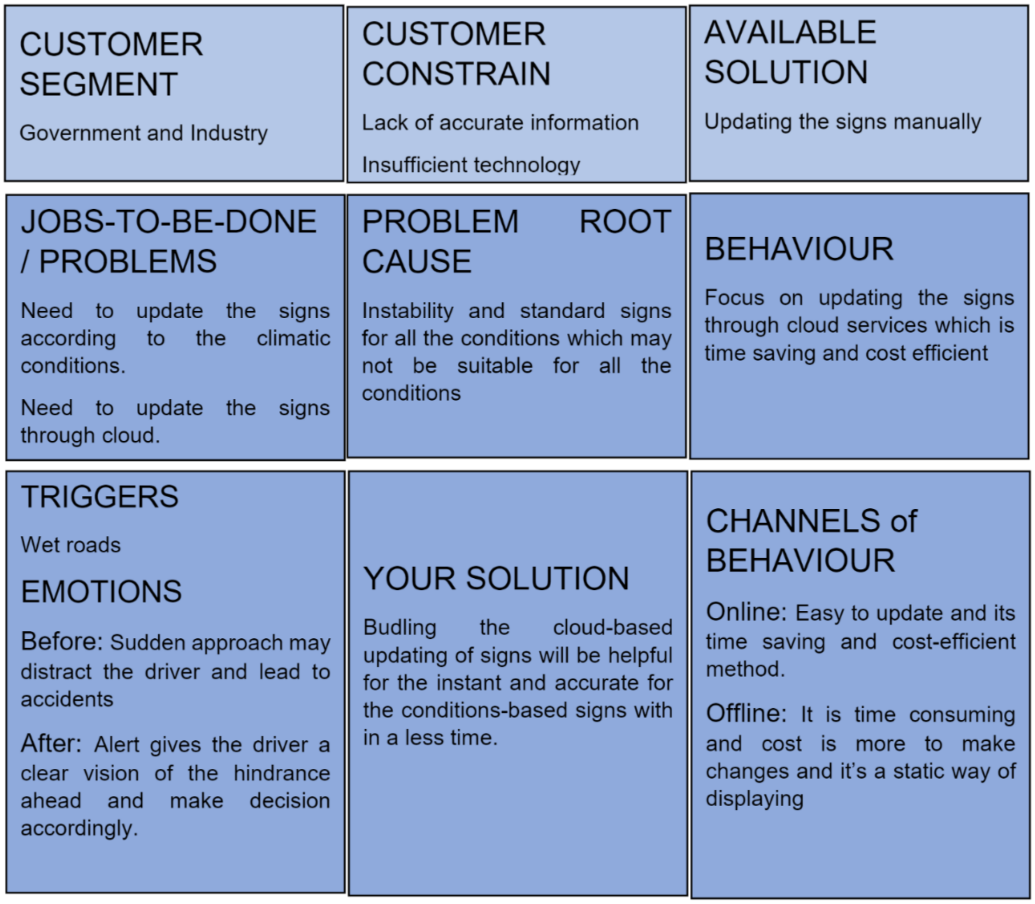
Key rules of brainstorming

## 3.3. Proposed Solution:

| S.No. | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | 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. |

| | | |
|---|---|---|
| 2. | Idea / Solution description | The Idea is to replace the static signboards. Instead, 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 (for Schools), Warning and Service (Hospitals, Restaurant) signs are also displayed accordingly. Additionally, Speed camera integrated with image processing technique is added to detect any traffic speed violations and charge fines. |
| 3. | Novelty / Uniqueness | Usage of speed camera integrated with Image Processing technique for detection of speed violation. |
| 4. | Social Impact / Customer Satisfaction | Diversion Indication System if traffic or constructions ahead. Speed limit Instructions. Guide (for Schools), Warning and Service (Hospitals, Restaurant) signs are displayed. |
| 5. | Business Model (Revenue Model) | Since Image Processing and APIs are used for monitor, this project employs a decent business strategy and enhance services. |
| 6. | Scalability of the Solution | Low-cost Implementation and Maintenance. Durability is of the product is high. |

## 3.4. Problem Solution Fit



| | | |
|---|---|---|
| CUSTOMER SEGMENT<br>Government and Industry | CUSTOMER CONSTRAIN<br>Lack of accurate information<br>Insufficient technology | AVAILABLE SOLUTION<br>Updating the signs manually |
| JOBS-TO-BE-DONE / PROBLEMS<br>Need to update the signs according to the climatic conditions.<br>Need to update the signs through cloud. | PROBLEM ROOT CAUSE<br>Instability and standard signs for all the conditions which may not be suitable for all the conditions | BEHAVIOUR<br>Focus on updating the signs through cloud services which is time saving and cost efficient |
| TRIGGERS<br>Wet roads<br>EMOTIONS<br>Before: Sudden approach may distract the driver and lead to accidents<br>After: Alert gives the driver a clear vision of the hindrance ahead and make decision accordingly. | YOUR SOLUTION<br>Budling the cloud-based updating of signs will be helpful for the instant and accurate for the conditions-based signs with in a less time. | CHANNELS of BEHAVIOUR<br>Online: Easy to update and its time saving and cost-efficient method.<br>Offline: It is time consuming and cost is more to make changes and it's a static way of displaying |

# 4. Requirements:

## 4.1. FunctionalRequirement:

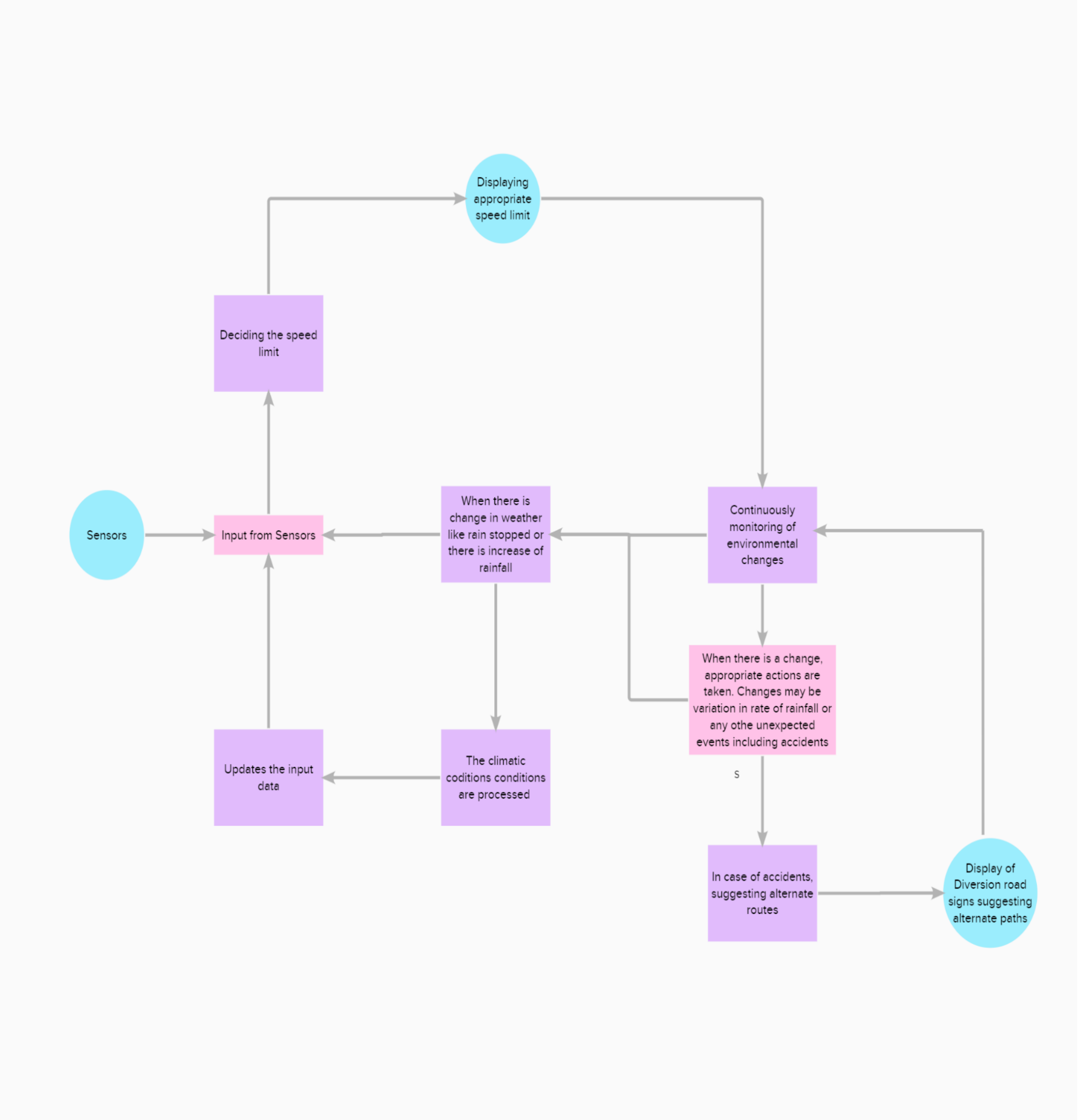
| **FR No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** |
|---|---|---|
| FR-1 | User Visibility | Sign Board will have and clear and interactive UI so that it will be clearly visible to all the users. |
| FR-2 | User Understanding | The signs that are to be displayed in the sign board will be with its respective names, so that the users can clearly understand everything |
| FR-3 | User Convenience | Signs will be displayed flawlessly such that it will be of better convenience. |

## 4.2. Non-Functional Requirement:

| **FR No.** | **Non-Functional Requirement** | **Description** |
|---|---|---|
| **NFR-1** | **Usability** | **For multiple sign display, time stamps will be allocated for each sign. It will automatic and dynamically changeable. No need for manual operations.** |
| **NFR-2** | **Security** | **Only required can will be showed. No chance of security vulnerability.** |
| **NFR-3** | **Reliability** | **More reliable than the existing system** |
| **NFR-4** | **Performance** | **Acceptable performance with dynamic updating of data regarding weather, traffic, etc.** |
| **NFR-5** | **Availability** | **It will available for working every 24/7.** |
| **NFR-6** | **Scalability** | **Implementation and Maintenance cost will be less, so that the product is highly scalable.** |

# 5. Project Design:

## 5.1. Data Flow Diagram:


Displaying appropriate speed limit
Deciding the speed limit
Sensors
Input from Sensors
When there is change in weather like rain stopped or there is increase of rainfall
Continuously monitoring of environmental changes
When there is a change, appropriate actions are taken. Changes may be variation in rate of rainfall or any othe unexpected events including accidents
s
Updates the input data
The climatic coditions conditions are processed
In case of accidents, suggesting alternate routes
Display of Diversion road signs suggesting alternate paths

## 5.2. Solution and Technical Architecture:

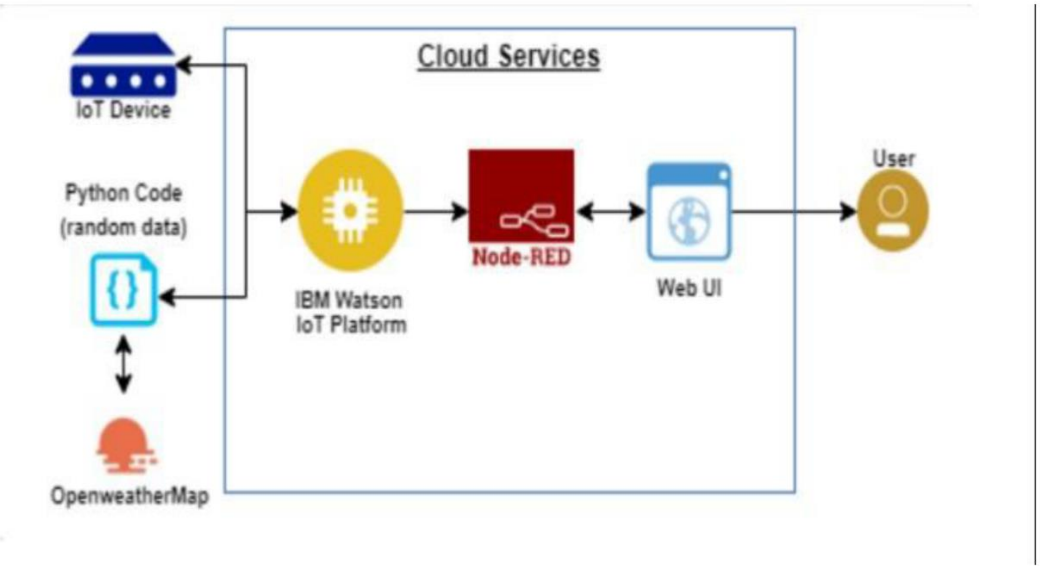
# Project Design Phase-II Technology Stack

# (Architecture & Stack)

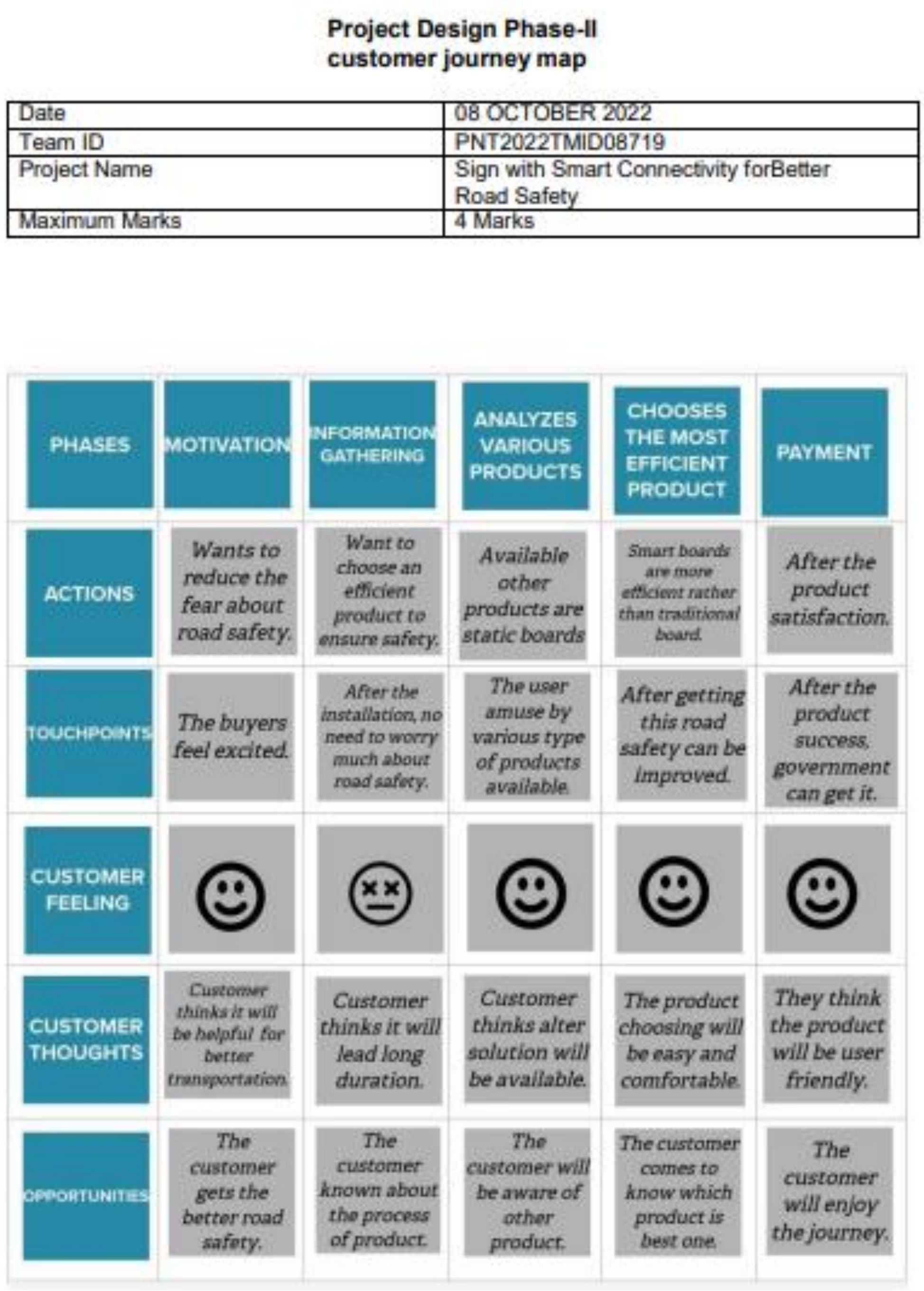
| | |
|---|---|
| Date | 10 October 2022 |
| Team ID | PNT2022TMID08719 |
| Project Name | Signs with Smart Connectivity for Better Road Safety |
| Maximum Marks | 4 Marks |

### Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information asper the table1 & table 2



## 5.3. User Stories:



**Project Design Phase-II**
**customer journey map**

| | |
|---|---|
| Date | 08 OCTOBER 2022 |
| Team ID | PNT2022TMID08719 |
| Project Name | Sign with Smart Connectivity forBetter Road Safety |
| Maximum Marks | 4 Marks |

| PHASES | MOTIVATION | INFORMATION GATHERING | ANALYZES VARIOUS PRODUCTS | CHOOSES THE MOST EFFICIENT PRODUCT | PAYMENT |
|---|---|---|---|---|---|
| ACTIONS | *Wants to reduce the fear about road safety.* | *Want to choose an efficient product to ensure safety.* | *Available other products are static boards* | *Smart boards are more efficient rather than traditional board.* | *After the product satisfaction.* |
| TOUCHPOINTS | *The buyers feel excited.* | *After the installation, no need to worry much about road safety.* | *The user amuse by various type of products available.* | *After getting this road safety can be improved.* | *After the product success, government can get it.* |
| CUSTOMER FEELING | ☺ | 😵 | ☺ | ☺ | ☺ |
| CUSTOMER THOUGHTS | *Customer thinks it will be helpful for better transportation.* | *Customer thinks it will lead long duration.* | *Customer thinks alter solution will be available.* | *The product choosing will be easy and comfortable.* | *They think the product will be user friendly.* |
| OPPORTUNITIES | *The customer gets the better road safety.* | *The customer known about the process of product.* | *The customer will be aware of other product.* | *The customer comes to know which product is best one.* | *The customer will enjoy the journey.* |

# 6. Project Planning & Scheduling:

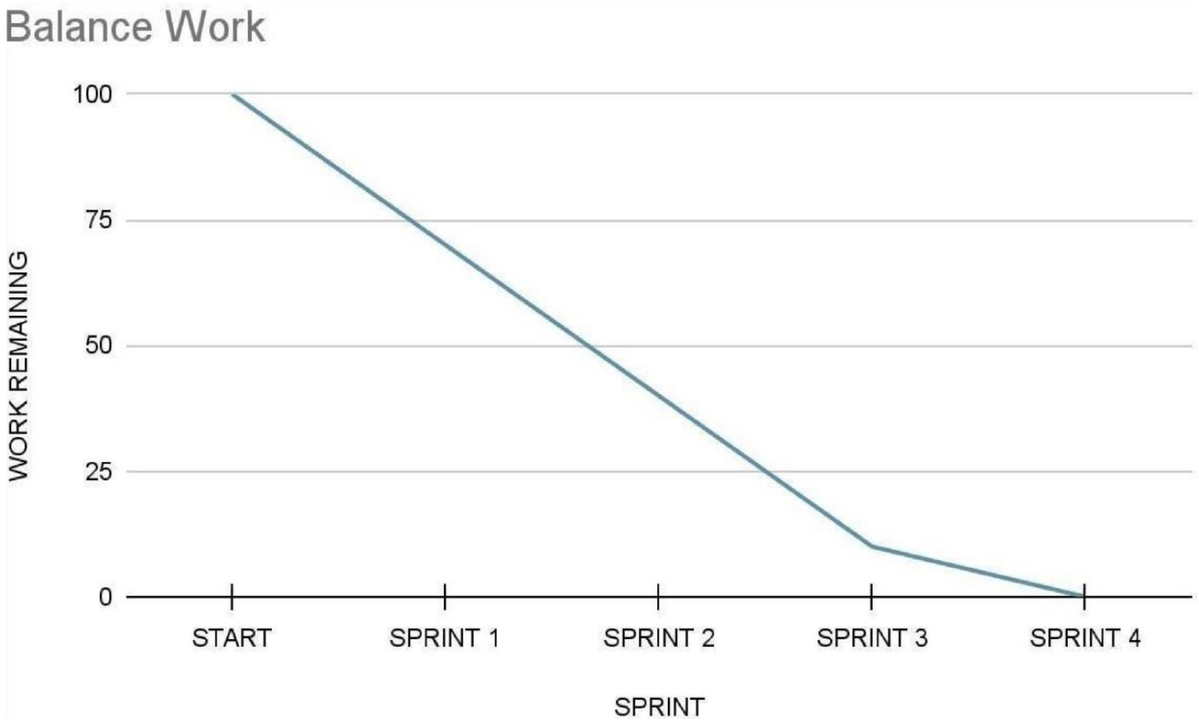
## 6.1. Sprint Planning & Estimation:

| Sprint | Functional Requirement (Epic) | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|
| Sprint-1 | Resources Initialization | Create and initialize accounts in various public APIs like Open Weather API. | 1 | LOW | KIRUTHIKA P<br>SIVANI S K<br>SHANMUGA<br>LAKSHMI M<br>HARI KRISHNA |
| Sprint-1 | Local Server/Software Run | Write a Python program that outputs results given the inputs like weather and location. | 1 | MEDIUM | KIRUTHIKA P<br>SIVANI S K<br>SHANMUGA<br>LAKSHMI M<br>HARI KRISHNA |
| Sprint-2 | Push the server/software to cloud | Push the code from Sprint 1 to cloud so it can be accessed from anywhere | 2 | MEDIUM | KIRUTHIKA P<br>SIVANI S K<br>SHANMUGA<br>LAKSHMI M<br>HARI KRISHNA |
| Sprint-3 | Hardware initialization | Integrate the hardware to be able to access the cloud functions and provide inputs to the same. | 2 | HIGH | KIRUTHIKA P<br>SIVANI S K<br>SHANMUGA<br>LAKSHMI M<br>HARI KRISHNA |
| Sprint-4 | UI / UX Optimization & Debugging | Optimize all the shortcomings and provide better user experience. | 2 | LOW | KIRUTHIKA P<br>SIVANI S K<br>SHANMUGA<br>LAKSHMI M<br>HARI KRISHNA |

## 6.2. Sprint Delivery Schedule:

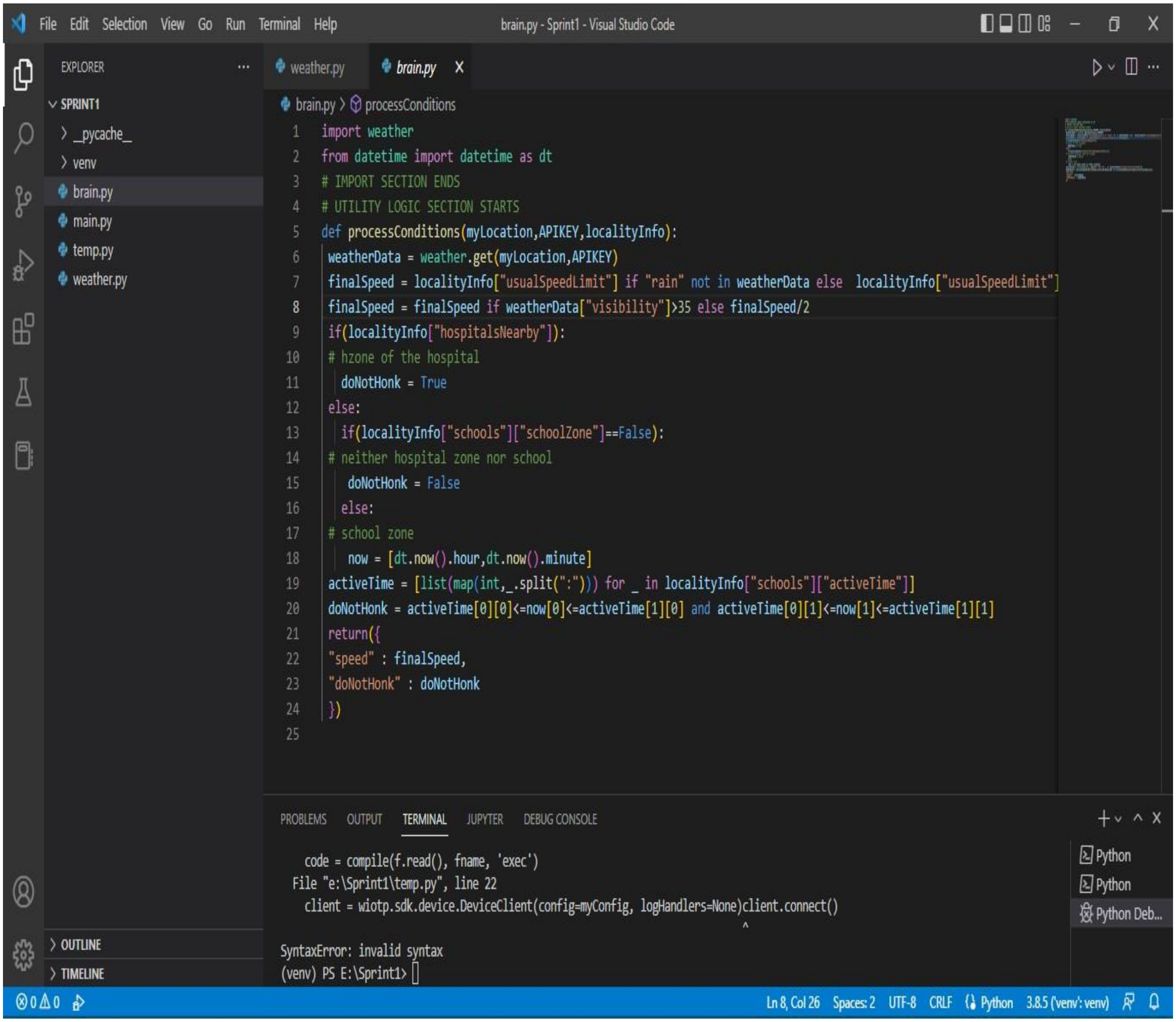
| Sprint | Total Story Points | Duration | Sprint Start Date | Sprint End Date (Planned) | Story Points Completed (as on Planned End Date) | Sprint Release Date (Actual) |
|---|---|---|---|---|---|---|
| Sprint-1 | 20 | 6 Days | 24 Oct 2022 | 29Oct 2022 | 20 | 29 Oct 2022 |
| Sprint-2 | 20 | 6 Days | 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. Balance work:



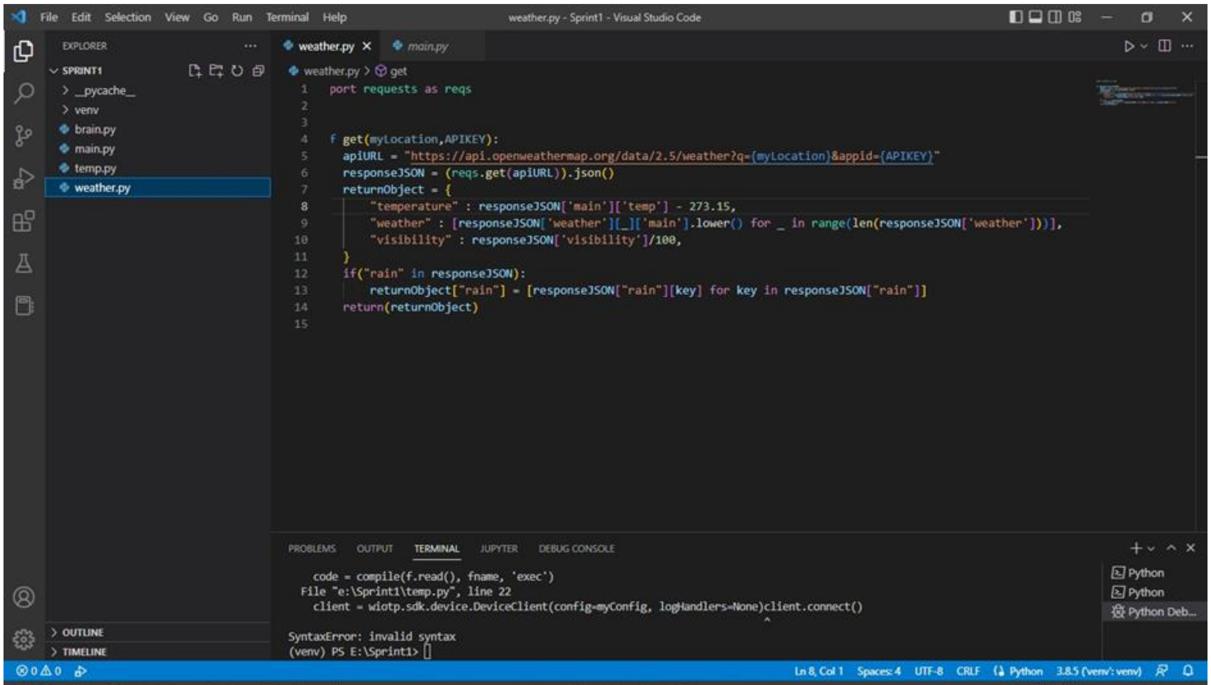
# 7. Coding & Solutioning:

## 7.1. Feature1:



```python
import weather
from datetime import datetime as dt
# IMPORT SECTION ENDS
# UTILITY LOGIC SECTION STARTS
def processConditions(myLocation,APIKEY,localityInfo):
  weatherData = weather.get(myLocation,APIKEY)
  finalSpeed = localityInfo["usualSpeedLimit"] if "rain" not in weatherData else  localityInfo["usualSpeedLimit"]
  finalSpeed = finalSpeed if weatherData["visibility"]>35 else finalSpeed/2
  if(localityInfo["hospitalsNearby"]):
  # hzone of the hospital
    doNotHonk = True
  else:
    if(localityInfo["schools"]["schoolZone"]==False):
  # neither hospital zone nor school
     doNotHonk = False
    else:
  # school zone
     now = [dt.now().hour,dt.now().minute]
  activeTime = [list(map(int,_.split(":"))) for _ in localityInfo["schools"]["activeTime"]]
  doNotHonk = activeTime[0][0]<=now[0]<=activeTime[1][0] and activeTime[0][1]<=now[1]<=activeTime[1][1]
  return({
  "speed" : finalSpeed,
  "doNotHonk" : doNotHonk
  })
```

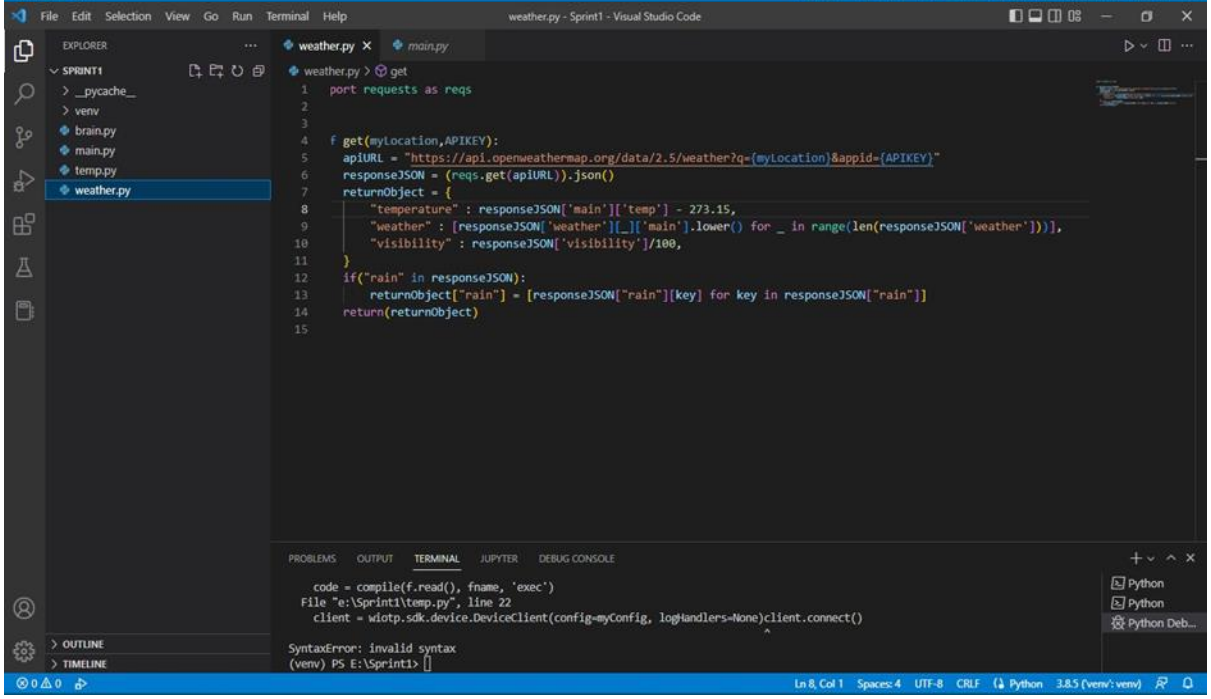
```
    code = compile(f.read(), fname, 'exec')
  File "e:\Sprint1\temp.py", line 22
    client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)client.connect()
                                                                             ^
SyntaxError: invalid syntax
(venv) PS E:\Sprint1> 
```



File Edit Selection View Go Run Terminal Help
weather.py - Sprint1 - Visual Studio Code
EXPLORER
SPRINT1
_pycache_
venv
brain.py
main.py
temp.py
weather.py
OUTLINE
TIMELINE
weather.py
main.py
weather.py > get
PROBLEMS OUTPUT TERMINAL JUPYTER DEBUG CONSOLE
Python
Python
Python Deb...
Ln 8, Col 1 Spaces: 4 UTF-8 CRLF Python 3.8.5 ('venv': venv)

```python
port requests as reqs


f get(myLocation,APIKEY):
  apiURL = "https://api.openweathermap.org/data/2.5/weather?q={myLocation}&appid={APIKEY}"
  responseJSON = (reqs.get(apiURL)).json()
  returnObject = {
      "temperature" : responseJSON['main']['temp'] - 273.15,
      "weather" : [responseJSON['weather'][_]['main'].lower() for _ in range(len(responseJSON['weather']))],
      "visibility" : responseJSON['visibility']/100,
  }
  if("rain" in responseJSON):
      returnObject["rain"] = [responseJSON["rain"][key] for key in responseJSON["rain"]]
  return(returnObject)
```

```
    code = compile(f.read(), fname, 'exec')
  File "e:\Sprint1\temp.py", line 22
    client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)client.connect()
                                                                             ^
SyntaxError: invalid syntax
(venv) PS E:\Sprint1> 
```

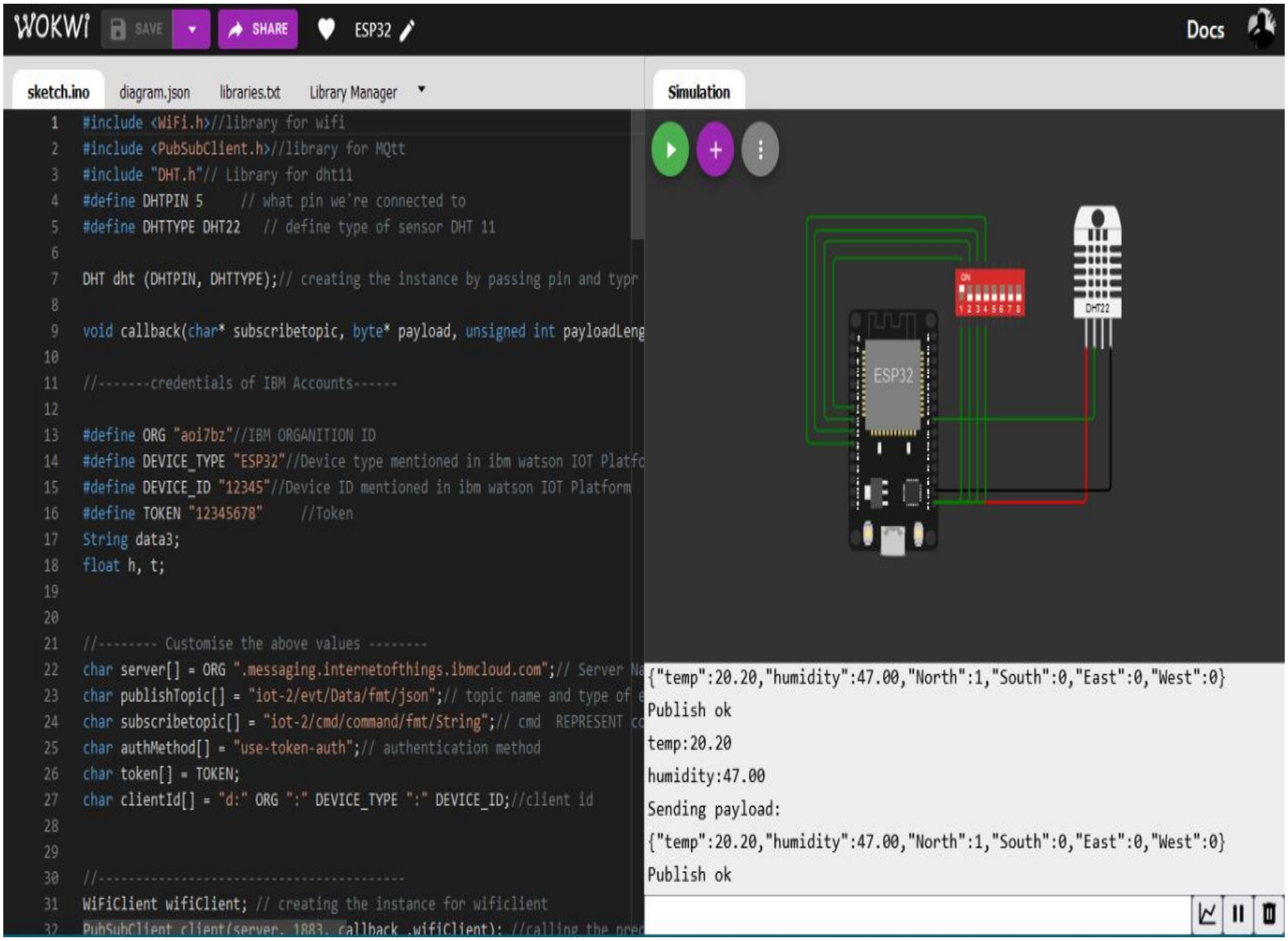


```python
port requests as reqs


f get(myLocation,APIKEY):
  apiURL = "https://api.openweathermap.org/data/2.5/weather?q={myLocation}&appid={APIKEY}"
  responseJSON = (reqs.get(apiURL)).json()
  returnObject = {
      "temperature" : responseJSON['main']['temp'] - 273.15,
      "weather" : [responseJSON['weather'][_]['main'].lower() for _ in range(len(responseJSON['weather']))],
      "visibility" : responseJSON['visibility']/100,
  }
  if("rain" in responseJSON):
      returnObject["rain"] = [responseJSON["rain"][key] for key in responseJSON["rain"]]
  return(returnObject)
```

```
    code = compile(f.read(), fname, 'exec')
  File "e:\Sprint1\temp.py", line 22
    client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)client.connect()
                                                                             ^
SyntaxError: invalid syntax
(venv) PS E:\Sprint1> 
```

## Output:

```
{
"Temperature": 20.05,
}
```



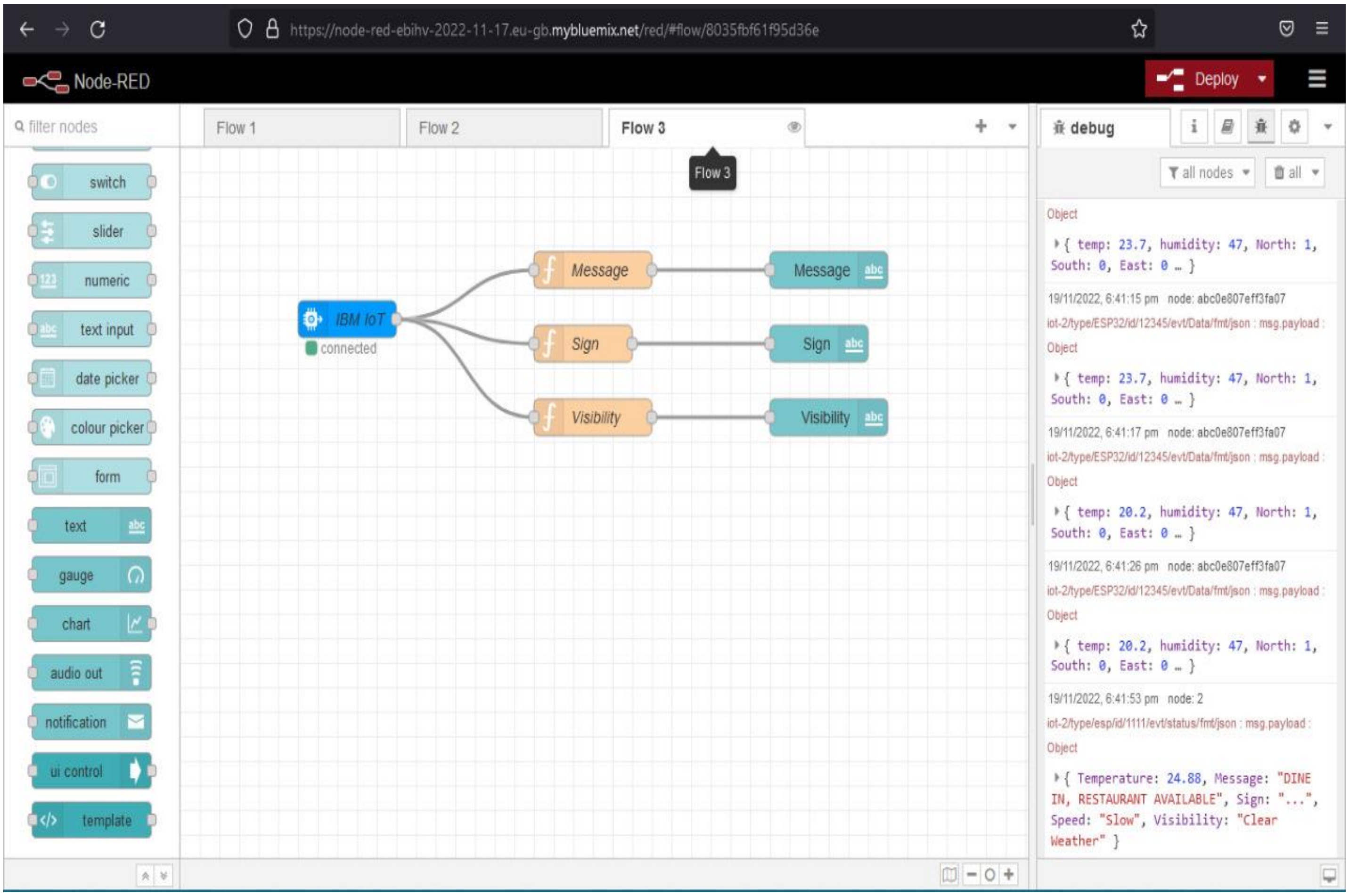
```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#include "DHT.h"// Library for dht11
#define DHTPIN 5     // what pin we're connected to
#define DHTTYPE DHT22   // define type of sensor DHT 11

DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr

void callback(char* subscribetopic, byte* payload, unsigned int payloadLeng

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

#define ORG "aoi7bz"//IBM ORGANITION ID
#define DEVICE_TYPE "ESP32"//Device type mentioned in ibm watson IOT Platfo
#define DEVICE_ID "12345"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "12345678"     //Token
String data3;
float h, t;


//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Na
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of e
char subscribetopic[] = "iot-2/cmd/command/fmt/String";// cmd  REPRESENT co
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 pred
```

```
{"temp":20.20,"humidity":47.00,"North":1,"South":0,"East":0,"West":0}
Publish ok
temp:20.20
humidity:47.00
Sending payload:
{"temp":20.20,"humidity":47.00,"North":1,"South":0,"East":0,"West":0}
Publish ok
```

Traffic data and Construction warning data are given with random inputs. Based ontraffic and construction data, warnings are displayed.

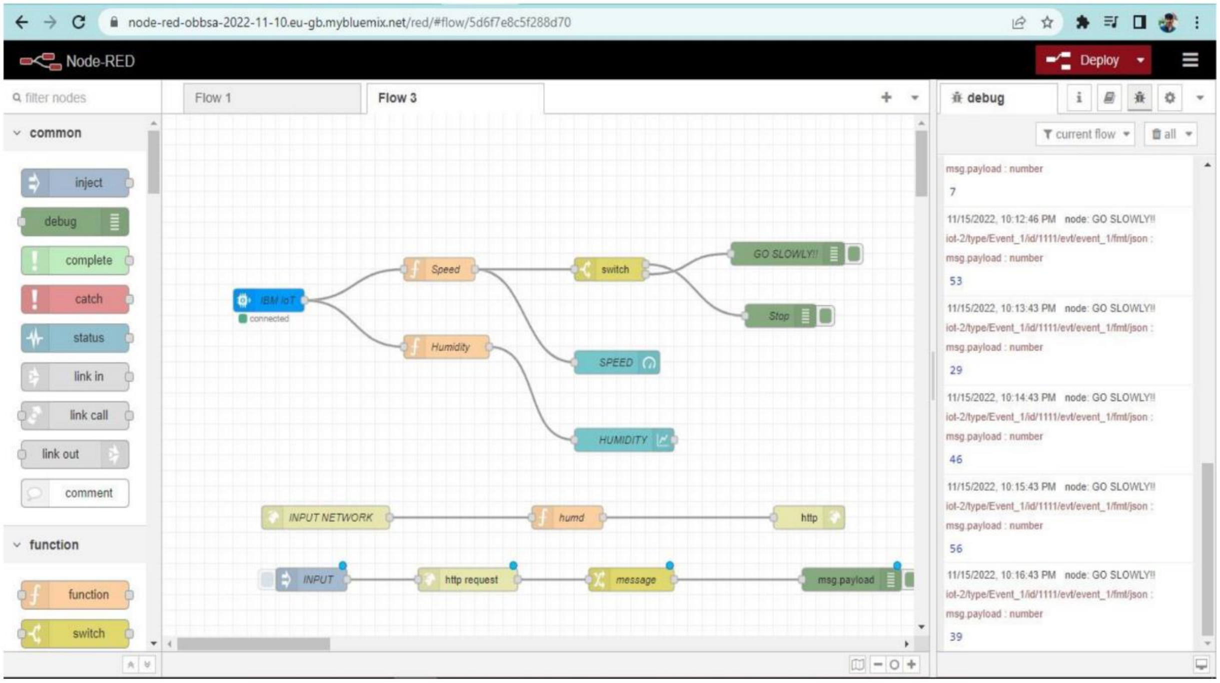
## 7..2. Feature 2:

The temperature and the location data are exactly displayed in the webpage using Node – Red and the for that is randomized using IBM Watson. A device is created for that purpose and is simulated to send data to node – red.

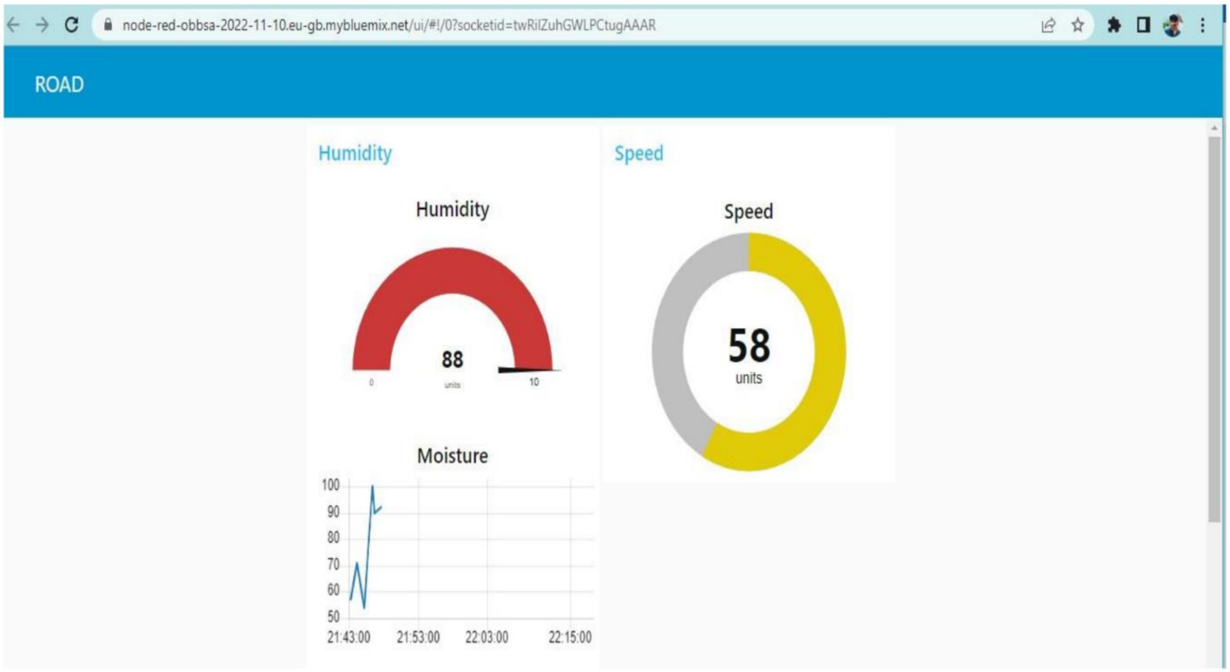


```
Object
{ temp: 23.7, humidity: 47, North: 1,
South: 0, East: 0 … }
19/11/2022, 6:41:15 pm   node: abc0e807eff3fa07
iot-2/type/ESP32/id/12345/evt/Data/fmt/json : msg.payload :
Object
{ temp: 23.7, humidity: 47, North: 1,
South: 0, East: 0 … }
19/11/2022, 6:41:17 pm   node: abc0e807eff3fa07
iot-2/type/ESP32/id/12345/evt/Data/fmt/json : msg.payload :
Object
{ temp: 20.2, humidity: 47, North: 1,
South: 0, East: 0 … }
19/11/2022, 6:41:26 pm   node: abc0e807eff3fa07
iot-2/type/ESP32/id/12345/evt/Data/fmt/json : msg.payload :
Object
{ temp: 20.2, humidity: 47, North: 1,
South: 0, East: 0 … }
19/11/2022, 6:41:53 pm   node: 2
iot-2/type/esp/id/1111/evt/status/fmt/json : msg.payload :
Object
{ Temperature: 24.88, Message: "DINE
IN, RESTAURANT AVAILABLE", Sign: "...",
Speed: "Slow", Visibility: "Clear
Weather" }
```

# Node-Red Connection and Dashboard Design

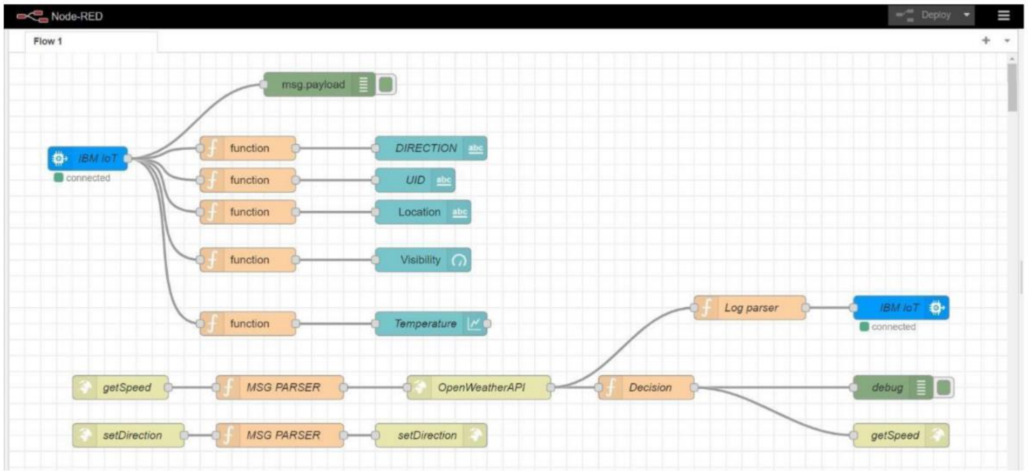


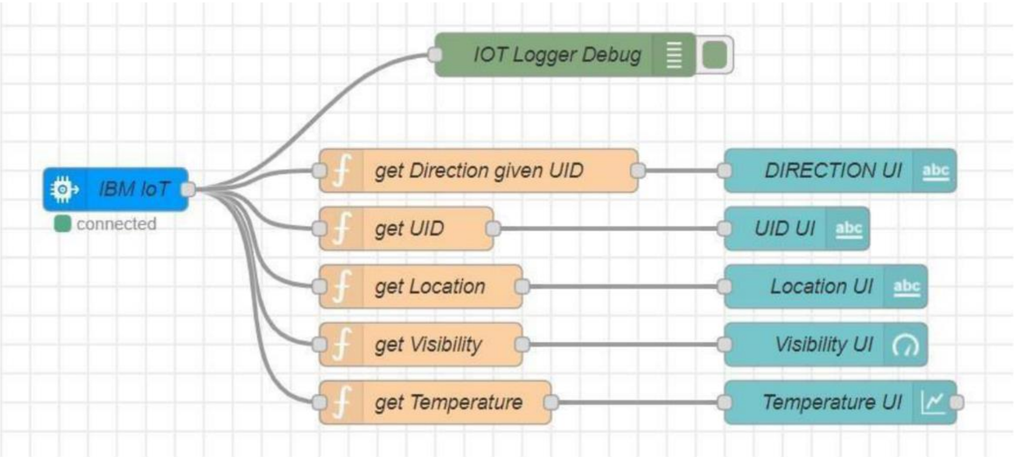
```
msg.payload : number
7
11/15/2022, 10:12:46 PM   node: GO SLOWLY!!
iot-2/type/Event_1/id/1111/evt/event_1/fmt/json :
msg.payload : number
53
11/15/2022, 10:13:43 PM   node: GO SLOWLY!!
iot-2/type/Event_1/id/1111/evt/event_1/fmt/json :
msg.payload : number
29
11/15/2022, 10:14:43 PM   node: GO SLOWLY!!
iot-2/type/Event_1/id/1111/evt/event_1/fmt/json :
msg.payload : number
46
11/15/2022, 10:15:43 PM   node: GO SLOWLY!!
iot-2/type/Event_1/id/1111/evt/event_1/fmt/json :
msg.payload : number
56
11/15/2022, 10:16:43 PM   node: GO SLOWLY!!
iot-2/type/Event_1/id/1111/evt/event_1/fmt/json :
msg.payload : number
39
```



## Node RED :

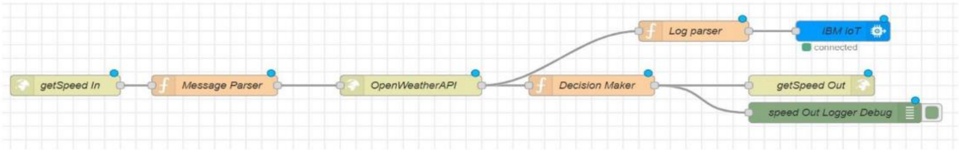
### Node RED flow :

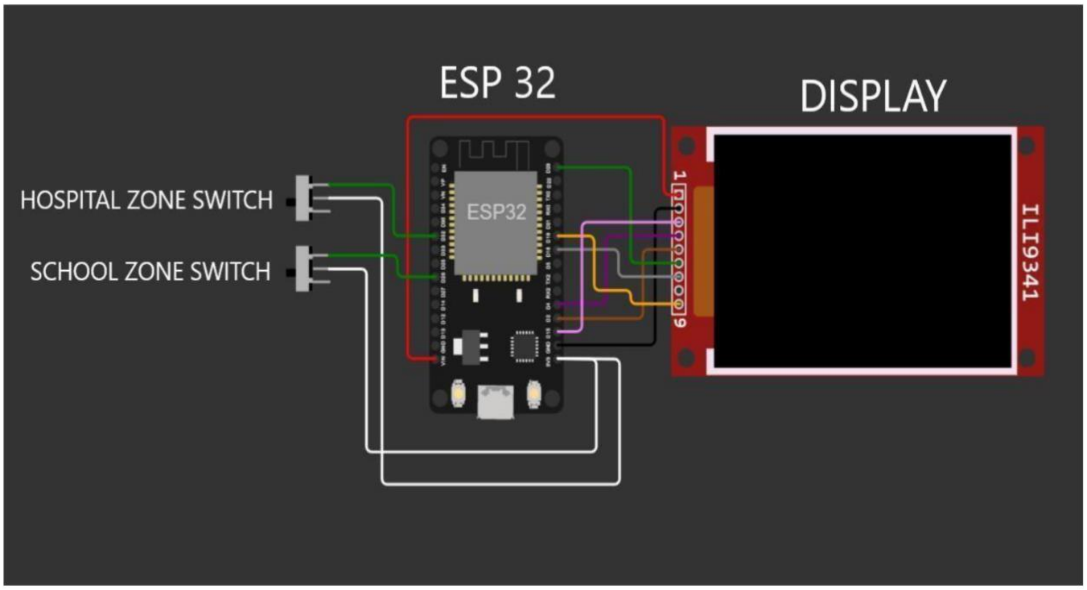




```
// get Direction given UID
msg.payload = global.get(String(msg.payload.uid)); return
msg;

// get UID msg.payload =
msg.payload.uid; return msg;

// get Location msg.payload =
msg.payload.location; return msg;

// get Visibility msg.payload =
msg.payload.visibility; return msg;

// get Temperature msg.payload =
msg.payload.temperature;
return msg;
```

**getSpeed API flow :**


getSpeed In
Message Parser
OpenWeatherAPI
Log parser
IBM IoT
connected
Decision Maker
getSpeed Out
speed Out Logger Debug


ESP 32
DISPLAY
HOSPITAL ZONE SWITCH
SCHOOL ZONE SWITCH
ESP32
1
9
ILI9341

**Esp code:**

```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#include "DHT.h"// Library for dht11
#define DHTPIN 5     // what pin we're connected to
#define DHTTYPE DHT22   // define type of sensor DHT 11

DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr of dht connected

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

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

#define ORG "aoi7bz"//IBM ORGANITION ID
#define DEVICE_TYPE "ESP32"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "12345"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "12345678"     //Token
String data3;
float h, t;



//-------- 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/command/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


void setup()// configureing the ESP32
{
  Serial.begin(115200);
  dht.begin();
  pinMode(33, INPUT); //North
  pinMode(25, INPUT); // South
  pinMode(26, INPUT); // East
  pinMode(27, INPUT); // West
  delay(10);
  Serial.println();
  wificonnect();
  mqttconnect();
}

int n, s, e, w;

void loop()// Recursive Function
{

  h = dht.readHumidity();
  t = dht.readTemperature();
  Serial.print("temp:");
  Serial.println(t);
  Serial.print("humidity:");
  Serial.println(h);

  n = digitalRead(33);
  s = digitalRead(25);
  e = digitalRead(26);
  w = digitalRead(27);

  PublishData(t, h, n, s, e, w);
  delay(1000);
  if (!client.loop()) {
    mqttconnect();
  }
}



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

void PublishData(float temp, float humid, int n, int s, int e, int w) {
  mqttconnect();//function call for connecting to ibm
  /*
     creating the String in in form JSon to update the data to ibm cloud
  */
  String payload = "{\"temp\":";
  payload += temp;
  payload += "," "\"humidity\":";
  payload += humid;
  payload += "," "\"North\":";
  payload += n;
  payload += "," "\"South\":";
  payload += s;
  payload += "," "\"East\":";
  payload += e;
  payload += "," "\"West\":";
  payload += w;
  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=="lighton")
//   {
// Serial.println(data3);
// digitalWrite(LED,HIGH);
//   }
//   else
//   {
// Serial.println(data3);
// digitalWrite(LED,LOW);
//   }
// data3="";
}
```

## 8. Testing:

### a. Test Cases:

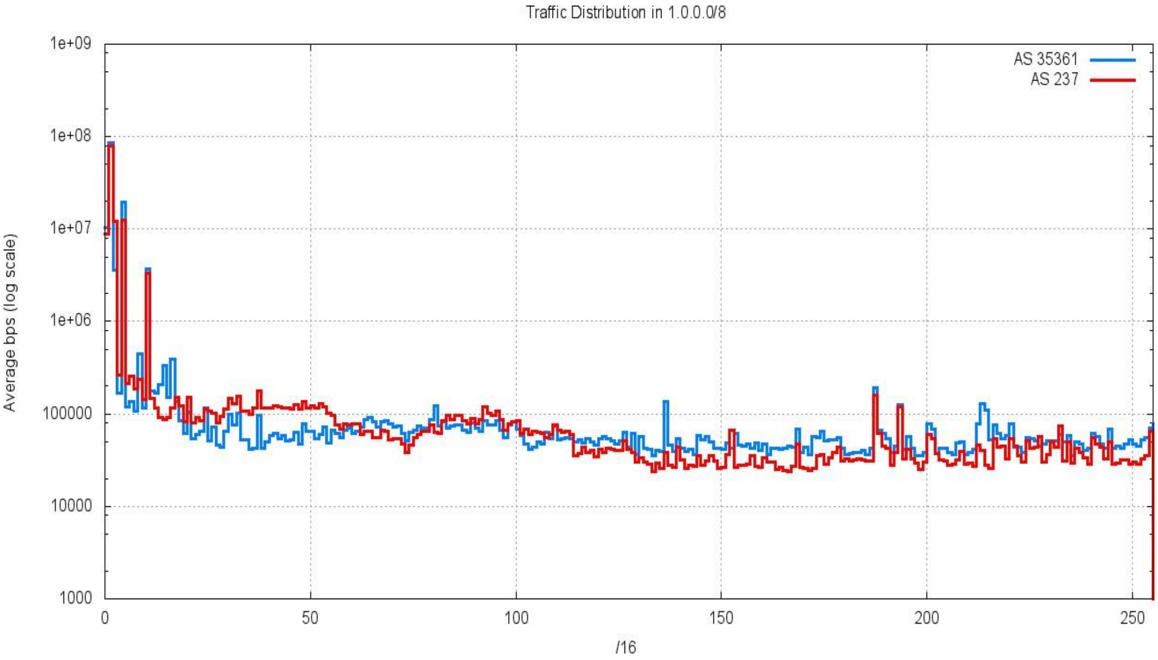
A test case documents strategy that will be used to verify and ensure that a product or system meets its design specification and other requirements. A test case is usually prepared by or with significant input from the engineer. This document describes the plans for testing the architectural prototype of System. In my Project the system has to be tested to get the Desired Output. I use different speed for testing the system.

### 8.2 User Acceptance Testing

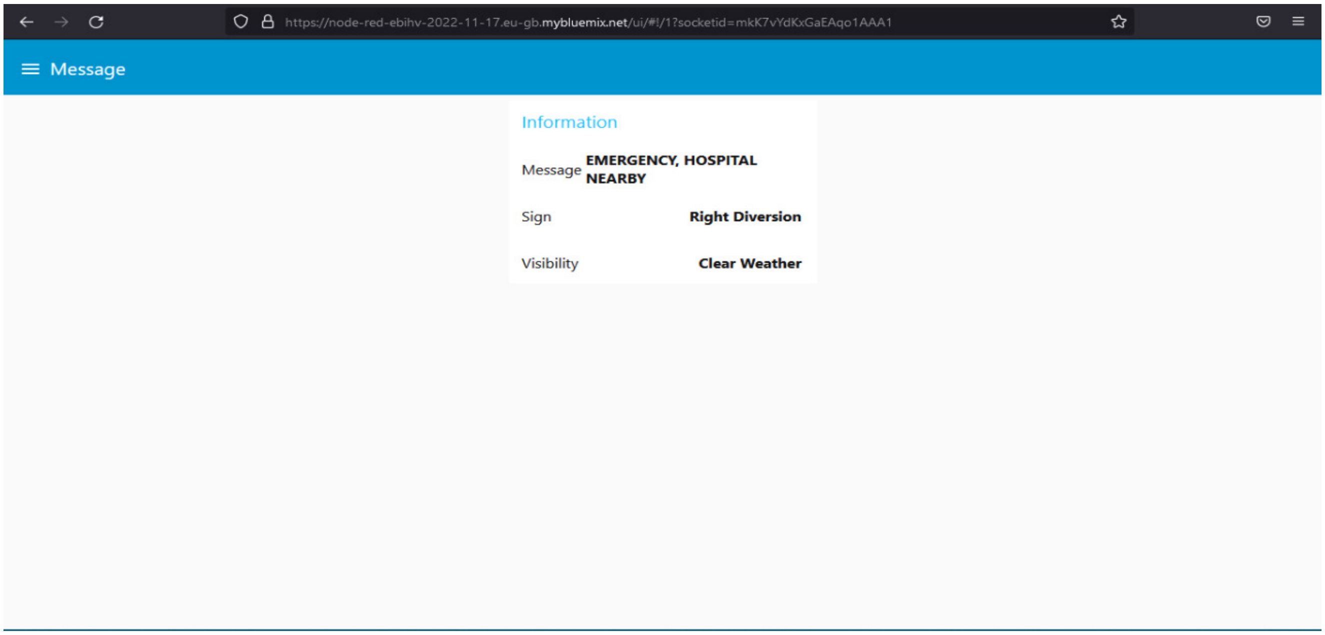
In engineering and its various sub disciplines, acceptance testing is black box testing performed on a system (e.g. software, lots of manufactured mechanical parts, or batches of chemical products) prior to its delivery. It is also known as functional testing, black-box testing, release acceptance, QA testing, application testing, confidence testing, final testing, validation testing, or factory acceptance testing. In software development, acceptance testing by the system provider is often distinguished from acceptance testing by the customer (the user or client) prior to accepting transfer of ownership. In such environments, acceptance testing performed by the customer is known as user acceptance testing (UAT). This is also known as end-user testing, site (acceptance) testing, or field (acceptance) testing. A smoke test is used as an acceptance test prior to introducing a build to the main testing process. Acceptance test cards are ideally created during sprint planning or iteration planning meeting, before development begins so that the developers have a clear idea of what to develop. Sometimes (due to bad planning!) acceptance tests may span multiple stories (that are not implemented 29 in the same sprint) and there are different ways to test them out during actual sprints. One popular technique is to mock external interfaces or data to mimick other stories which might not be played out during an iteration (as those stories may have been relatively lower business priority). A user story is not considered complete until the acceptance tests have passed. The acceptance test suite is run against the supplied input data or using an acceptance test script to direct the testers. Then the results obtained are compared with the expected results. If there is a correct match for every case, the test suite is said to pass. If not, the system may either be rejected or accepted on conditions previously agreed between the sponsor and the manufacturer. The objective is to provide confidence that the delivered system meets the business requirements of both sponsors and users. The acceptance phase may also act as the final quality gateway, where any quality defects not previously detected may be uncovered. In these testing procedures the project is given to the customer to test whether all requirements have been fulfilled and after the user is fully satisfied. The project is perfectly ready. If the user makes request for any change and if they found any errors those all errors has to be taken into consideration and to be correct it to make a project a perfect project.

# 9. Results:

## 9.1. Performance Metrics:



# OUTPUT:

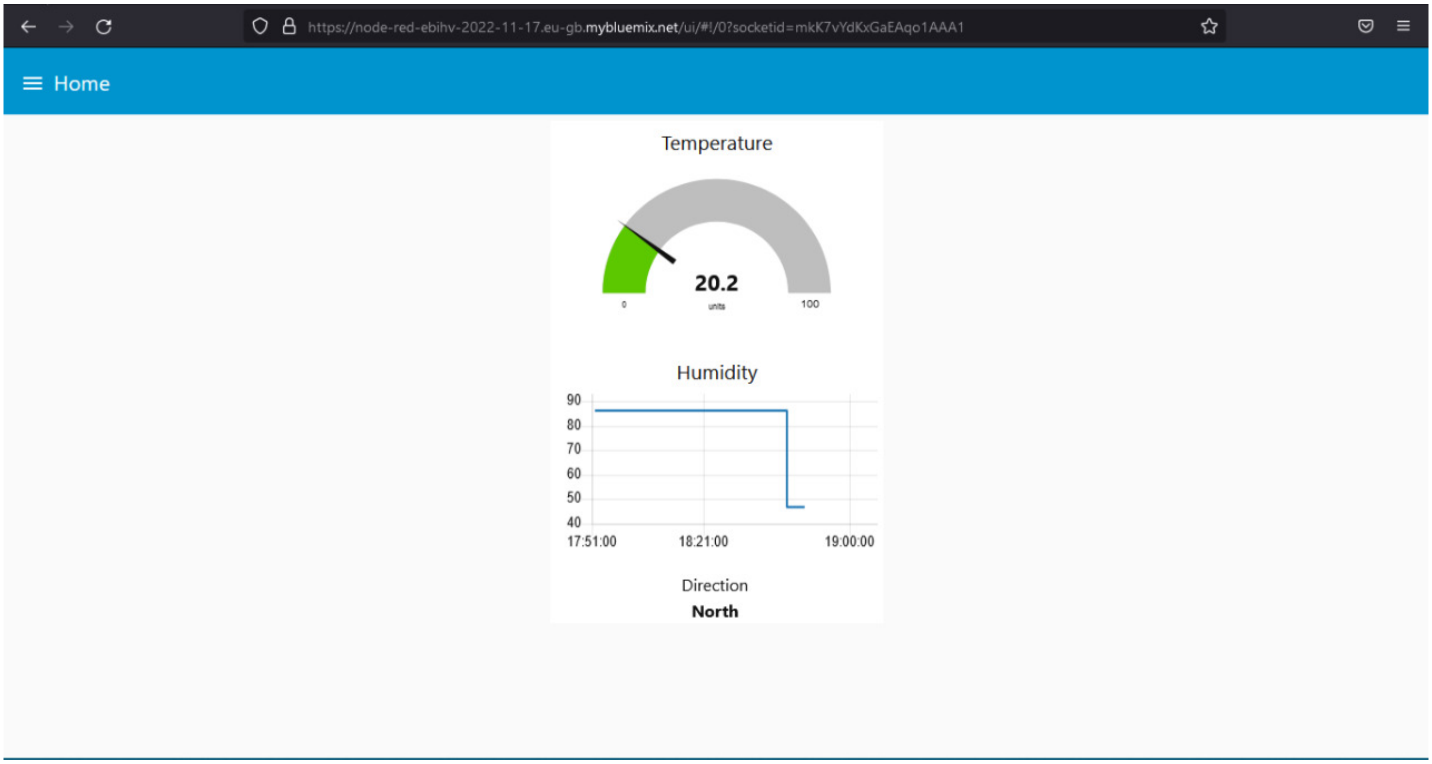

https://node-red-ebihv-2022-11-17.eu-gb.mybluemix.net/ui/#!/1?socketid=mkK7vYdKxGaEAqo1AAA1
Message

Information

Message EMERGENCY, HOSPITAL NEARBY

Sign Right Diversion

Visibility Clear Weather


https://node-red-ebihv-2022-11-17.eu-gb.mybluemix.net/ui/#!/0?socketid=mkK7vYdKxGaEAqo1AAA1
Home
Temperature
20.2
units
0
100
Humidity
90
80
70
60
50
40
17:51:00
18:21:00
19:00:00

Direction

North

## 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.
- The digital signboards help 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 involve 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 sign boards 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.

## 11. Conclusion:

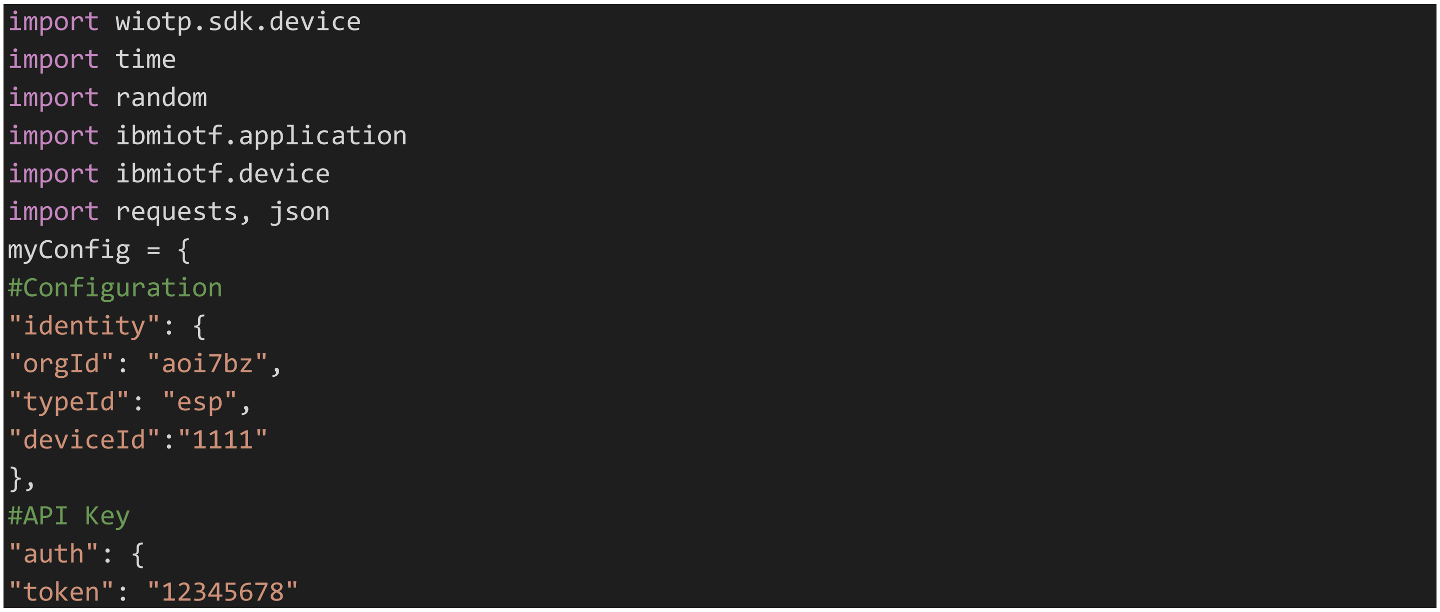
The project concluded by replacing the static signboards with smart connected digital sign boards. Digital road signs are an important part of modern infrastructure and are becoming increasingly common. Digital road signs are becoming more common as technology improves and more states adopt them. The 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 static signs.

## 12. Future Scope:

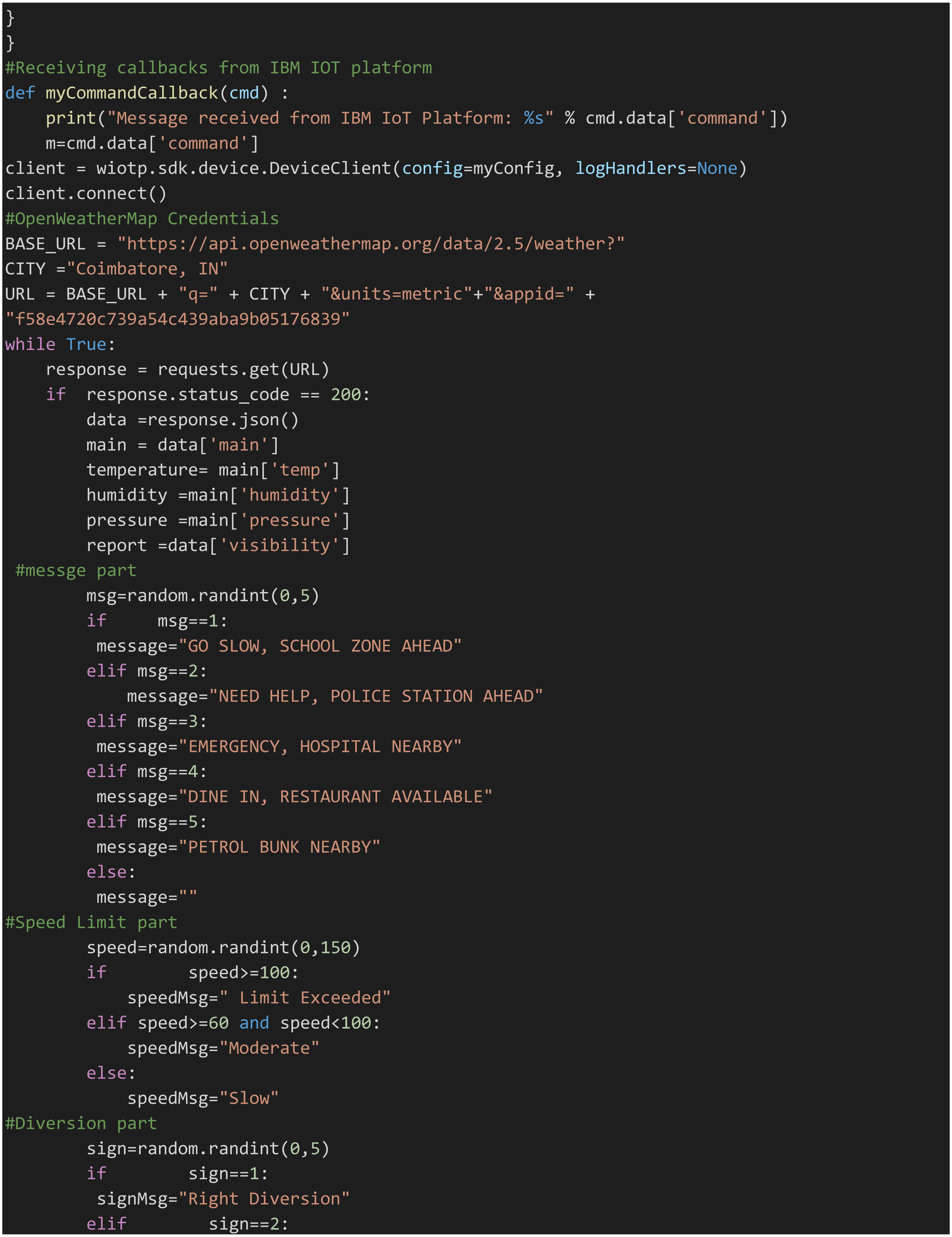
- In the future a speed cam will be integrated with the digital sign board.
- Using Image processing & AI, the details of the driver who breaks the traffic rules will be updated in the cloud database.
- No parking and One way rule violations can also be detected and appropriate action can be taken.  Violations of stop signs in intersection will also be detected using AI.

## 13. Appendix:

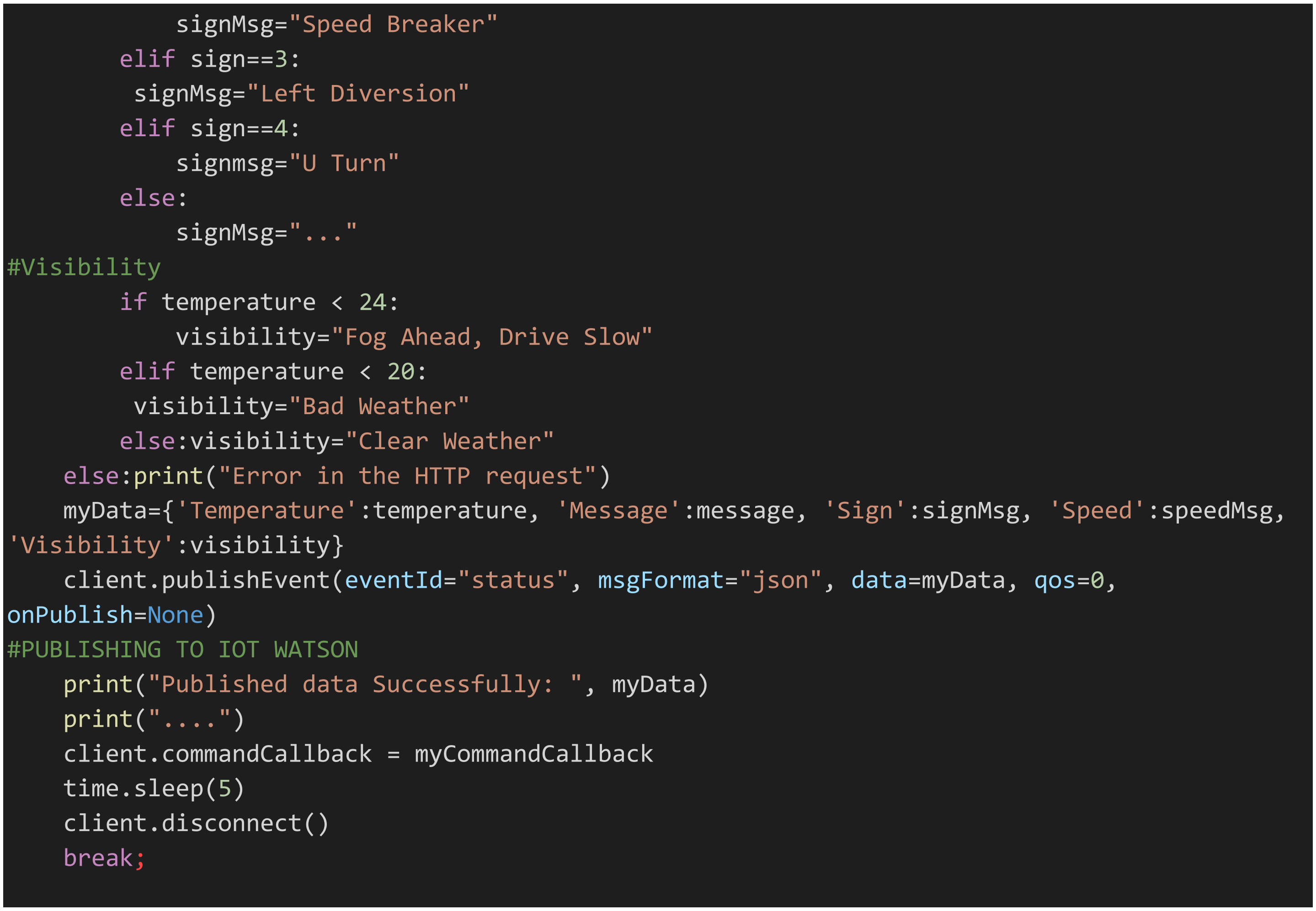
**Code:**



```
import wiotp.sdk.device
import time
import random
import ibmiotf.application
import ibmiotf.device
import requests, json
myConfig = {
#Configuration
"identity": {
"orgId": "aoi7bz",
"typeId": "esp",
"deviceId":"1111"
},
#API Key
"auth": {
"token": "12345678"
```



```
}
}
#Receiving callbacks from IBM IOT platform
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 ="Coimbatore, IN"
URL = BASE_URL + "q=" + CITY + "&units=metric"+"&appid=" +
"f58e4720c739a54c439aba9b05176839"
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, RESTAURANT 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"
        elif temperature < 20:
         visibility="Bad Weather"
        else:visibility="Clear Weather"
    else:print("Error in the HTTP request")
    myData={'Temperature':temperature, 'Message':message, 'Sign':signMsg, '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)
    print("....")
    client.commandCallback = myCommandCallback
    time.sleep(5)
    client.disconnect()
    break;
```

GitHub Project Link-

https://github.com/IBM-EPBL/IBM-Project-6999-1658844863