SIGNS WITH SMART CONNECTIVITY FOR

BETTER ROAD SAFETY

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1. **Introduction:**

**1.1 Project Overview**

Roads are the foremost source of linking between cities and villages. Due to the ease of traveling by road, vehicles have become the main way people travel. The chances of vehicular accidents (Vas) have increased with the growing number of vehicles on the roads. During a journey, one does not know what will happen on the next road, particularly during bad weather conditions (BWC). In such a situation, driving can be difficult due to bad visibility, which can lead to an accident. It was also noticed that in BWC, multiple vehicle collisions (MVCs) can occur owing to delays in receiving information about an incident. According to one study by the Islamabad police, there were 9582 accidents from 2016 to 2017 all over Pakistan, involving 11,317 vehicles, leading to 5047 fatalities and 12,696 persons injured

Digital technologies like the Internet of Things (IoT) are reshaping road safety measures. Many technology initiatives are undertaken the world over to make smarter and safer roads, the ones that can interact with traffic and pedestrians. Assuming that by giving in vehicle technology information to the driver, accidents can be averted, several technology-based products have been developed. The latest technology researchers are working on is based on the Internet of Things (IoT). IoT is all about data. Data is becoming a valuable resource for our world.

Many sectors and industries have adopted IoT to reduce errors and improve performance in manufacturing, energy, health care, and communication. A cornerstone of these steps is realizing economic systems for “monitoring road safety by strengthening data systems”. Meanwhile, a key theme in the package is motivating the adoption of a Safe System approach, which is a holistic approach to road safety that parts from traditional management solutions by emphasizing safety by design.

Mobile-phone-based applications use built-in sensor data to detect the speed limit based on environmental situations.

The risks for of life, injuries, and other damage may increase if an incident is not reported to an EOC in a timely fashion. Lives can be saved by sending timely information about an accident through an automated mechanism. Moreover, quick automobile accident detection and an alert system are required to protect approaching vehicles against an MVC. Several methods have been implemented in advanced vehicles (Avs) for avoiding an accident. An accident threat is detected through sensors installed in vehicles or by using smartphone sensors. Previous researchers have used accelerometers, smoke detectors, infrared (IR) obstacle sensors, proximity sensors, and biosensors to detect an accident.

# 1.2 Purpose:

# A large amount of research is being carried out in the domain of accident avoidance and accident alarms by a large number of researchers and practitioners. To avoid accidents, many approaches are utilized to enhance safety. For ease of reference, the literature on accident detection and avoidance is separated into three approaches: stand-alone, cooperative, and hybrid. Stand-alone approaches use sensors, such as radar and light detection and ranging (LiDAR), for accident avoidance and detection, whereas cooperative approaches rely on V2X technology and hybrid approaches. The project tries stand-alone approach where we use sensors to predict the weather conditions of the area and display them on digital boards. (We have used an API to get weather conditions of the place)

# LITERATURE SURVEY:

* 1. **Existing Problems**

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. There are a lot of problems that drivers face while driving in highways cause of bad weather condition lead to accidents, Tree’s falling which halts traffic and time is wasted. There are a lot of vehicles which are driven far past the speed limit which cause accidents so to speed sensors are placed to alert authorities about over speeding a lot of other ideas can

be added according to problems that arises

# 2.2 REFERENCE:

1. World Health Organization, “Global status report on road safety 2015, ‘[https://www.who.int/violence\_injury\_prevention/road\_safety\_status/20](https://www.who.int/violence_injury_prevention/road_safety_status/20%20) [15/en/](https://www.who.int/violence_injury_prevention/road_safety_status/2015/en/)' View at: [GoogleScholar](https://scholar.google.com/scholar_lookup?title=Global%20status%20report%20on%20road%20safety%202015&author=World%20Health%20Organization)
2. World Health Organization, “Decade of Action for Road Safety 2011-2020 seeks to save millions of lives,” <http://www.who.int/roadsafety/decade_of_action/en/>

View at: [Publisher Site |](https://doi.org/10.18356/36e51ced-en) [Google Scholar](https://scholar.google.com/scholar_lookup?title=Decade%20of%20Action%20for%20Road%20Safety%202011-2020%20seeks%20to%20save%20millions%20of%20lives&author=World%20Health%20Organization)

1. F. Wegman, “The future of road safety: A worldwide perspective,” *IATSSResearch*, vol. 40, no. 2, pp. 66–71,2017.

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1. World Health Organization, “Save LIVES-A road safety technical package,”2017. View at: [Google Scholar](https://scholar.google.com/scholar_lookup?title=Save%20LIVES%20-%20A%20road%20safety%20technical%20package&author=World%20Health%20Organization)
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1. “Open Street Maps, with New York County highlighted,” [https://www.openstreetmap.org/relation/2552485.](https://www.openstreetmap.org/relation/2552485)

View at: [Google Scholar](https://scholar.google.com/scholar_lookup?title=Open%20Street%20Maps%2C%20with%20New%20York%20County%20highlighte)

1. United States Census Bureau, “TIGER/Line® Shapefiles: Roads,” <https://www.census.gov/cgi-> [bin/geo/shapefiles/index.php?year=2018&amp;layergroup=Roads.](https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2018&amp%3Blayergroup=Roads) View at: [Google](https://scholar.google.com/scholar_lookup?title=TIGER%2FLine%26%23xae%3B%20Shapefiles%3ARoads&author=United%20States%20Census%20Bureau) [Scholar](https://scholar.google.com/scholar_lookup?title=TIGER%2FLine%26%23xae%3B%20Shapefiles%3ARoads&author=United%20States%20Census%20Bureau)
2. X. Wang, X. Wu, M. Abdel-Aty, and P. J. Tremont, “Investigation of road network features and safety performance,” *Accident Analysis & Prevention*, vol. 56, pp. 22–31,2013. View at: [Publisher Site |](https://doi.org/10.1016/j.aap.2013.02.026) [Google Scholar](https://scholar.google.com/scholar_lookup?title=Investigation%20of%20road%20network%20features%20and%20safety%20performance&author=X.%20Wang&author=X.%20Wu&author=M.%20Abdel-Aty&author=P.%20J.%20Tremont&publication_year=2013)
3. European Road Assessment Program (EuroRAP), “European Road Safety Atlas,” <http://atlas.eurorap.org/>.

View at: [Google Scholar](https://scholar.google.com/scholar_lookup?title=European%20Road%20Safety%20Atlas&author=European%20Road%20Assessment%20Program%20(EuroRAP))

1. European Road Assessment Program (EuroRAP), “Star Ratings,” <http://www.eurorap.org/protocols/star-ratings/.>
2. International Road Assessment Program (iRAP),“iRAP,”[https://www.irap.org/.](https://www.irap.org/) View at: [Google](https://scholar.google.com/scholar_lookup?title=iRAP&author=International%20Road%20Assessment%20Programme%20(iRAP)) [Scholar](https://scholar.google.com/scholar_lookup?title=iRAP&author=International%20Road%20Assessment%20Programme%20(iRAP))
3. H.M.Hassanand H.Al-Faleh,“Exploring the risk factors associated with the size and severity of roadway crash in Riyadh,” *Journal of Safety Research*, vol. 47, pp. 67–74,2013.

View at: [Publisher Site |](https://doi.org/10.1016/j.jsr.2013.09.002) [Google Scholar](https://scholar.google.com/scholar_lookup?title=Exploring%20the%20risk%20factors%20associated%20with%20the%20size%20and%20severity%20of%20roadway%20crashes%20in%20Riyadh&author=H.%20M.%20Hassan&author=H.%20Al-Faleh&publication_year=2013)

1. E. Ahmed, I. Yaqoob, A. Gani, M. Imran, and M. Guizani, “Internet-of-things- based smart environments: State of the art, taxonomy, and open research challenges,” *IEEE Wireless Communications Magazine*, vol. 23, no. 5, pp. 10– 16, 2016. View at: [Publisher Site |](https://doi.org/10.1109/MWC.2016.7721736) [Google Scholar](https://scholar.google.com/scholar_lookup?title=Internet-of-things-based%20smart%20environments%3A%20State%20of%20the%20art%2C%20taxonomy%2C%20and%20open%20research%20challenges&author=E.%20Ahmed&author=I.%20Yaqoob&author=A.%20Gani&author=M.%20Imran&author=M.%20Guizani&publication_year=2016)

**2.3 Problem Statement Definition**

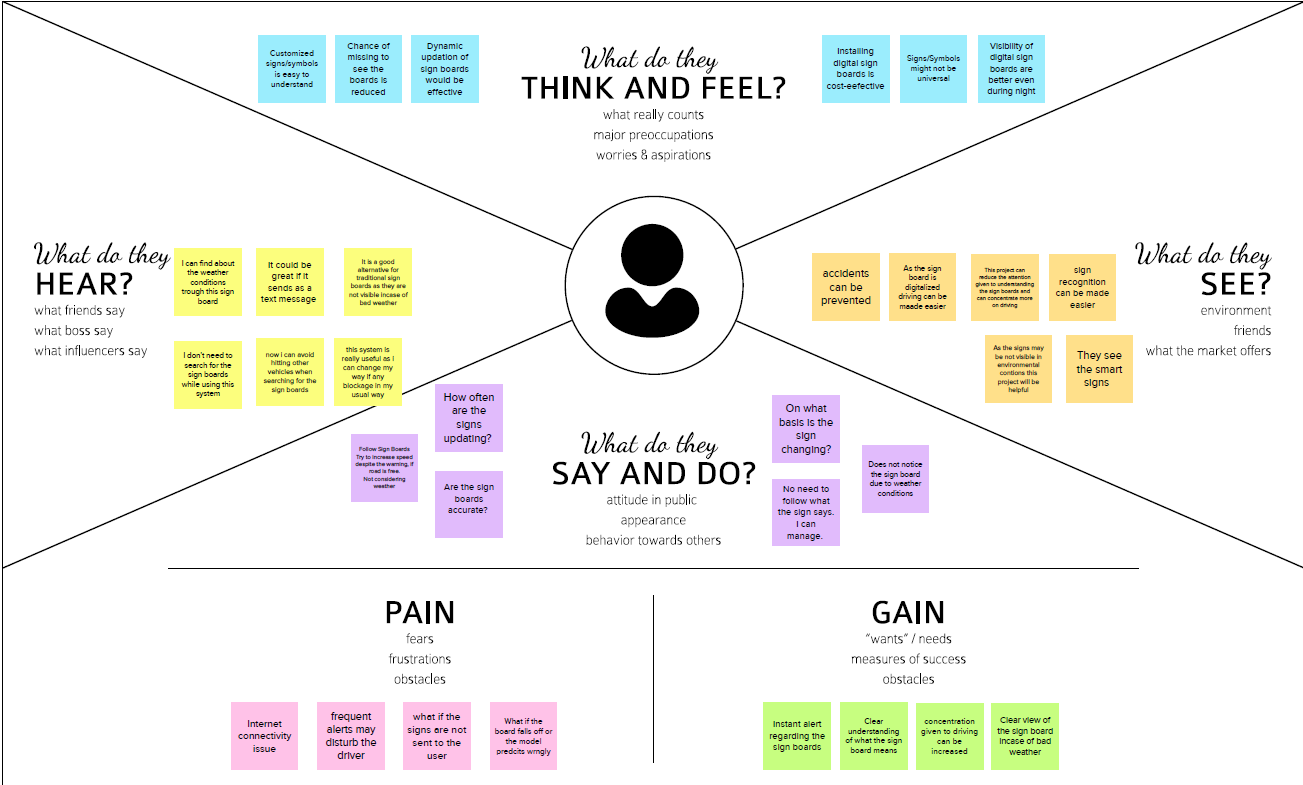
A problem statement is a concise description of an issue to be addressed or a condition to be improved upon. It identifies the gap between the current (problem) state and desired (goal) state of a process or product. Focusing on the facts, the problem statement should be designed to address the [Five Ws.](https://en.wikipedia.org/wiki/Five_Ws) The first condition of solving a problem is understanding the problem, which can be done by way of a problem statement.

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. Weather API hosts informat

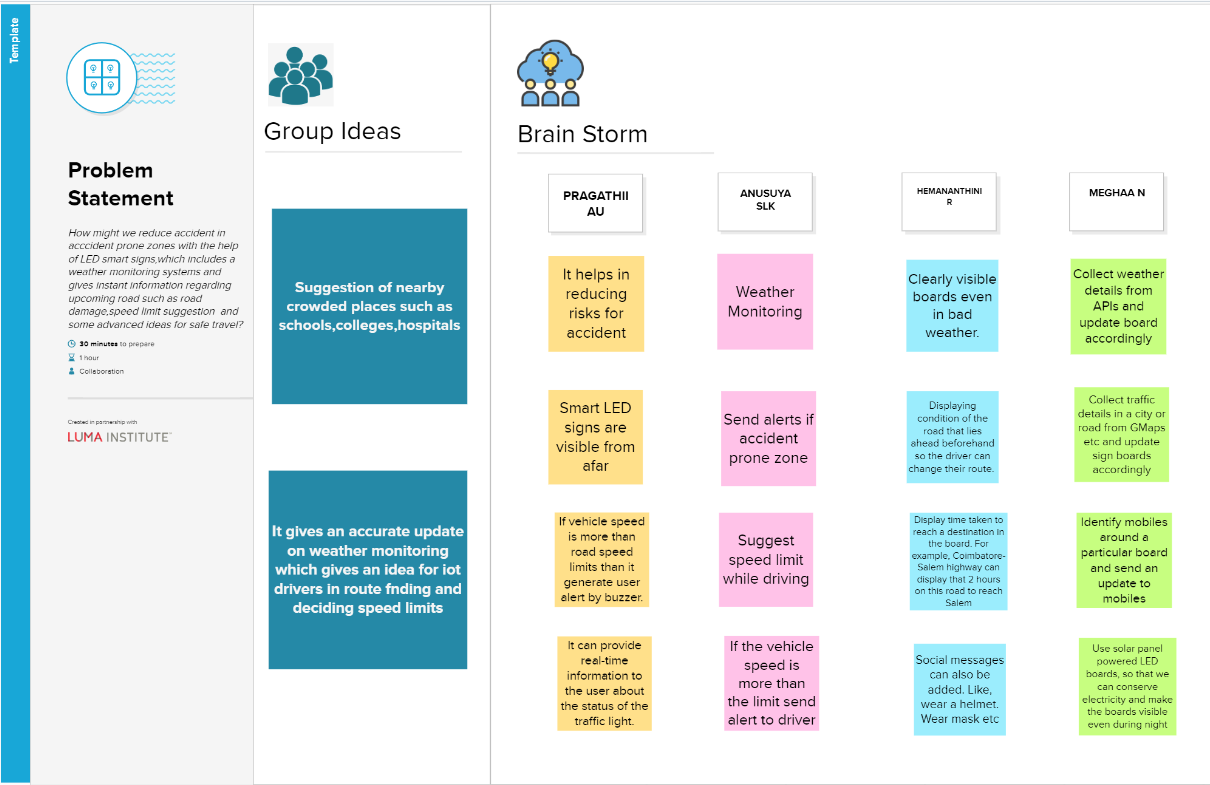
ion about the city’s weather conditions. This data is retrieved and displayed on the signboards accordingly.

## IDEATION & PROPOSED SOLUTION

* 1. Empathy Map



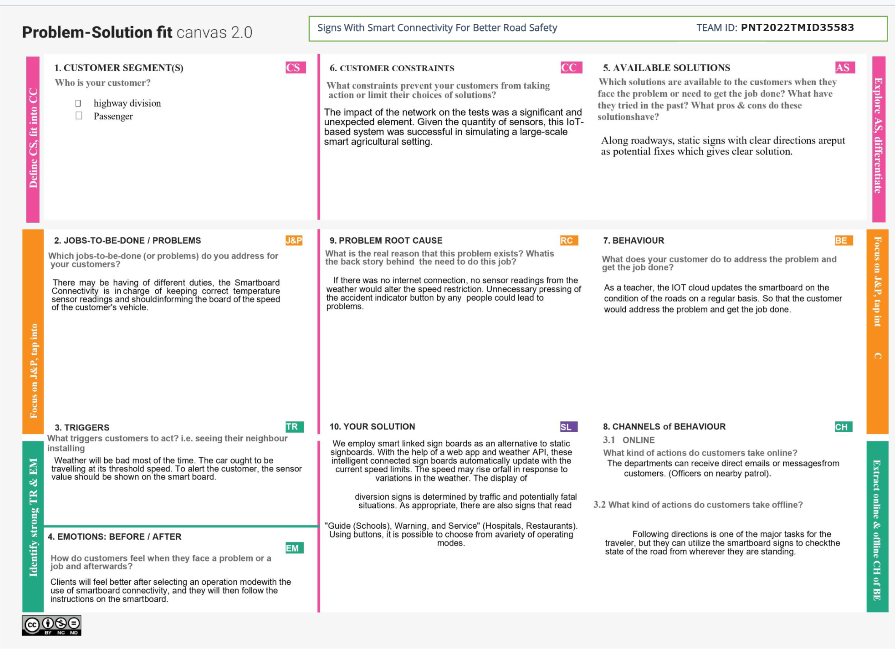
* 1. **Canvas Ideation & Brainstorming**



* 1. **Proposed Solutions**

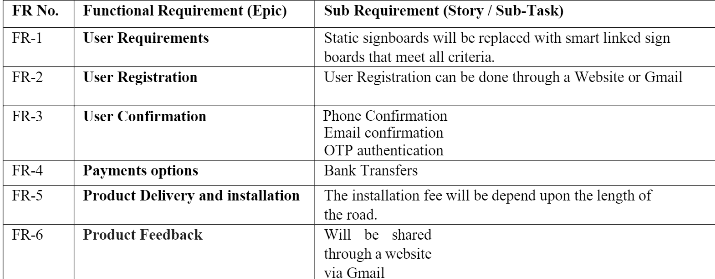
|  |  |
| --- | --- |
| **Parameter** | **Description** |
| Problem Statement (Problem to be solved) | ● To prevent road accidents from happening using IOT. |
| Idea/Solution description | ● By preparing smart signs using IOT instead of regular signs hung on the road.  ● Smart signs are built with IOT and LEDs are used. |
| Novelty/  Uniqueness | Since LEDs are used which are visible from afar. ● The smart signs consist of temperature, humidity, wind speed.  ● This information is received from a weather monitoring app.  ● It also gives information about nearby places such as hospitals, schools etc..,so that the users can decide their speeding according to that information. |
| Social Impact/  Customer Satisfaction | ● These create a noticeable impact on the road safety department.  ● By deciding a speed limit for the user, there is a significant chance in reducing the accidents. |
| Business Model (Revenue Model) | ● By executing these for commoners by the government, it is a great initiative in creating awareness among the people.  ● A separate budget can be allocated for this by the government, which paves a way for a safer environment |
| Scalability of the Solution | ● It has greater chance in reducing the risk for the people as it is more visible than the normal signs, which saves a lot of lives at stake. |

**3.4 Problem Solution Fit**

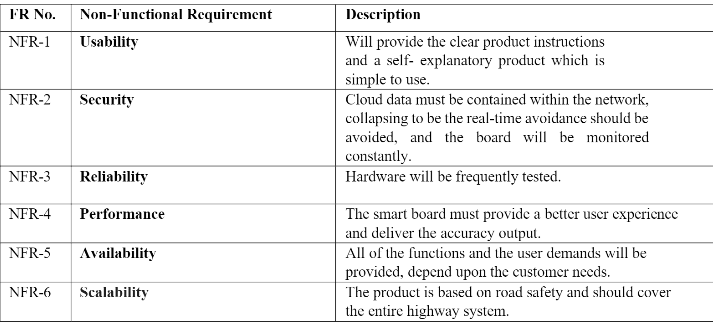
****

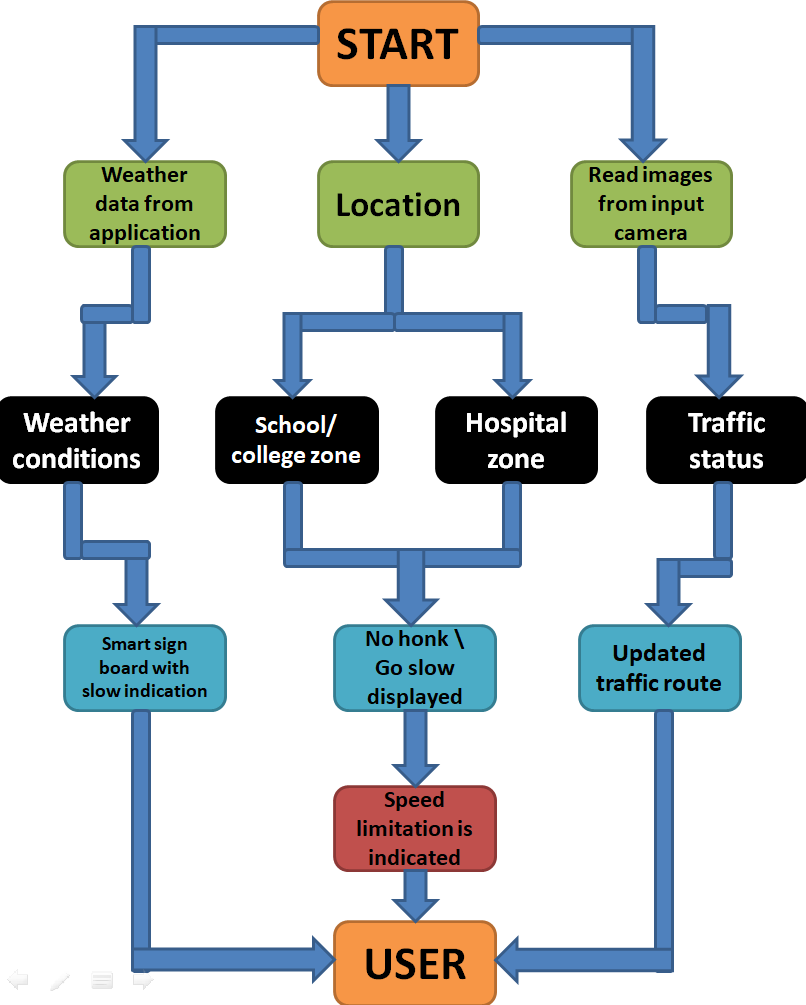
## REQUIREMENTANALYSIS

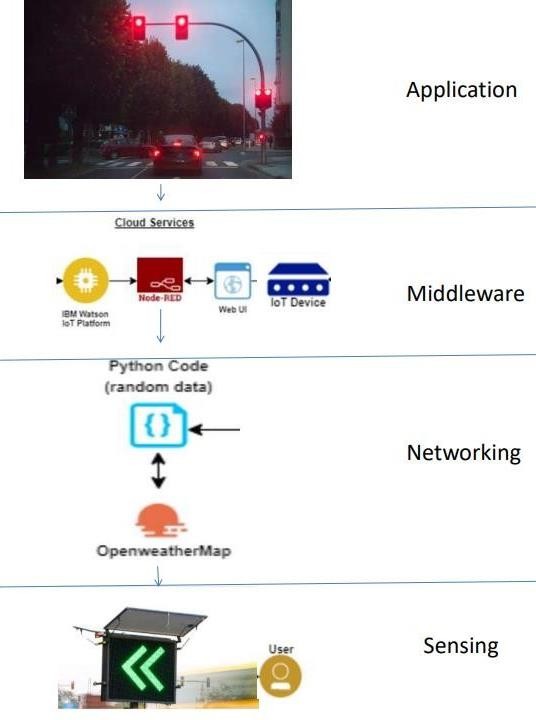
* 1. Functional requirement



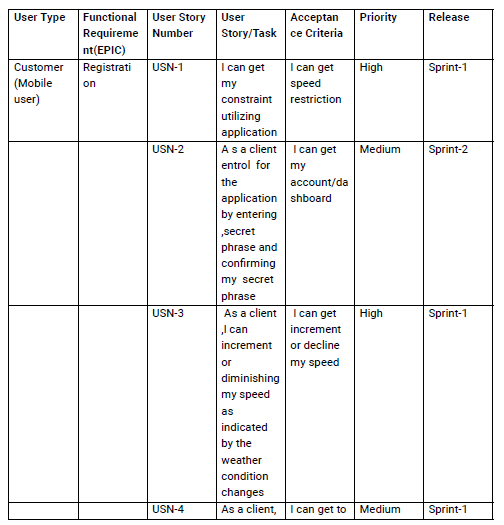
* 1. Non-Functional requirements



1. **PROJECT DESIGN** 
   1. Data Flow Diagrams
   2. Solution & Technical Architecture



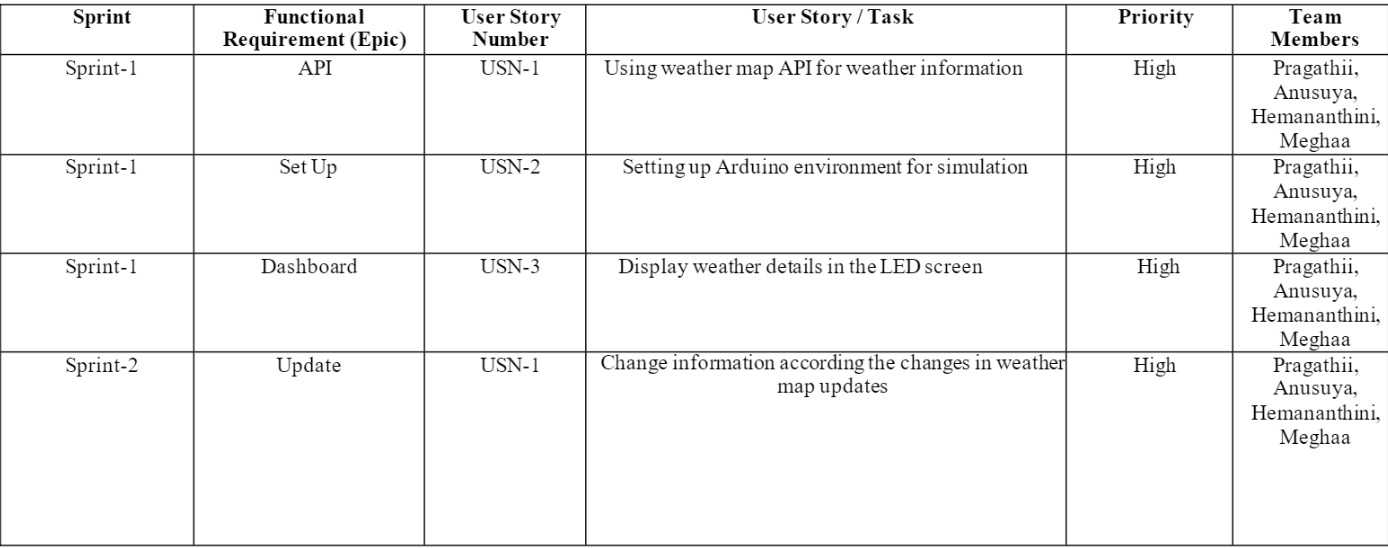
5.3 User Stories

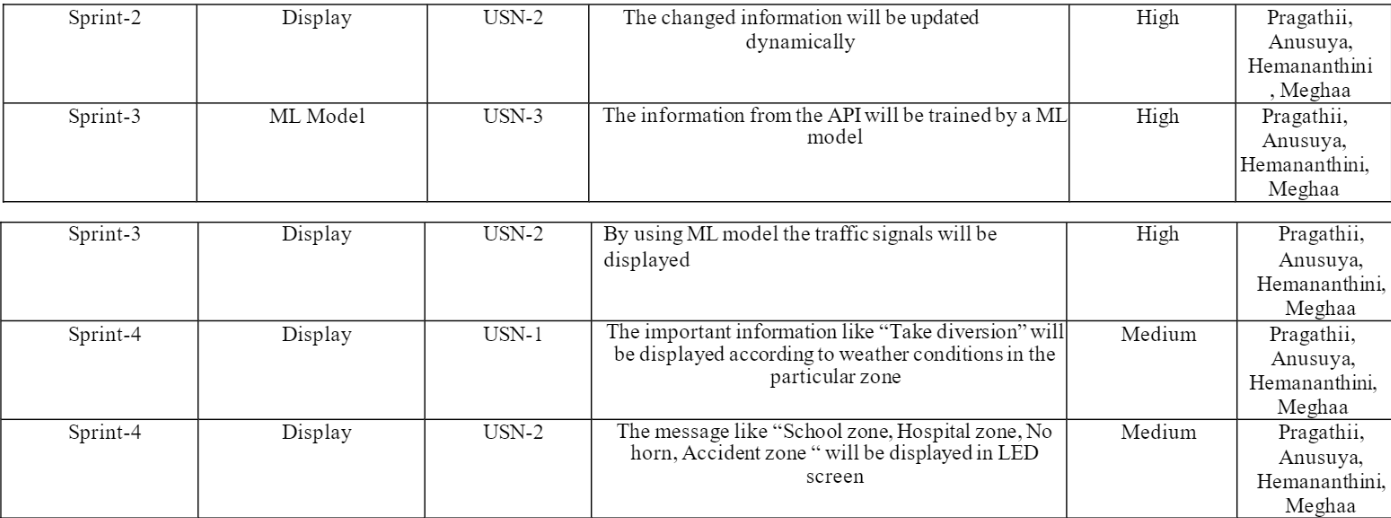


## 

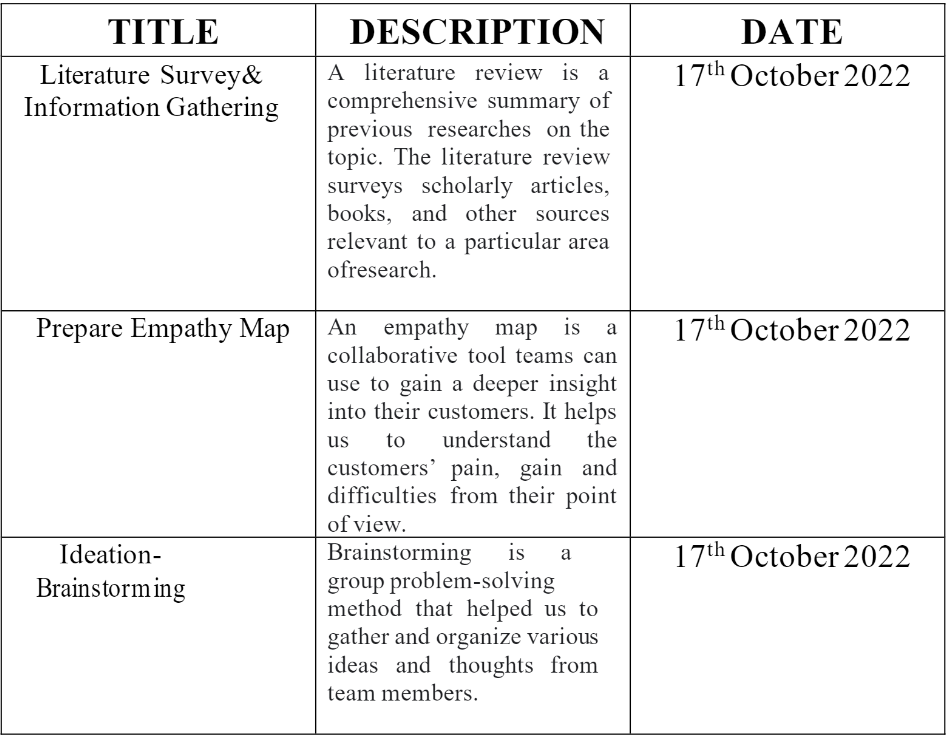
## PROJECT PLANNING &SCHEDULING

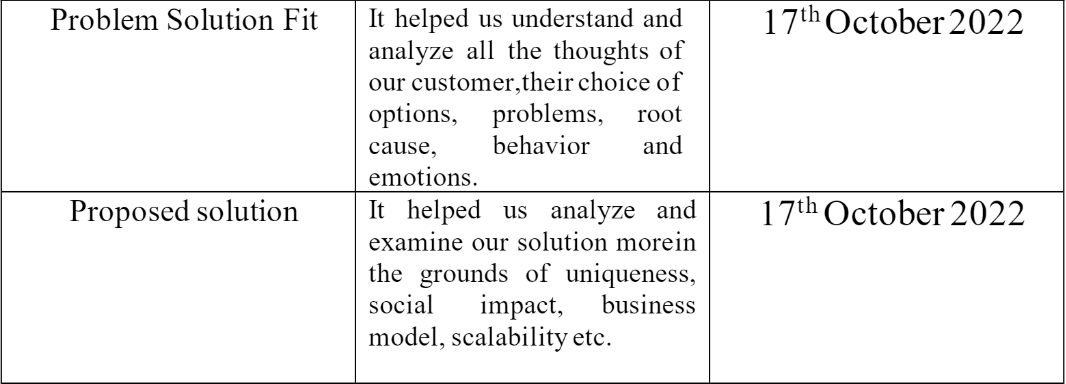
* 1. Sprint Planning & Estimation

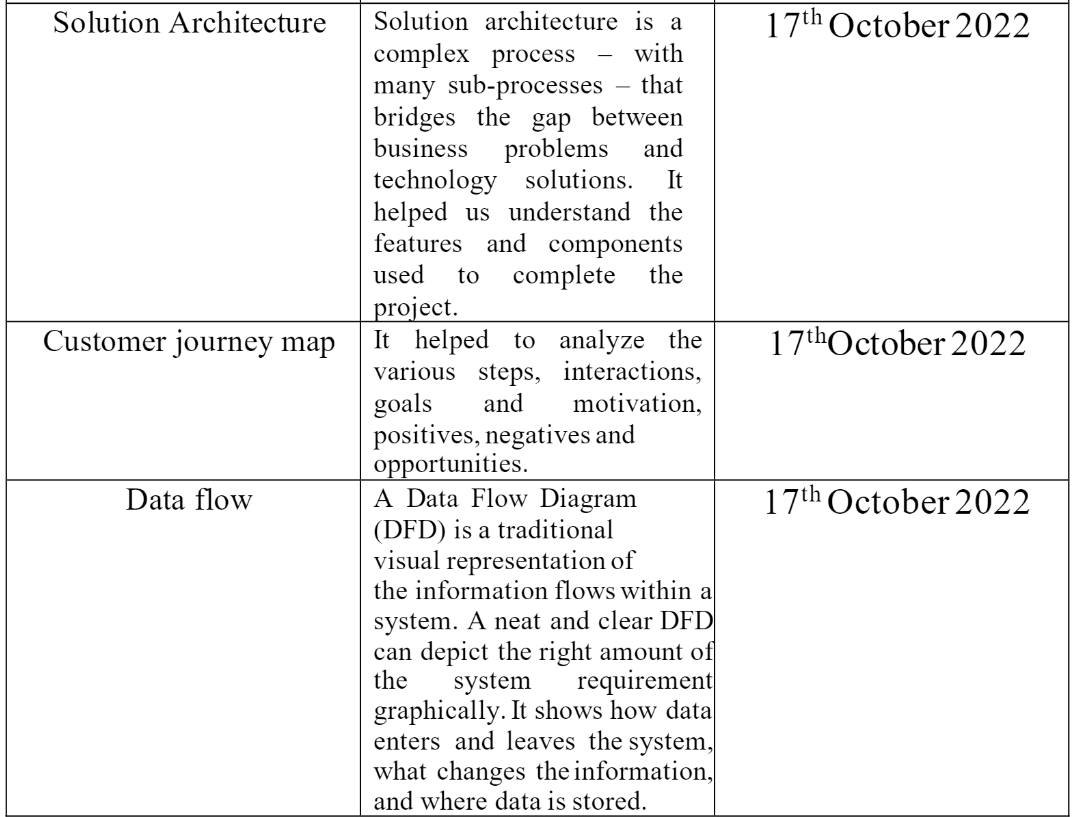




* 1. Delivery Schedule Reports from JIRA







## CODING & SOLUTIONING (Explain the features added in the project along with code)

* 1. Feature 1

Integration of Weather API to IBM Cloud Platform

* 1. Feature 2

Integration of IBM Cloud Platform with NodeRed and displaying in UI

## 10. ADVANTAGES & DISADVANTAGES

**Advantages**

* Monitor the Traffic
* Used to keep in check over speeding drivers
* Helps people to change direction when under a time constraint
* Ensure safety of drivers and passengers
* Helps in finding the number of passengers in a vehicle so as to maintain the convert limit

for passenger

* Helps in supervising the roads and catch criminals

**Disadvantages:**

* It times of complete shutdown, Inverts cannot be used for every single.

## Sometimes malfunctioning or even hacking can be done

1. **CONCLUSION**

Static signboards are not very efficient and cannot properly help the drivers

Hence, this leads to accidents, time wastage and a lot problems. This project will be very

helpful and it is a very necessary project which will reduce a whole lot of accidents and save lines this project can be used by the government to improve road safety

## FUTURE SCOPE

As we know, the population of the world just become 8 billion so as the population grows the numbers of people in metropolitan cities increase which in turn leads to a lot of people using cars and roads. Hence, roads should be safe for the people to use. The scope for this project will skyrocket in the coming years this project also is very flexible that is a lot of new ideas can be added to this base idea. We can use advanced concepts of ML to calculate speed and integrate it with GMaps to know traffic details.

1. **APPENDIX**

13.1 Source Code

#include <WiFi.h>//library for wifi

#include <PubSubClient.h>//library for MQtt

#include "DHT.h"// Library for dht11

#define DHTPIN 15 // what pin we're connected to

#define DHTTYPE DHT22 // define type of sensor DHT 11

#define LED 2

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 "7myu88"//IBM ORGANITION ID

#define DEVICE\_TYPE "abcde"//Device type mentioned in ibm watson IOT Platform

#define DEVICE\_ID "98765"//Device ID mentioned in ibm watson IOT Platform

#define TOKEN "987654321" //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(LED,OUTPUT);

delay(10);

Serial.println();

wificonnect();

mqttconnect();

}

void loop()// Recursive Function

{

h = dht.readHumidity();

t = dht.readTemperature();

Serial.print("temp:");

Serial.println(t);

Serial.print("Humid:");

Serial.println(h);

PublishData(t, h);

delay(1000);

if (!client.loop()) {

mqttconnect();

}

}

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

void PublishData(float temp, float humid) {

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 += "," "\"Humid\":";

payload += humid;

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="";

}

#include <SPI.h>

#include<WiFi.h>

const char\* ssid = "Wokwi-GUEST";

const char\* pass = "";

//open weather map api key

String apiKey= "2433516c3d8cf727338deab79e2ea38d";

//the city you want the weather for

String location= "torino,IT";

int status = WL\_IDLE\_STATUS;

char server[] = "api.openweathermap.org";

WiFiClient client;

void setup(){

Serial.begin(115200);

WiFi.begin(ssid, pass);

while(WiFi.status() != WL\_CONNECTED){

delay(100);

Serial.println(".");

}

Serial.println("WiFi Connected!");

Serial.println(WiFi.localIP());

}

void loop(){

getWeather();

delay(10000);

}

void getWeather() {

Serial.println("\nStarting connection to server...");

// if you get a connection, report back via serial:

if (client.connect(server, 80)) {

Serial.println("connected to server");

// Make a HTTP request:

client.print("GET /data/2.5/forecast?");

client.print("q="+location);

client.print("&appid="+apiKey);

client.print("&cnt=3");

client.println("&units=metric");

client.println("Host: api.openweathermap.org");

client.println("Connection: close");

client.println();

} else {

Serial.println("unable to connect");

}

delay(1000);

String line = "";

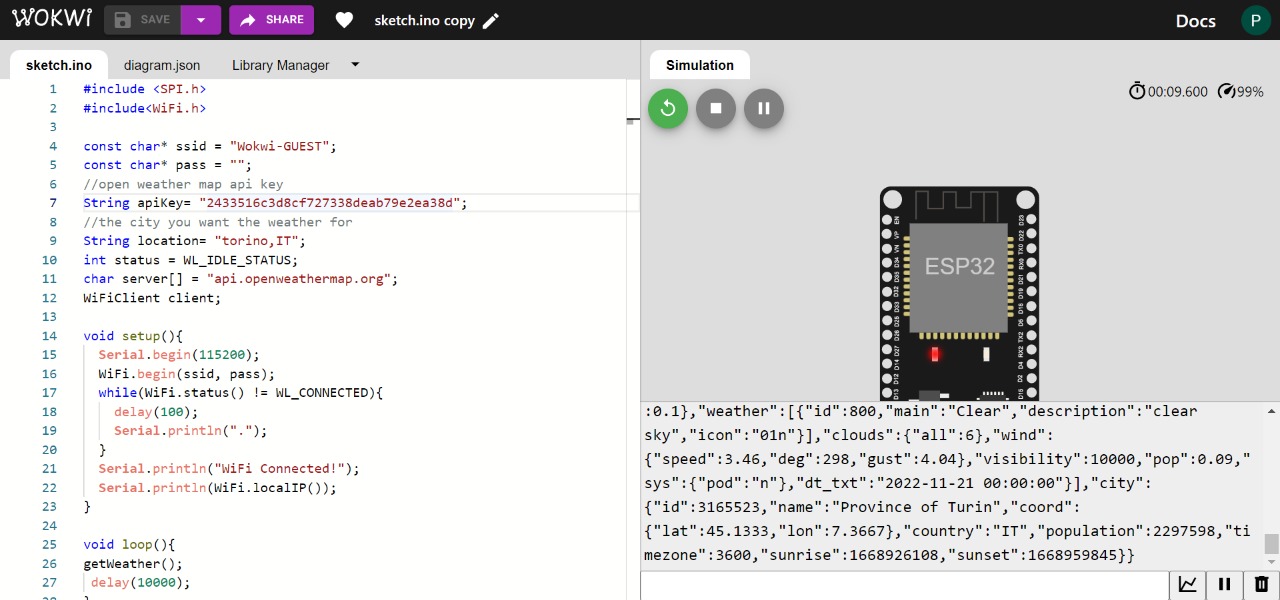
while (client.connected()) {

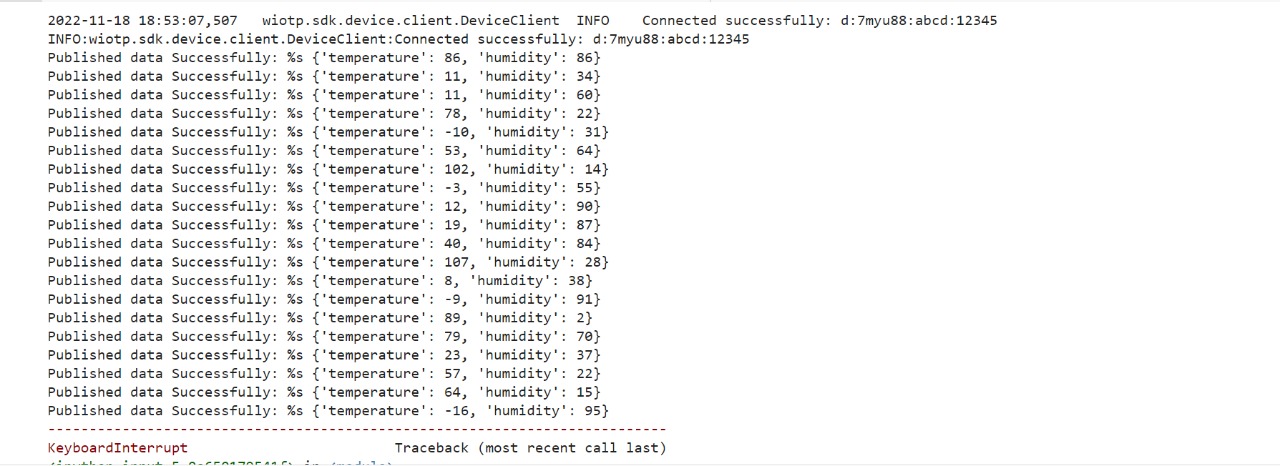
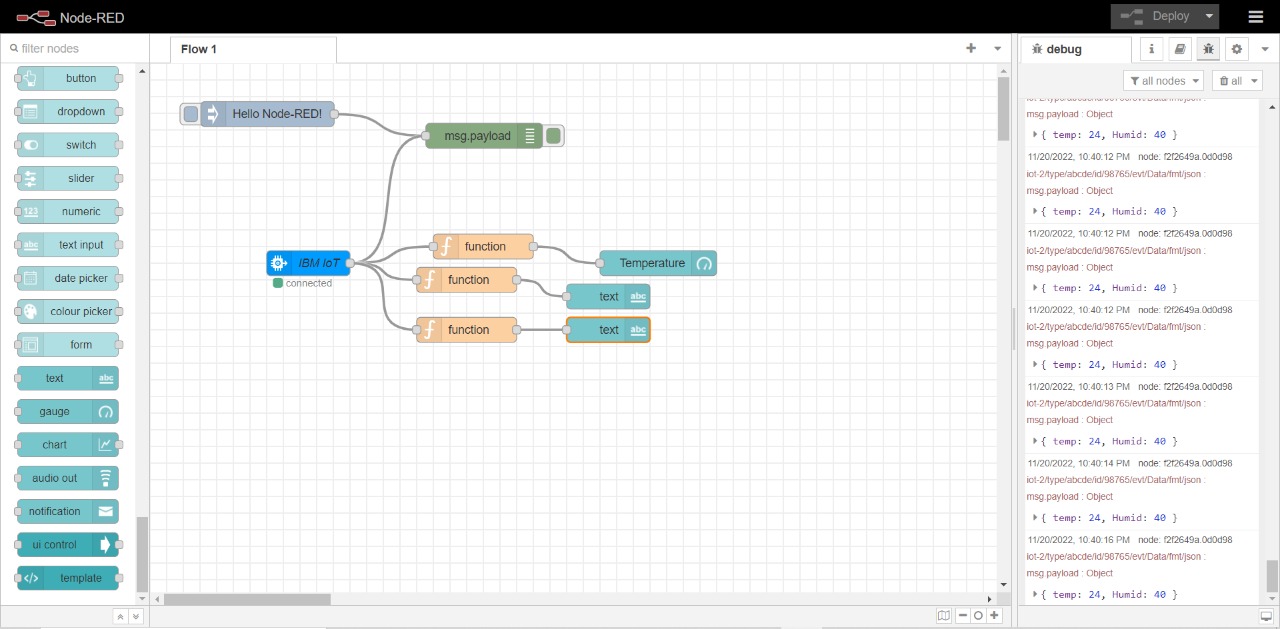
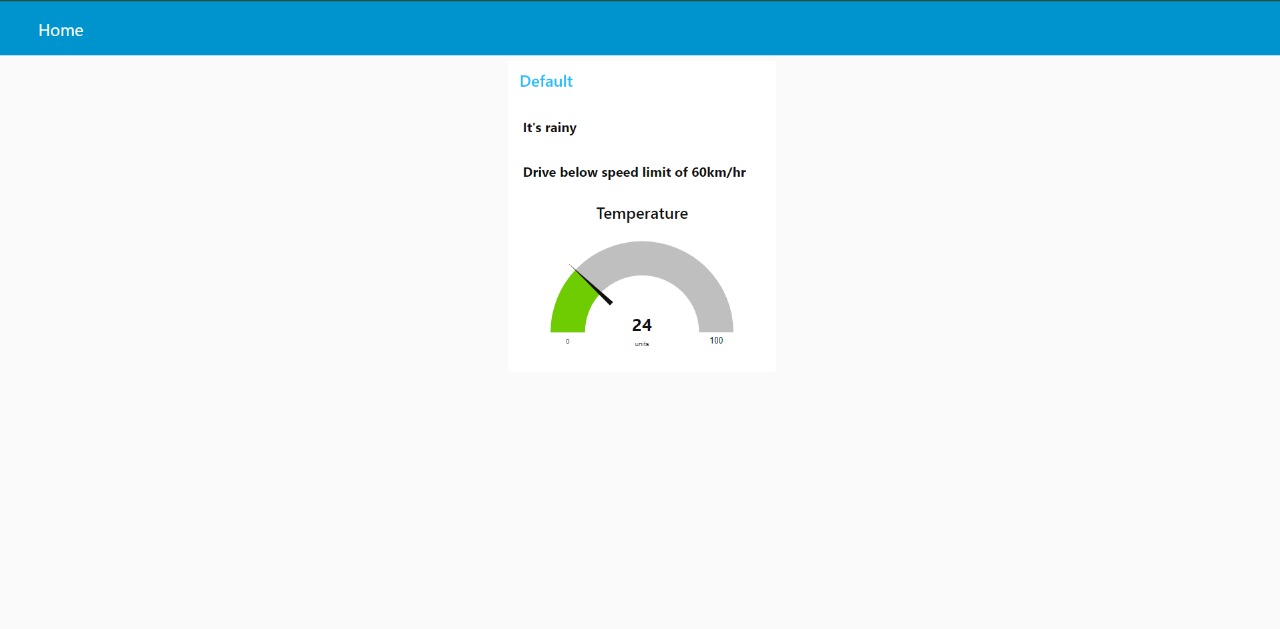
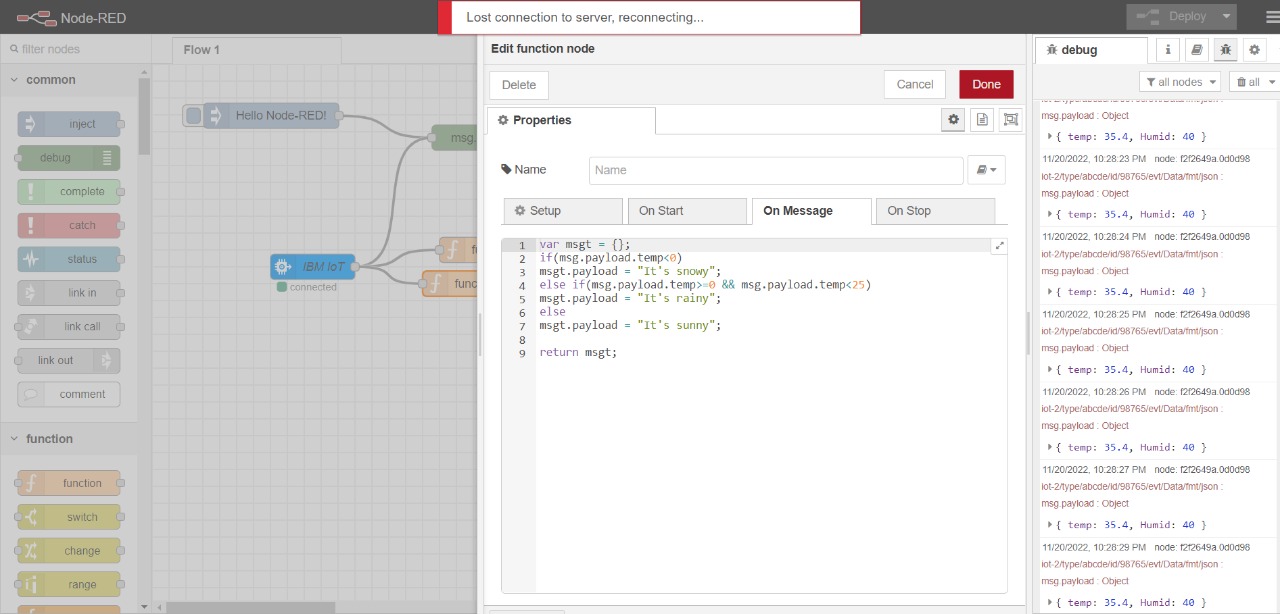
line = client.readStringUntil('\n');

Serial.println(line);

}

}





* 1. GitHub & Project Demo Link

**Github**

https://github.com/IBM-EPBL/IBM-Project-10622-1659192963.git