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 caninteract 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 sensorsinstalled in vehicles or by using smartphone sensors. Previous researchers have used accelerometers, smoke detectors, infrared (IR) obstacle sensors, proximity sensors, andbiosensors 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)

2. LITERATURE SURVEY:

2.1 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/2015/en/'

View at: GoogleScholar

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 | Google Scholar

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

View at: Publisher Site | Google Scholar

4. World Health Organization, “Save LIVES-A road safety technical package,”2017. View at: Google Scholar

5. W. E. Marshall, “Understanding international road safety disparities: Why is Australia so much safer than the United States?” *Accident Analysis & Prevention*, vol. 111, pp. 251–265,2018.

View at: Publisher Site | Google Scholar

6. “Open Street Maps, with New York County highlighted,” https://www.openstreetmap.org/relation/2552485.

View at: Google Scholar

7. United States Census Bureau, “TIGER/Line® Shapefiles: Roads,” https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2018&amp;layergroup=Roads. View at: GoogleScholar

8. 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 | Google Scholar

9. European Road Assessment Program (EuroRAP), “European Road Safety Atlas,” http://atlas.eurorap.org/.

View at: Google Scholar

10. European Road Assessment Program (EuroRAP), “Star Ratings,” http://www.eurorap.org/protocols/star-ratings/.

11. International Road Assessment Program (iRAP),“iRAP,”https://www.irap.org/. View at: Google Scholar

12. 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 | Google Scholar

13. 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 | Google Scholar

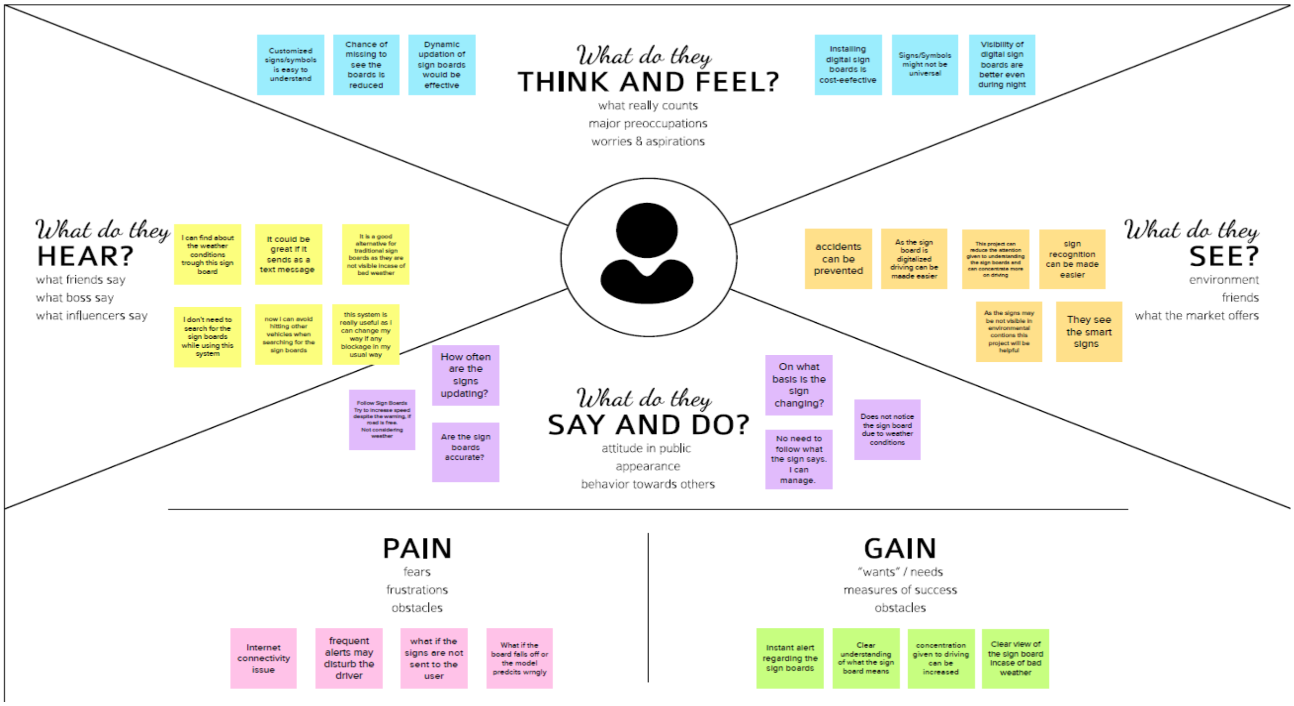
2.3 Problem Statement Definition

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 toaddress the 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 heavytraffic 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 information about the city's weather conditions. This data is retrieved and displayed on the signboards accordingly.

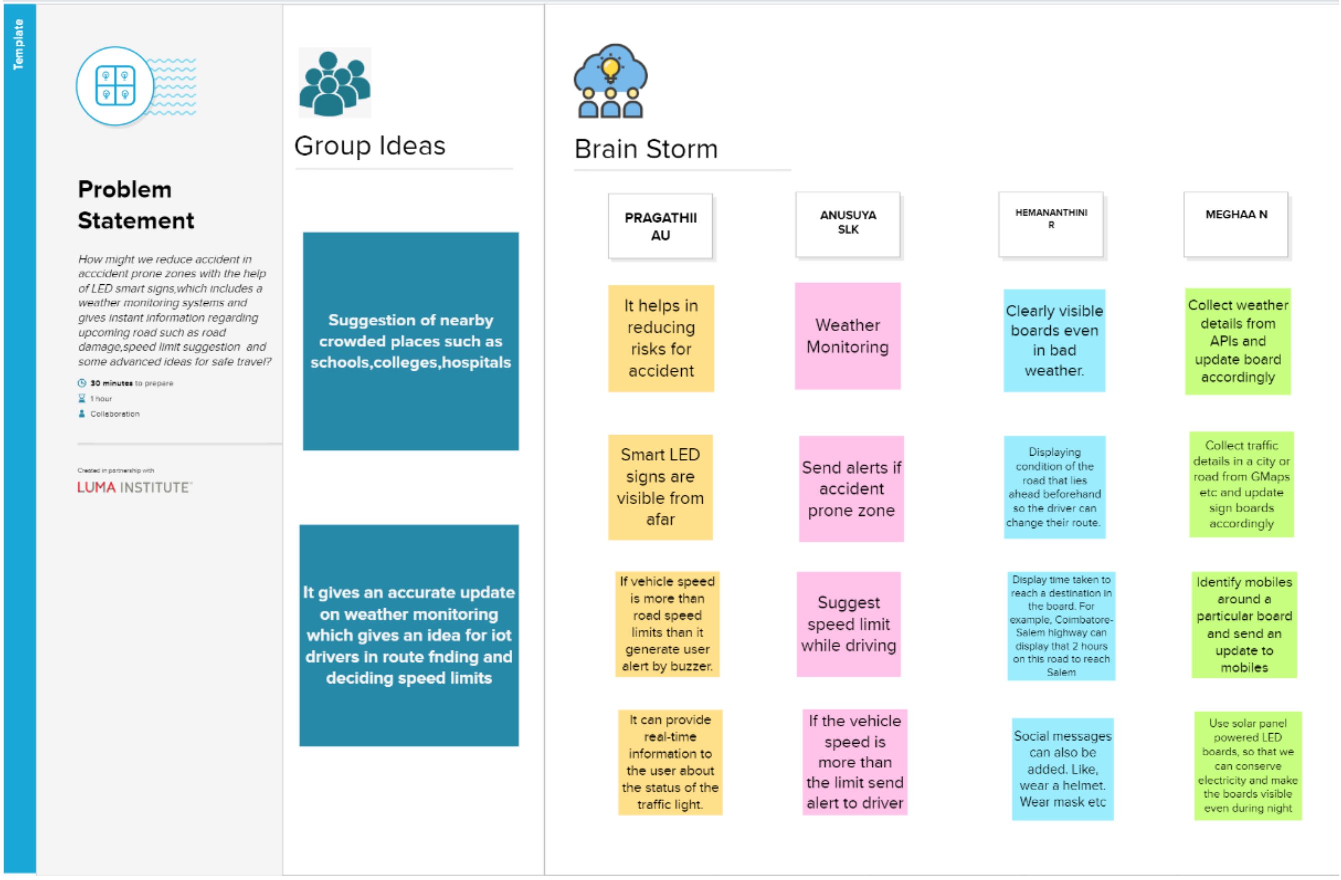
3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map



Customized signs/symbols is easy to understand
Chance of missing to see the boards is reduced
Dynamic updation of sign boards would be effective
What do they THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
Installing digital sign boards is cost-eefective
Signs/Symbols might not be universal
Visibility of digital sign boards are better even during night
What do they HEAR?
what friends say
what boss say
what influencers say
I can find about the weather conditions trough this sign board
It could be great if it sends as a text message
It is a good alternative for traditional sign boards as they are not visible incase of bad weather
I don't need to search for the sign boards while using this system
now i can avoid hitting other vehicles when searching for the sign boards
this system is really useful as I can change my way if any blockage in my usual way
accidents can be prevented
As the sign board is digitalized driving can be meade easier
This project can reduce the attention given to understanding the sign boards and can concentrate more on driving
sign recognition can be made easier
As the signs may be not visible in environmental contions this project will be helpful
They see the smart signs
What do they SEE?
environment
friends
what the market offers
Follow Sign Boards Try to increase speed despite the warning, if road is free. Not considering weather
How often are the signs updating?
Are the sign boards accurate?
What do they SAY AND DO?
attitude in public
appearance
behavior towards others
On what basis is the sign changing?
No need to follow what the sign says. I can manage.
Does not notice the sign board due to weather conditions
PAIN
fears
frustrations
obstacles
Internet connectivity issue
frequent alerts may disturb the driver
what if the signs are not sent to the user
What if the board falls off or the model predcits wrngly
GAIN
"wants" / needs
measures of success
obstacles
Instant alert regarding the sign boards
Clear understanding of what the sign board means
concentration given to driving can be increased
Clear view of the sign board incase of bad weather

3.2 Canvas Ideation & Brainstorming



Template

Problem Statement

How might we reduce accident in acccident prone zones with the help of LED smart signs,which includes a weather monitoring systems and gives instant information regarding upcoming road such as road damage,speed limit suggestion and some advanced ideas for safe travel?

30 minutes to prepare

1 hour

Collaboration

Created in partnership with

LUMA INSTITUTE

Group Ideas

Suggestion of nearby crowded places such as schools,colleges,hospitals

It gives an accurate update on weather monitoring which gives an idea for iot drivers in route fnding and deciding speed limits

Brain Storm

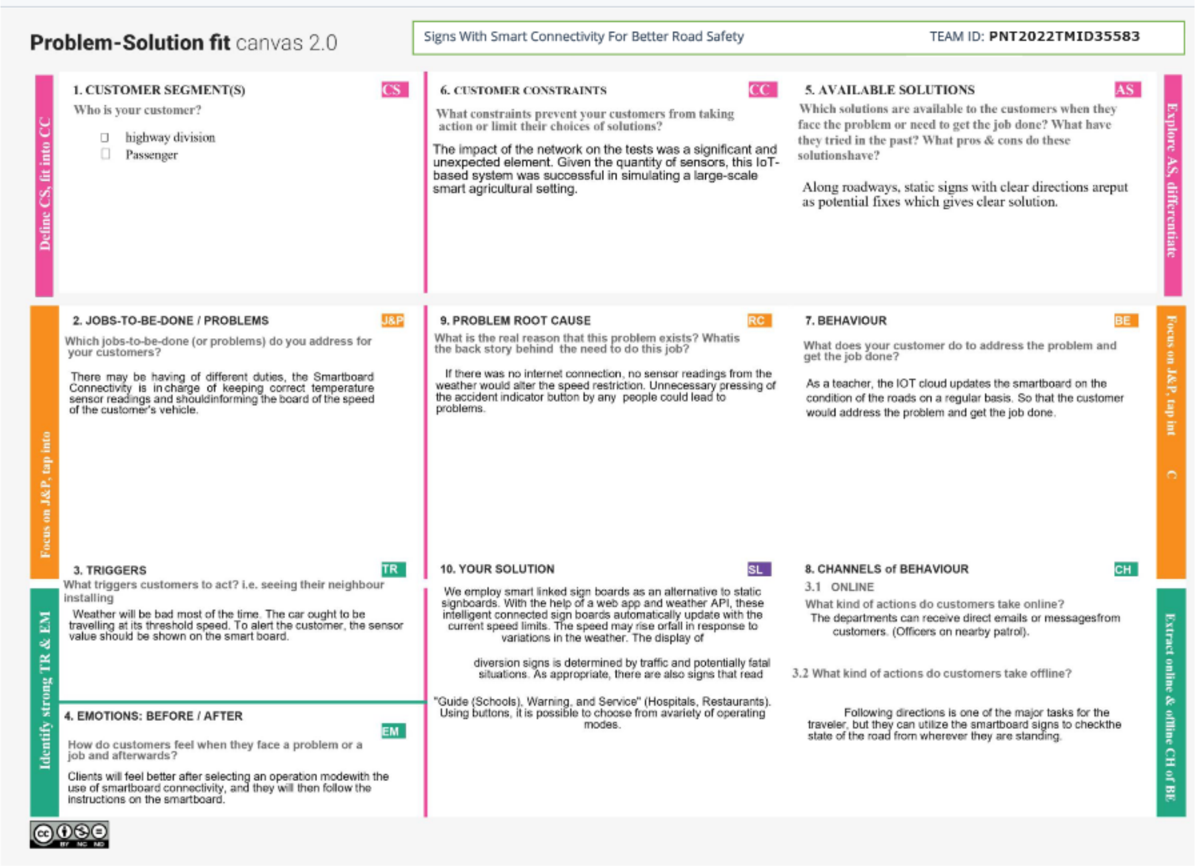
PRAGATHII AU	ANUSUYA SLK	HEMANANTHINI R	MEGHAA N
It helps in reducing risks for accident	Weather Monitoring	Clearly visible boards even in bad weather.	Collect weather details from APIs and update board accordingly
Smart LED signs are visible from afar	Send alerts if accident prone zone	Displaying condition of the road that lies ahead beforehand so the driver can change their route.	Collect traffic details in a city or road from GMaps etc and update sign boards accordingly
If vehicle speed is more than road speed limits than it generate user alert by buzzer.	Suggest speed limit while driving	Display time taken to reach a destination in the board. For example, Coimbatore-Salem highway can display that 2 hours on this road to reach Salem	Identify mobiles around a particular board and send an update to mobiles
It can provide real-time information to the user about the status of the traffic light.	If the vehicle speed is more than the limit send alert to driver	Social messages can also be added. Like, wear a helmet. Wear mask etc	Use solar panel powered LED boards, so that we can conserve electricity and make the boards visible even during night

3.3 Proposed Solutions

Parameter	**Description**
Problem Statement (Problem tobe 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



Define CS, fit into CC
Explore AS, differentiate
Focus on J&P, tap into
Focus on J&P, tap int C
Identify strong TR & EM
Extract online & offline CH of BE

Problem-Solution fit canvas 2.0

Signs With Smart Connectivity For Better Road Safety

TEAM ID: **PNT2022TMID35583**

1. CUSTOMER SEGMENT(S) CS

Who is your customer?

□ highway division
□ Passenger

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or limit their choices of solutions?

The impact of the network on the tests was a significant and unexpected element. Given the quantity of sensors, this IoT-based system was successful in simulating a large-scale smart agricultural setting.

5. AVAILABLE SOLUTIONS AS

Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutionshave?

Along roadways, static signs with clear directions areput as potential fixes which gives clear solution.

2. JOBS-TO-BE-DONE / PROBLEMS J&P

Which jobs-to-be-done (or problems) do you address for your customers?

There may be having of different duties, the Smartboard Connectivity is in charge of keeping correct temperature sensor readings and shouldinforming the board of the speed of the customer's vehicle.

9. PROBLEM ROOT CAUSE RC

What is the real reason that this problem exists? Whatis the back story behind the need to do this job?

If there was no internet connection, no sensor readings from the weather would alter the speed restriction. Unnecessary pressing of the accident indicator button by any people could lead to problems.

7. BEHAVIOUR BE

What does your customer do to address the problem and get the job done?

As a teacher, the IOT cloud updates the smartboard on the condition of the roads on a regular basis. So that the customer would address the problem and get the job done.

3. TRIGGERS TR

What triggers customers to act? i.e. seeing their neighbour installing

Weather will be bad most of the time. The car ought to be travelling at its threshold speed. To alert the customer, the sensor value should be shown on the smart board.

4. EMOTIONS: BEFORE / AFTER EM

How do customers feel when they face a problem or a job and afterwards?

Clients will feel better after selecting an operation modewith the use of smartboard connectivity, and they will then follow the instructions on the smartboard.

10. YOUR SOLUTION SL

We employ smart linked sign boards as an alternative to static signboards. With the help of a web app and weather API, these intelligent connected sign boards automatically update with the current speed limits. The speed may rise orfall in response to variations in the weather. The display of

diversion signs is determined by traffic and potentially fatal situations. As appropriate, there are also signs that read

"Guide (Schools), Warning, and Service" (Hospitals, Restaurants). Using buttons, it is possible to choose from avariety of operating modes.

8. CHANNELS of BEHAVIOUR CH

3.1 ONLINE

What kind of actions do customers take online?

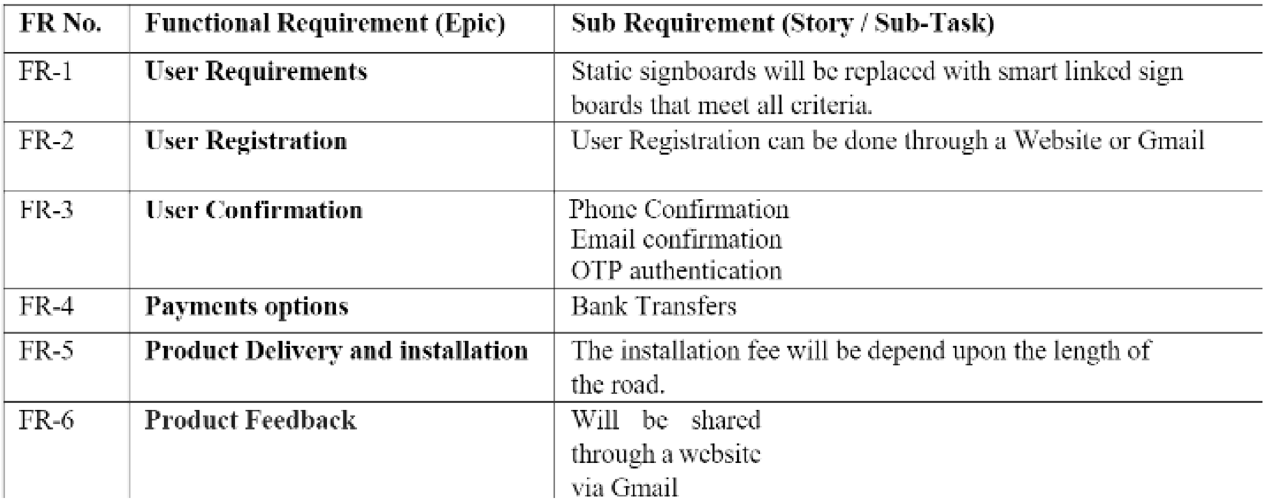
The departments can receive direct emails or messagesfrom customers. (Officers on nearby patrol).

3.2 What kind of actions do customers take offline?

Following directions is one of the major tasks for the traveler, but they can utilize the smartboard signs to checkthe state of the road from wherever they are standing.

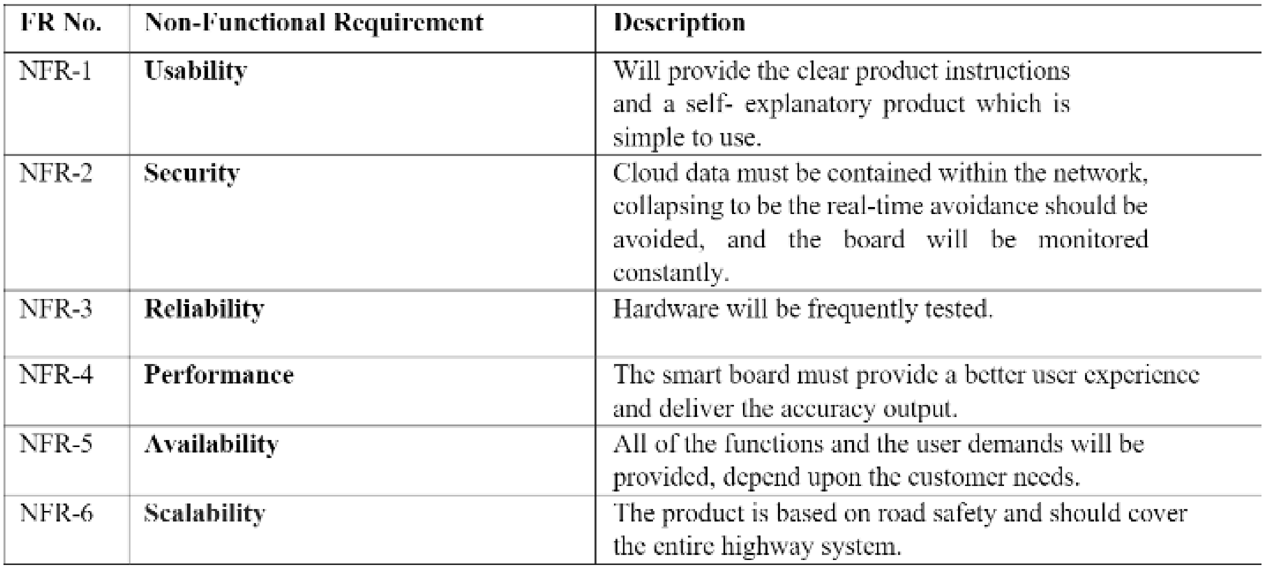
4. REQUIREMENTANALYSIS

4.1 Functional requirement



FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Requirements**	Static signboards will be replaced with smart linked sign boards that meet all criteria.
FR-2	**User Registration**	User Registration can be done through a Website or Gmail
FR-3	**User Confirmation**	Phone Confirmation Email confirmation OTP authentication
FR-4	**Payments options**	Bank Transfers
FR-5	**Product Delivery and installation**	The installation fee will be depend upon the length of the road.
FR-6	**Product Feedback**	Will be shared through a website via Gmail

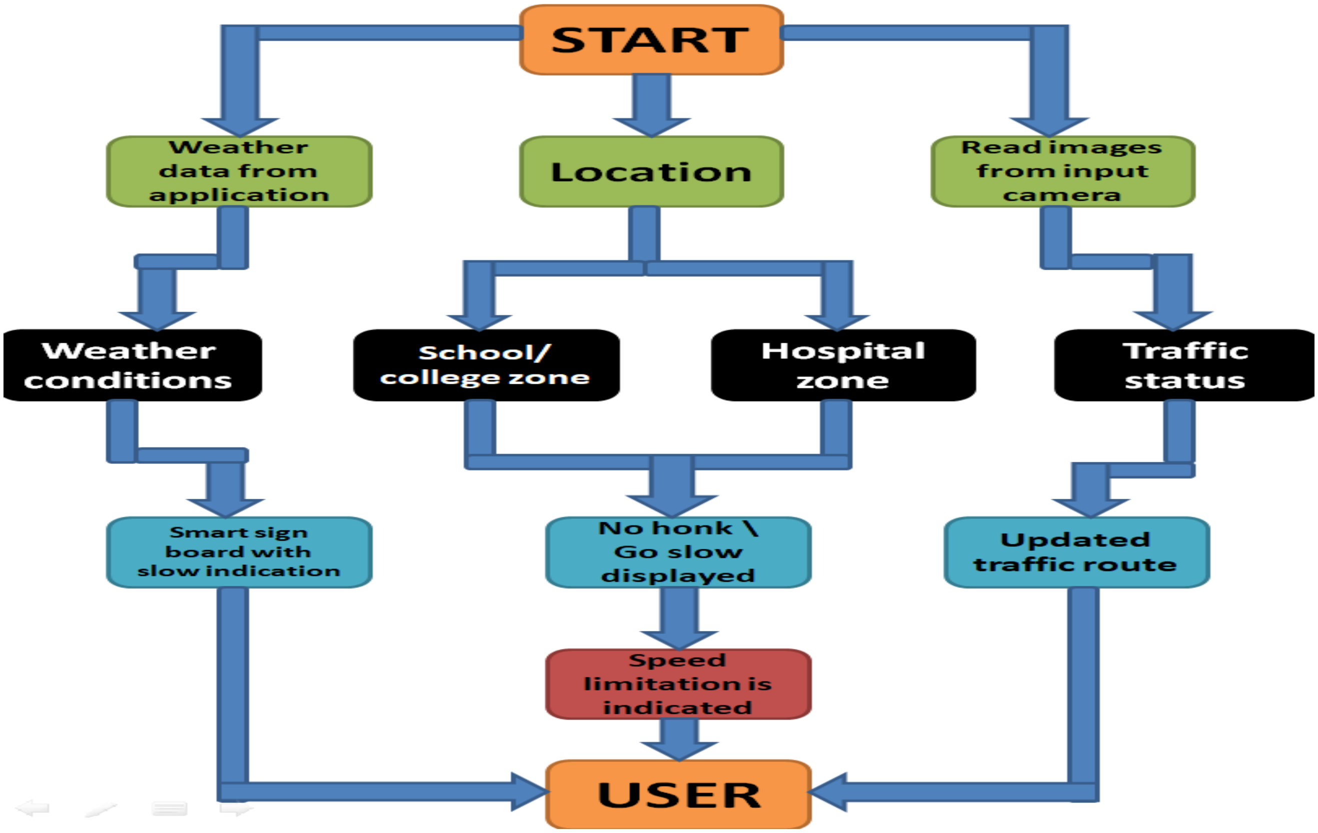
4.2 Non-Functional requirements



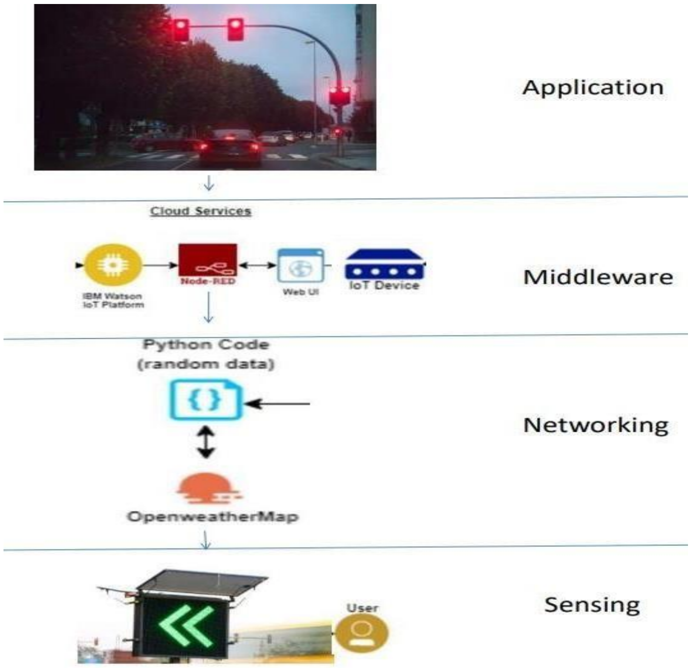
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Will provide the clear product instructions and a self- explanatory product which is simple to use.
NFR-2	**Security**	Cloud data must be contained within the network, collapsing to be the real-time avoidance should be avoided, and the board will be monitored constantly.
NFR-3	**Reliability**	Hardware will be frequently tested.
NFR-4	**Performance**	The smart board must provide a better user experience and deliver the accuracy output.
NFR-5	**Availability**	All of the functions and the user demands will be provided, depend upon the customer needs.
NFR-6	**Scalability**	The product is based on road safety and should cover the entire highway system.

5. PROJECT DESIGN

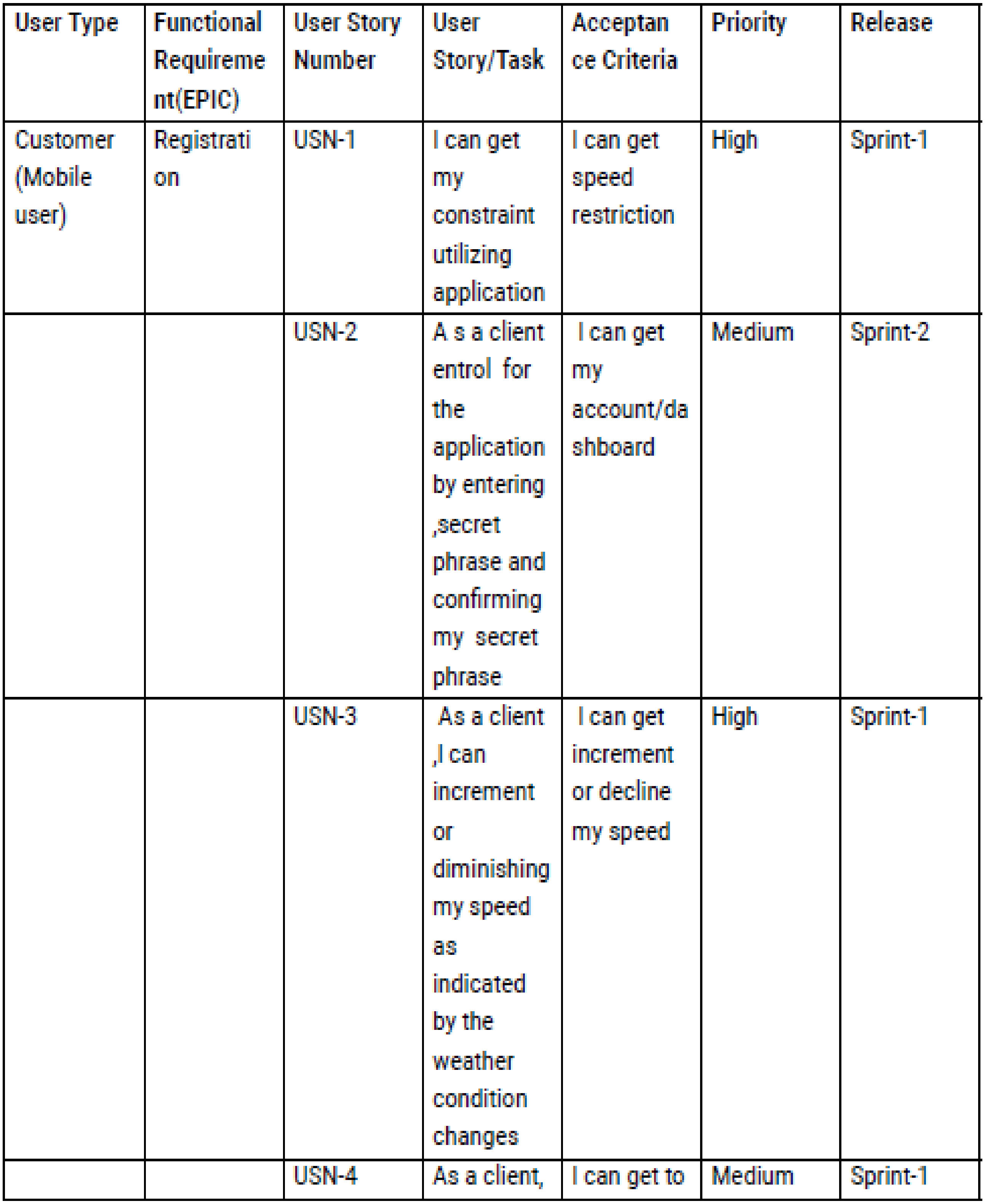
5.1 Data Flow Diagrams


START
Weather data from application
Location
Read images from input camera
Weather conditions
School/ college zone
Hospital zone
Traffic status
Smart sign board with slow indication
No honk \ Go slow displayed
Updated traffic route
Speed limitation is indicated
USER

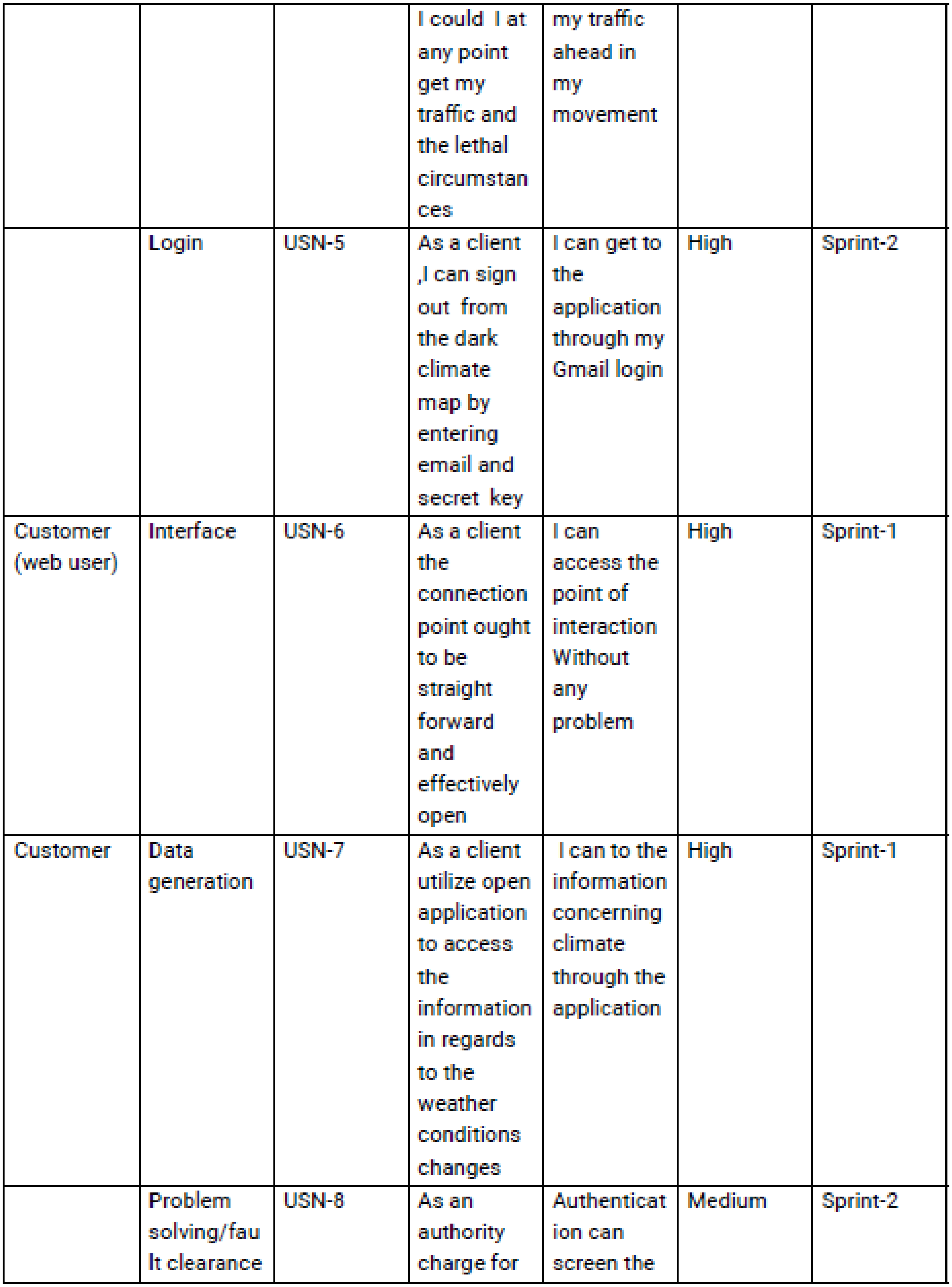
5.2 Solution & Technical Architecture



5.3 User Stories



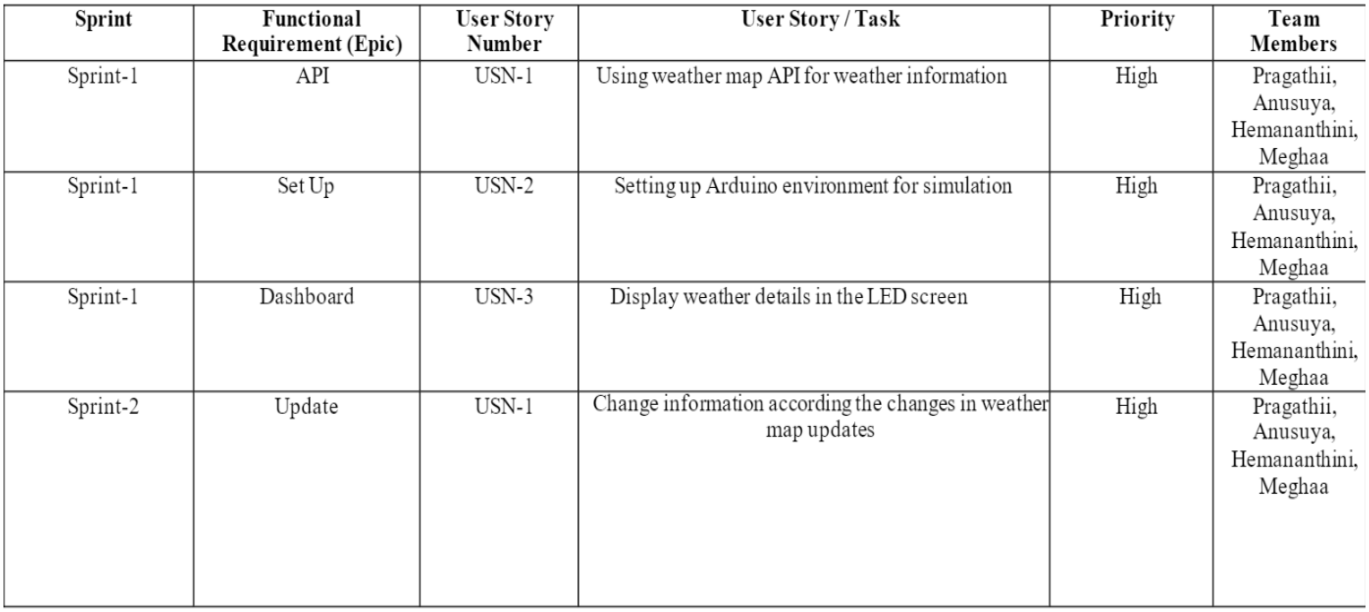
User Type	Functional Requirement(EPIC)	User Story Number	User Story/Task	Acceptance Criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	I can get my constraint utilizing application	I can get speed restriction	High	Sprint-1
		USN-2	A s a client entrol for the application by entering ,secret phrase and confirming my secret phrase	I can get my account/dashboard	Medium	Sprint-2
		USN-3	As a client ,I can increment or diminishing my speed as indicated by the weather condition changes	I can get increment or decline my speed	High	Sprint-1
		USN-4	As a client,	I can get to	Medium	Sprint-1



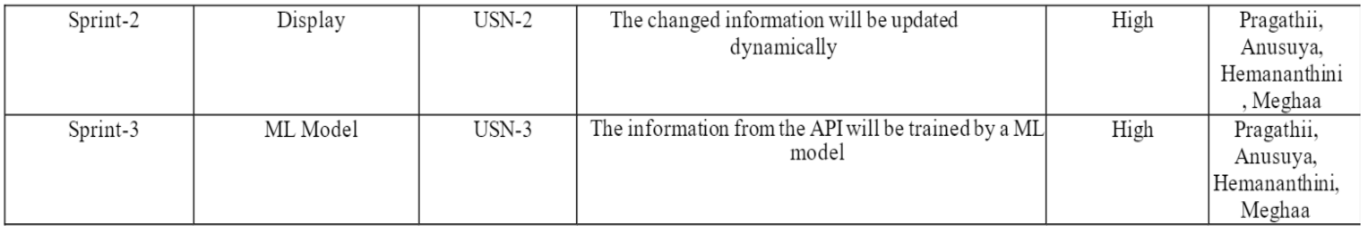
			I could I at any point get my traffic and the lethal circumstances	my traffic ahead in my movement		
	Login	USN-5	As a client ,I can sign out from the dark climate map by entering email and secret key	I can get to the application through my Gmail login	High	Sprint-2
Customer (web user)	Interface	USN-6	As a client the connection point ought to be straight forward and effectively open	I can access the point of interaction Without any problem	High	Sprint-1
Customer	Data generation	USN-7	As a client utilize open application to access the information in regards to the weather conditions changes	I can to the information concerning climate through the application	High	Sprint-1
	Problem solving/fault clearance	USN-8	As an authority charge for	Authentication can screen the	Medium	Sprint-2

6. PROJECT PLANNING &SCHEDULING

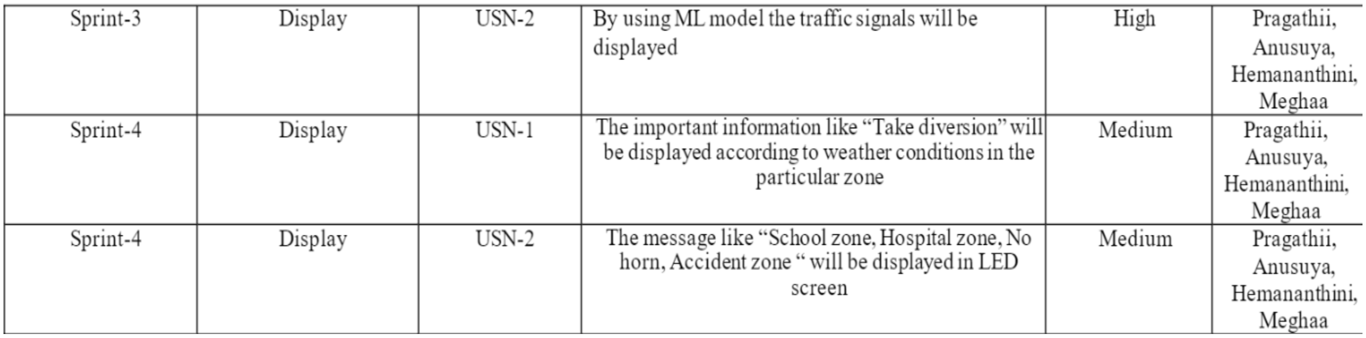
6.1 Sprint Planning & Estimation



Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Priority	Team Members
Sprint-1	API	USN-1	Using weather map API for weather information	High	Pragathii, Anusuya, Hemananthini, Meghaa
Sprint-1	Set Up	USN-2	Setting up Arduino environment for simulation	High	Pragathii, Anusuya, Hemananthini, Meghaa
Sprint-1	Dashboard	USN-3	Display weather details in the LED screen	High	Pragathii, Anusuya, Hemananthini, Meghaa
Sprint-2	Update	USN-1	Change information according the changes in weather map updates	High	Pragathii, Anusuya, Hemananthini, Meghaa

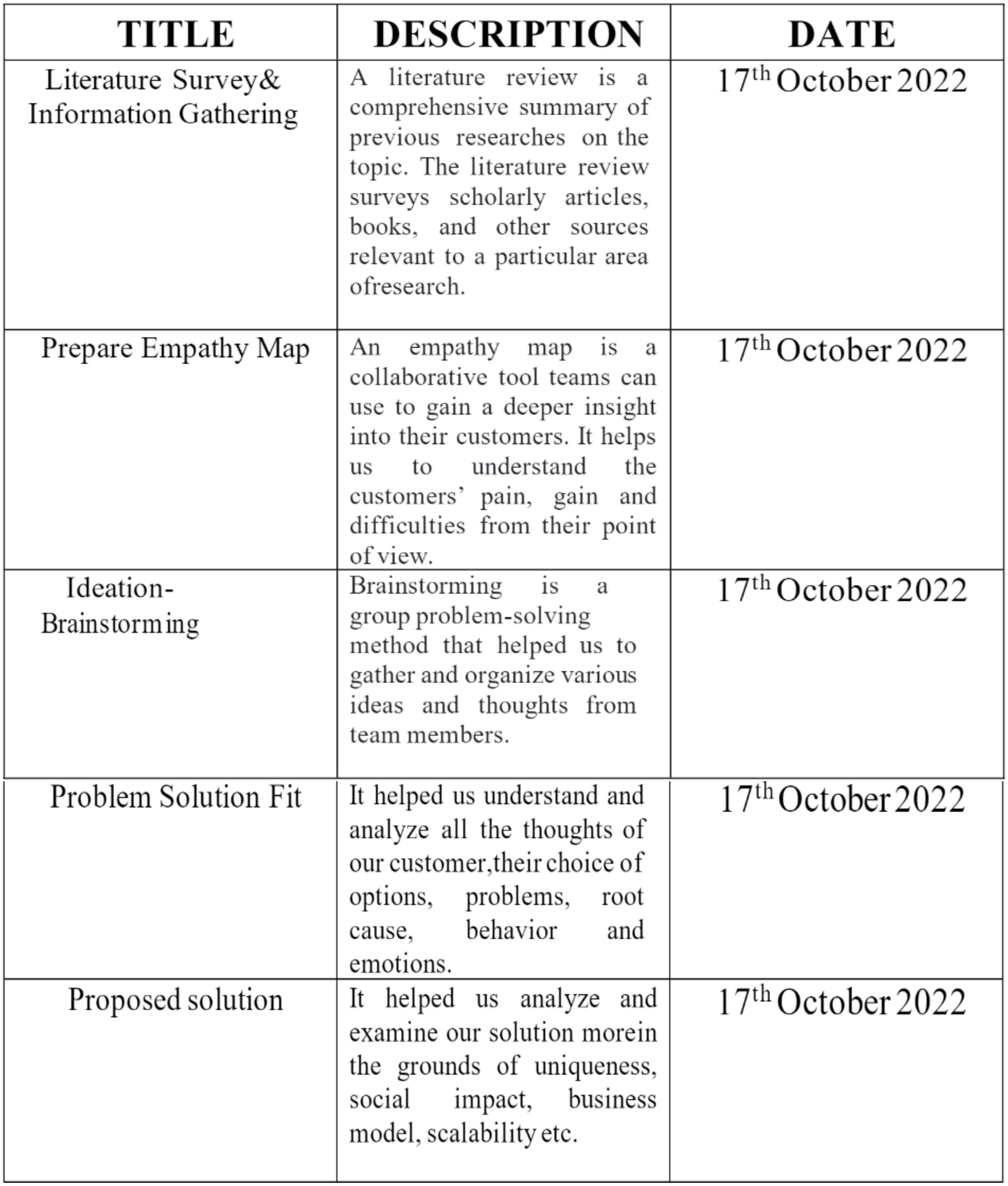


Sprint-2	Display	USN-2	The changed information will be updated dynamically	High	Pragathii, Anusuya, Hemananthini , Meghaa
Sprint-3	ML Model	USN-3	The information from the API will be trained by a ML model	High	Pragathii, Anusuya, Hemananthini, Meghaa

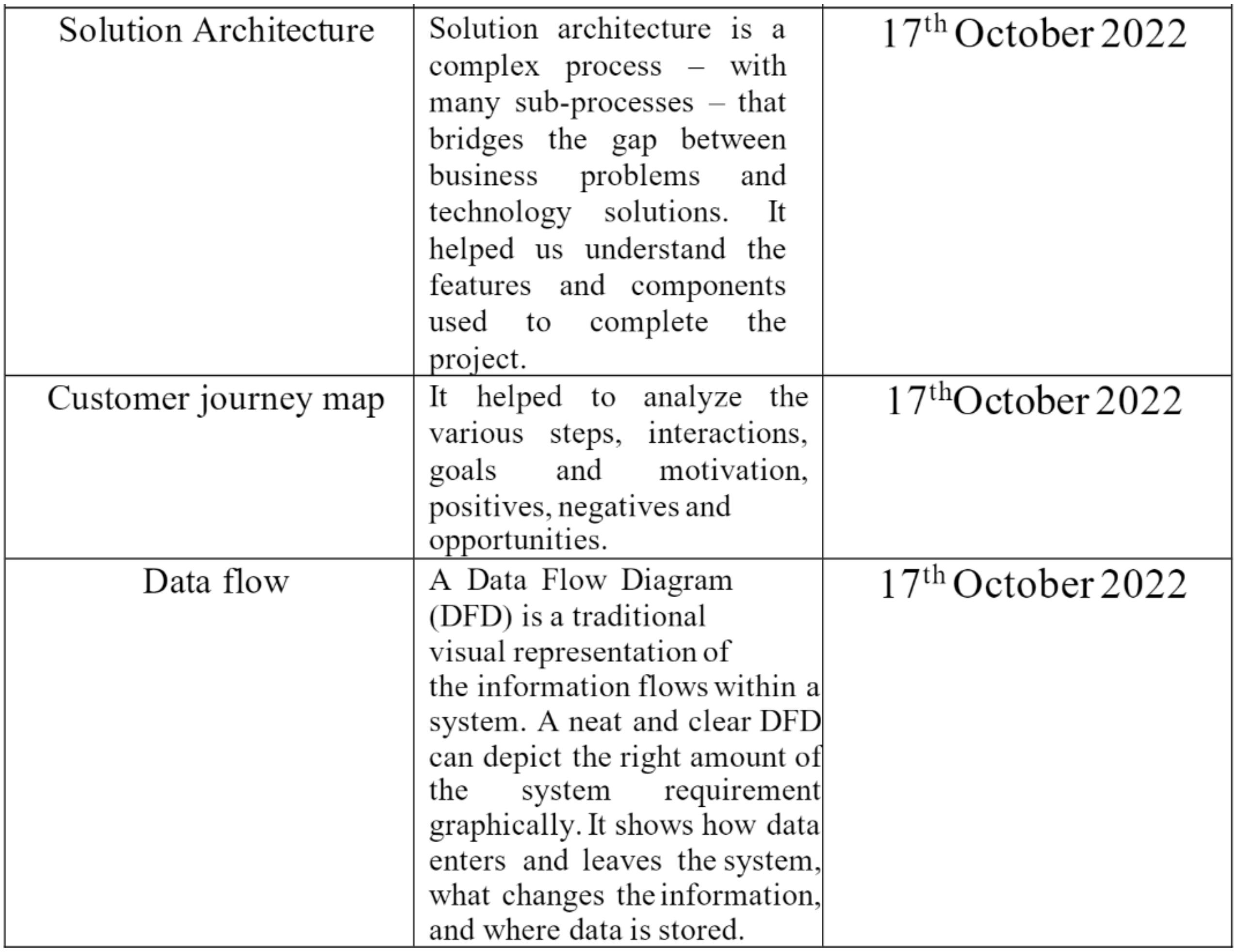


Sprint-3	Display	USN-2	By using ML model the traffic signals will be displayed	High	Pragathii, Anusuya, Hemananthini, Meghaa
Sprint-4	Display	USN-1	The important information like "Take diversion" will be displayed according to weather conditions in the particular zone	Medium	Pragathii, Anusuya, Hemananthini, Meghaa
Sprint-4	Display	USN-2	The message like "School zone, Hospital zone, No horn, Accident zone " will be displayed in LED screen	Medium	Pragathii, Anusuya, Hemananthini, Meghaa

6.2 Delivery Schedule Reports from JIRA



TITLE	DESCRIPTION	DATE
Literature Survey& Information Gathering	A literature review is a comprehensive summary of previous researches on the topic. The literature review surveys scholarly articles, books, and other sources relevant to a particular area ofresearch.	17th October 2022
Prepare Empathy Map	An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. It helps us to understand the customers' pain, gain and difficulties from their point of view.	17th October 2022
Ideation-Brainstorming	Brainstorming is a group problem-solving method that helped us to gather and organize various ideas and thoughts from team members.	17th October 2022
Problem Solution Fit	It helped us understand and analyze all the thoughts of our customer,their choice of options, problems, root cause, behavior and emotions.	17th October 2022
Proposed solution	It helped us analyze and examine our solution morein the grounds of uniqueness, social impact, business model, scalability etc.	17th October 2022



Solution Architecture	Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. It helped us understand the features and components used to complete the project.	17th October 2022
Customer journey map	It helped to analyze the various steps, interactions, goals and motivation, positives, negatives and opportunities.	17thOctober 2022
Data flow	A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.	17th October 2022

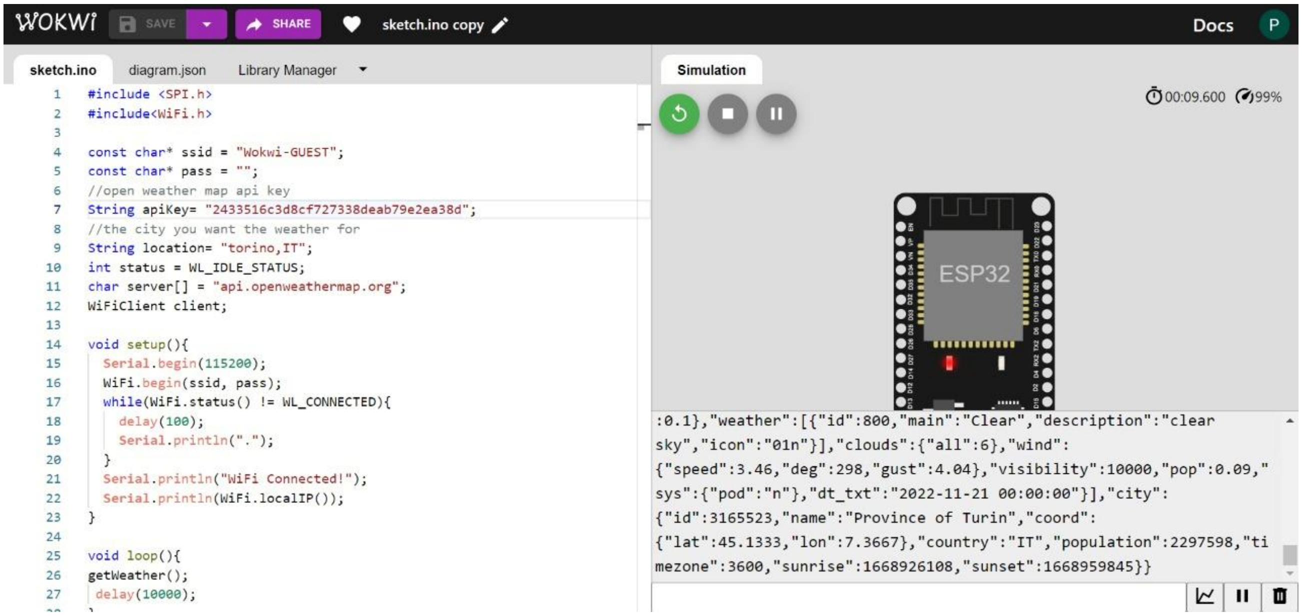
7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1

Integration of Weather API to IBM Cloud Platform

```
#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);
}
```



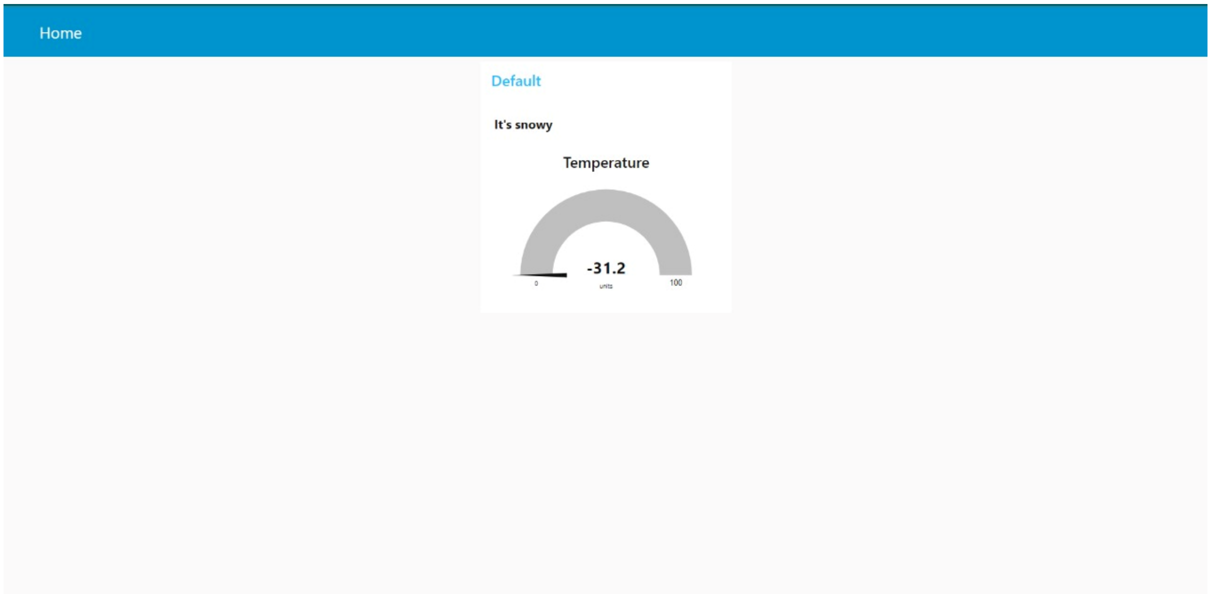
```
#include <SPI.h>
#include<WiFi.h>

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);
}
```

```
:0.1},"weather":[{"id":800,"main":"Clear","description":"clear
sky","icon":"01n"}],"clouds":{"all":6},"wind":
{"speed":3.46,"deg":298,"gust":4.04},"visibility":10000,"pop":0.09,"
sys":{"pod":"n"},"dt_txt":"2022-11-21 00:00:00"}],"city":
{"id":3165523,"name":"Province of Turin","coord":
{"lat":45.1333,"lon":7.3667},"country":"IT","population":2297598,"ti
mezone":3600,"sunrise":1668926108,"sunset":1668959845}}
```

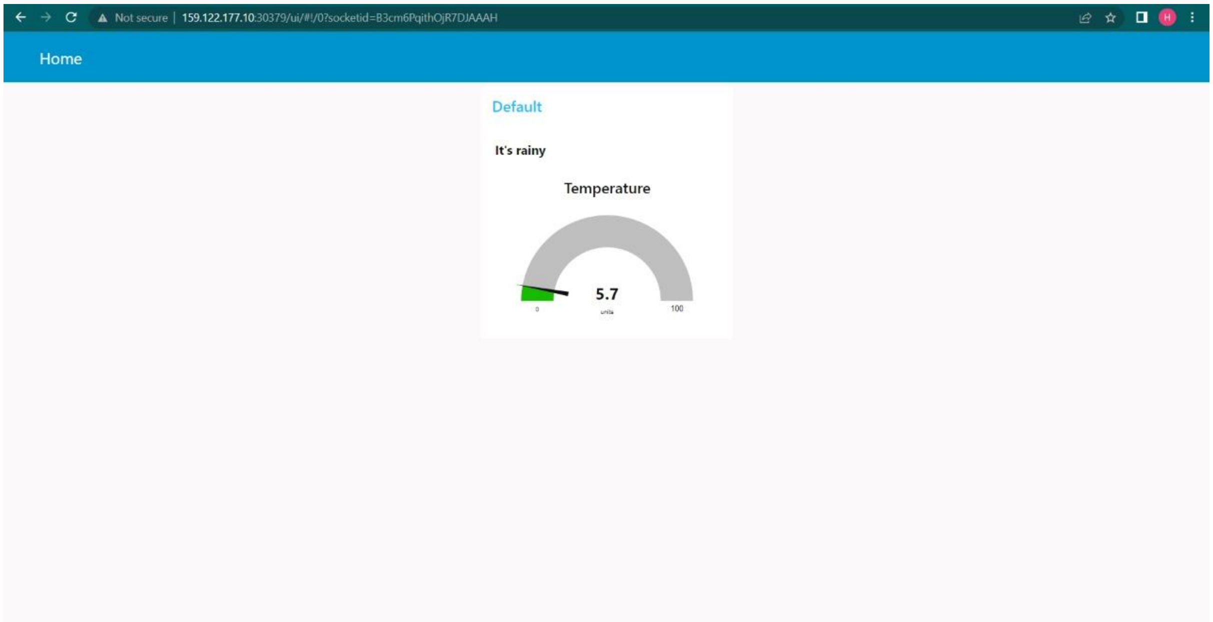
7.2 Feature 2

Integration of IBM Cloud Platform with NodeRed and displaying in UI

```
var msgt = {};
if(msg.payload.temp<0)
msgt.payload = "Drive below speed limit of 20km/hr";
else if(msg.payload.temp>=0 && msg.payload.temp<25)
msgt.payload = "Drive below speed limit of 60km/hr";
else
msgt.payload = "Drive below speed limit of 100km/hr";

return msgt;
```



It's snowy


Not secure | 159.122.177.10:30379/ui/#!/0?socketid=B3cm6PqithOjR7DJAAAH

It's rainy

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

11. 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

12. 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.

16. APPENDIX

13.1 Source Code

API to Cloud Platform

```
#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();
  }
```

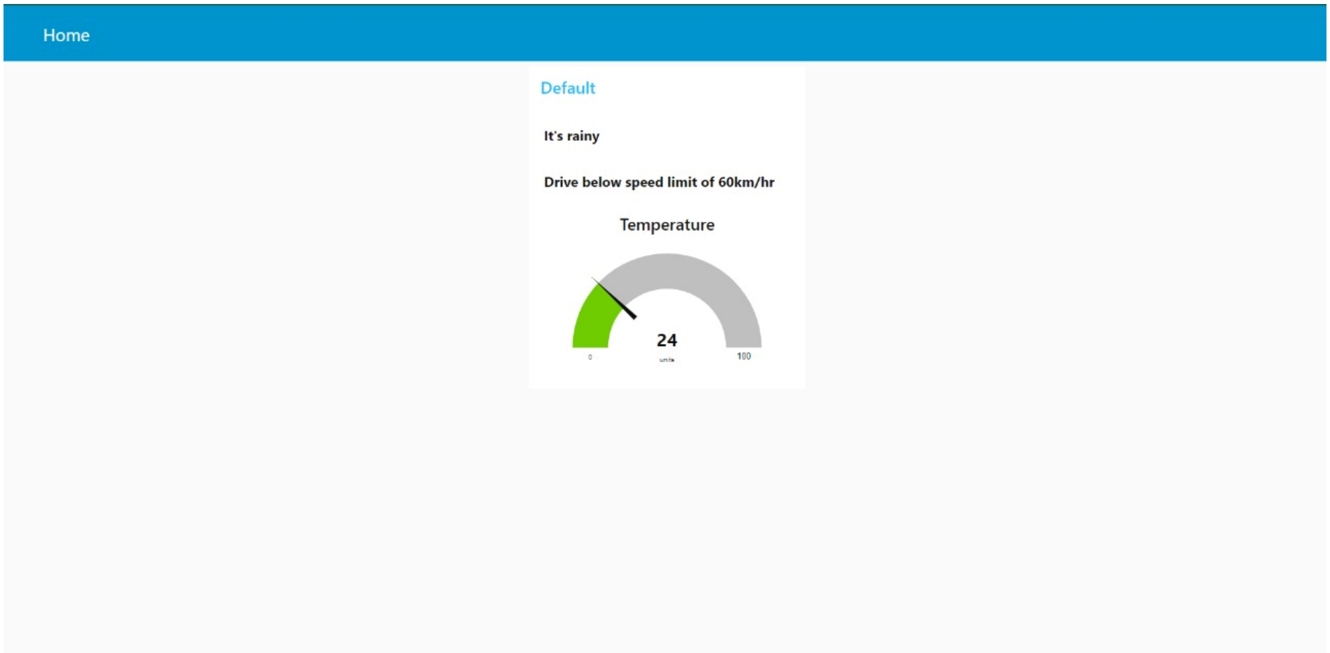
```
}
void wificonnect() //function defination for wificonnect
{
  Serial.println();
  Serial.print("Connecting to ");

  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);
 }
}



#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);
 }
}
```

NodeRed Code

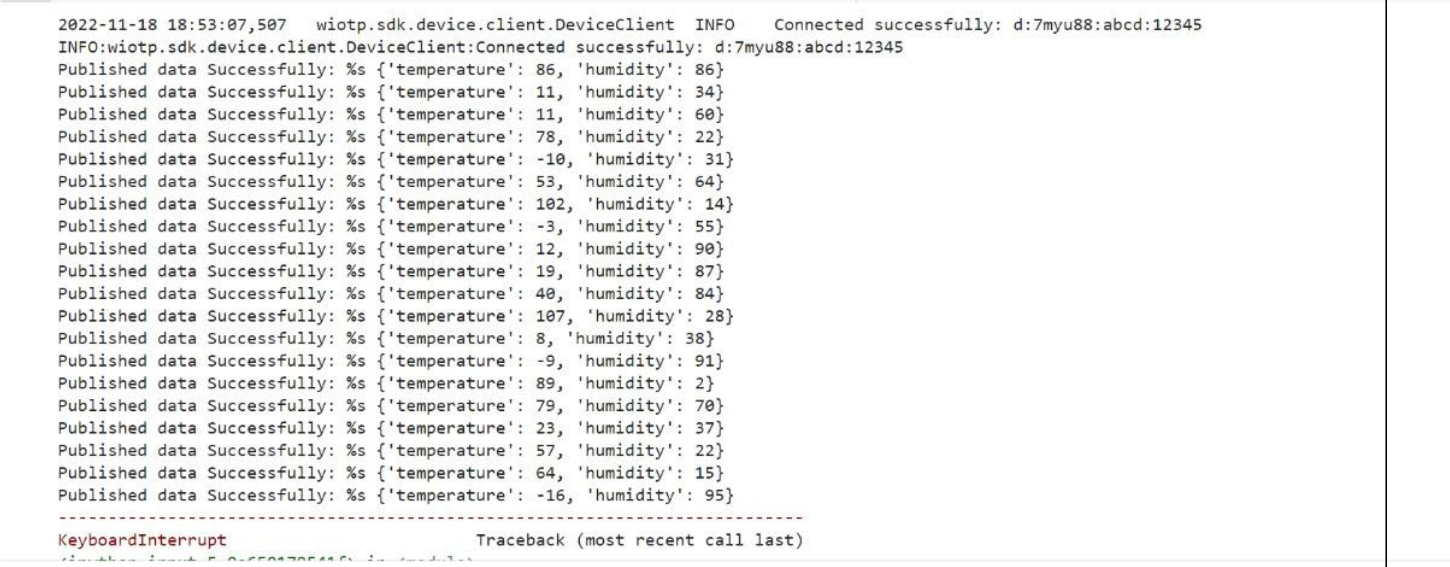
```
import wiotp.sdk.device
import time
import random
myConfig = {
"identity":{
"orgId": "7myu88",
"typeId": "abcd",
"deviceId":"12345"},
"auth": {"token": "12345678"}
}

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

  m=cmd.data['command']
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

while True:

  temp=random.randint(-20,125)
 hum=random.randint(0,100)
myData={'temperature': temp, 'humidity':hum}
client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
print("Published data Successfully: %s", myData)
client.commandCallback= myCommandCallback
 time.sleep(2)
client.disconnect()
```

OUTPUT



It's rainy

Drive below speed limit of 60km/hr



```
2022-11-18 18:53:07,507   wiotp.sdk.device.client.DeviceClient  INFO    Connected successfully: d:7myu88:abcd:12345
INFO:wiotp.sdk.device.client.DeviceClient:Connected successfully: d:7myu88:abcd:12345
Published data Successfully: %s {'temperature': 86, 'humidity': 86}
Published data Successfully: %s {'temperature': 11, 'humidity': 34}
Published data Successfully: %s {'temperature': 11, 'humidity': 60}
Published data Successfully: %s {'temperature': 78, 'humidity': 22}
Published data Successfully: %s {'temperature': -10, 'humidity': 31}
Published data Successfully: %s {'temperature': 53, 'humidity': 64}
Published data Successfully: %s {'temperature': 102, 'humidity': 14}
Published data Successfully: %s {'temperature': -3, 'humidity': 55}
Published data Successfully: %s {'temperature': 12, 'humidity': 90}
Published data Successfully: %s {'temperature': 19, 'humidity': 87}
Published data Successfully: %s {'temperature': 40, 'humidity': 84}
Published data Successfully: %s {'temperature': 107, 'humidity': 28}
Published data Successfully: %s {'temperature': 8, 'humidity': 38}
Published data Successfully: %s {'temperature': -9, 'humidity': 91}
Published data Successfully: %s {'temperature': 89, 'humidity': 2}
Published data Successfully: %s {'temperature': 79, 'humidity': 70}
Published data Successfully: %s {'temperature': 23, 'humidity': 37}
Published data Successfully: %s {'temperature': 57, 'humidity': 22}
Published data Successfully: %s {'temperature': 64, 'humidity': 15}
Published data Successfully: %s {'temperature': -16, 'humidity': 95}
---------------------------------------------------------------------------
KeyboardInterrupt                         Traceback (most recent call last)
```

13.3 GitHub & Project Demo Link

Github

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

Project Demo Link

https://drive.google.com/drive/folders/1UObZnz-sd4zYQkgREaaaez2SqRNxzabl?usp=share_link