

Project Report

Date	17Nov2022
TeamID	PNT2022TMID19258
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 signboards are used.
- These smart connected signboards 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 situation 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 signboard 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 signboards:
 - 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. 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 communication technologies.
2.	Traffic Sign Board Detection and Recognition using Augmented	2020, International Research Journal of	Real-time approach for fast an

	Reality. AkshataAnantPrabhu,Deepika V.D.,Muralikrishna.N,P. VaishnaviAcharya,A.R.Manjula	Engineeringand Technology(IRJET).	Frame work for traffic sign recognition Which super imposes virtual object onto a realsceneunderalltypesof drivingsituations,includi ngunfavorableweatherco nditionsandgivesavoiceal ertwiththehelpofspeakers .
3.	AutomaticSignboardDetectionSystem bythe Vehicles Anushree.A.S,HimanshuKumar,Id ahIram,KumarDivyam,Rajeshwari .J	2019,IJESC.	Signboarddetectionsyst eminthevehiclewhichw illdetectthesignboardan dwarnthedriveraboutit. Itdisplaysthealertmessa georinformationonprov idedLCDandvoicealertt hroughspeakers.
4.	DevelopmentandTestingofRoad SignsAlertSystem Using aSmartMobilePhone EricM.Masatu,RamadhaniSinde,an dAraelSam	2022,HindawiJourn alofAdvancedTransp ortation).	Thepaperisbasedonthere searchaboutAdvancedDr iverAssistancesystemwh ichisoneofthesalientfeatu resofintelligentsystemint ransportation.
5.	AWi-FibasedElectronicRoadSignforEnhancingtheAwarenessofVehicle. ABhawiyuga,RASabriansyah,WYahya,REPutra.	2016, IOP PublishingLtd.	Employmentof vehicularnetworkconcept inwhichavehiclecancom municatewithothervehicl esorwiththeinfrastructure installedalongtheroad.
6.	AutomaticDetectionofRoadSignsto ControlVehicleSpeed AnujaNanal,PoojaMotwani,	2019,InternationalJo urnalofComputerAp plications.	ElectronicDisplaycontrol lerneantforcontrollingve hiclespeedandmonitorsth ezones,

	Pragati Pawar, Rajat Nirhale, Rahul Patil.		and which can also display the speed to the reader with the help of a unit attached in the car.
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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 RA Sabriansyah, W Yahya and RE 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*

6. Bhawna Saini¹, Rachna Devi², Shilpi Dhankhar³, Mohammad-ziaul-Haque⁴, Jagandeep Kaur⁵, 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 signboards. These smart connected signboards get the speed limitations from weather API

and update automatically.

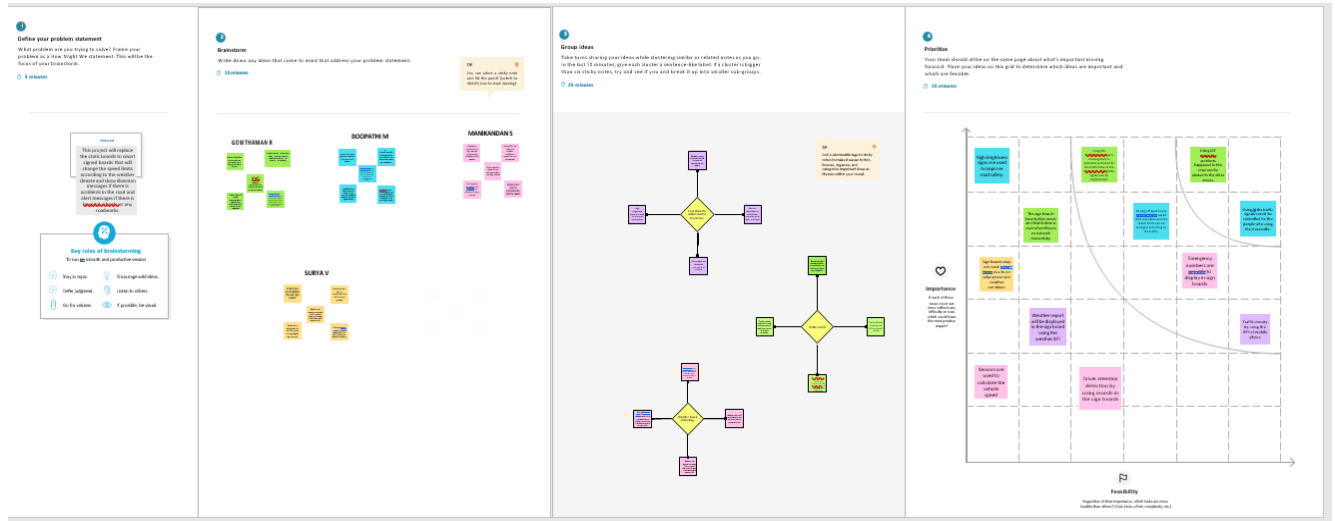
Based on the weather change the speed may increase or decrease. It will display the normal signs in necessary places with wording to be aware of the signs. Based on the traffic and fatal situation the diversion signs are displayed. Guide (Schools), Warning and Service (Hospitals, Restaurant) signs are also displayed accordingly. Change of modes will take place automatically.

3. Ideation and Proposed Solution:

3.1. Empathy Map Canvas:



3.2. Ideation&Brainstorming:



3.3. ProposedSolution:

S.No.	Parameter	Description
1.	ProblemStatement(Problemtoresolved)	InpresentSystemstheroadsignsandthespeed limitsareStatic.Buttheroadsignscanbechangedinsomecases.Wecanconsidersomecases whentherearesomeroaddiversionsduetoheavytrafficordue to accidents then we can change the road signs accordingly, if they are digitalized. This project proposes a system which has digital signboards on which the signs can be changed dynamically. If there is rainfall then the roads will be slippery and the speed limit would be decreased. There is a web app through which you can enter the data of the road diversions, accident prone areas and the information signboard can be entered through web app. This data is retrieved and displayed on the signboards accordingly.
2.	Idea/Solutiondescription	The Idea is to replace the static signboards. Instead, smart connected signboards are used. These smart connected signboards get the speed limitations from a web app using weather API and update

		<p>automatically. Based on the weather change the speed may increase or decrease. Based on the traffic and fatal situation the diversion signs are displayed. Guide (for Schools), Warning and Service (Hospitals, Restaurant) signs are also displayed accordingly.</p> <p>Additionally, Speed camera integrated with image processing technique is added to detect any traffic speed violations and charge fines.</p>
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 enhances services.
6.	Scalability of the Solution	Low-cost Implementation and Maintenance. Durability of the product is high.

3.4. ProblemSolutionFit:

Project Design Phase-I - Solution Fit Template Team ID: PNT2022TMID19258

Signs with Smart Connectivity for Better Road Safety

<p>1. CUSTOMER SEGMENT(S) Who is your customer?</p> <ul style="list-style-type: none"> Highway division passenger 	<p>6. CUSTOMER CONSTRAINTS What constraints prevent your customers from taking action or limit their choices of solutions?</p> <p>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 sign board.</p>	<p>5. AVAILABLE SOLUTIONS Which solutions are available to the customers when they face the problem?</p> <p>Along roadways, static signs with clear directions are put as potential fixes.</p>
<p>2. JOBS-TO-BE-DONE / PROBLEMS Which jobs to be done (or problems) do you address for your customers?</p> <p>Among its many duties, the Smartboard Connectivity is in charge of keeping correct temperature sensor readings and informing the board of the speed of the customer's vehicle.</p>	<p>9. PROBLEM ROOT CAUSE What is the real reason that this problem exists? What is the back story behind the need to do this job?</p> <p>No Sensor readings from the weather would alter the speed restriction if there was no internet connection. Unnecessary pressing of the accident indicator button by some people could lead to problems.</p>	<p>7. BEHAVIOUR What does your customer do to address the problem and get the job done?</p> <p>As a teacher, the IoT cloud updates the smartboard on the condition of the roads on a regular basis.</p>
<p>3. TRIGGERS What triggers customers to act?</p> <p>Poor weather conditions prevail. The vehicle should be moving at threshold speed. The sensor value should be shown on the smart board to alert the customer.</p>	<p>10. YOUR SOLUTION</p> <p>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</p>	<p>8. CHANNELS of BEHAVIOUR</p> <p>8.1 ONLINE What kind of actions do customers take online? The departments can receive direct emails or messages from customers. (Officers on nearby patrol).</p> <p>8.2 OFFLINE</p>

4. Requirements:

4.1. FunctionalRequirement:

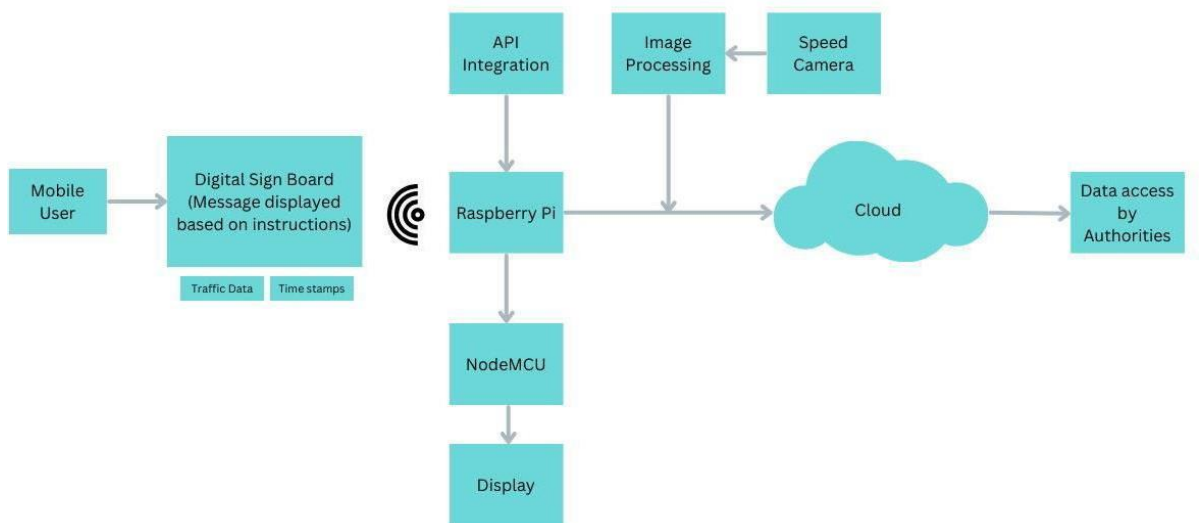
FR No.	FunctionalRequirement(Epic)	SubRequirement(Story/Sub-Task)
FR-1	UserVisibility	SignBoardwillhaveand clearandinteractiveUIsothatitwillbeclearlyvisibletoal
FR-2	UserUnderstanding	Thesignsthataretobedisplayedinthesignboardwillbewit hitsrespectivenames,sothattheuserscanclearlyundersta ndeverything
FR-3	UserConvenience	Signswillbedisplayedflawlesslysuchthatit willbeofbetterconvenience.

4.2. Non-Functional Requirement:

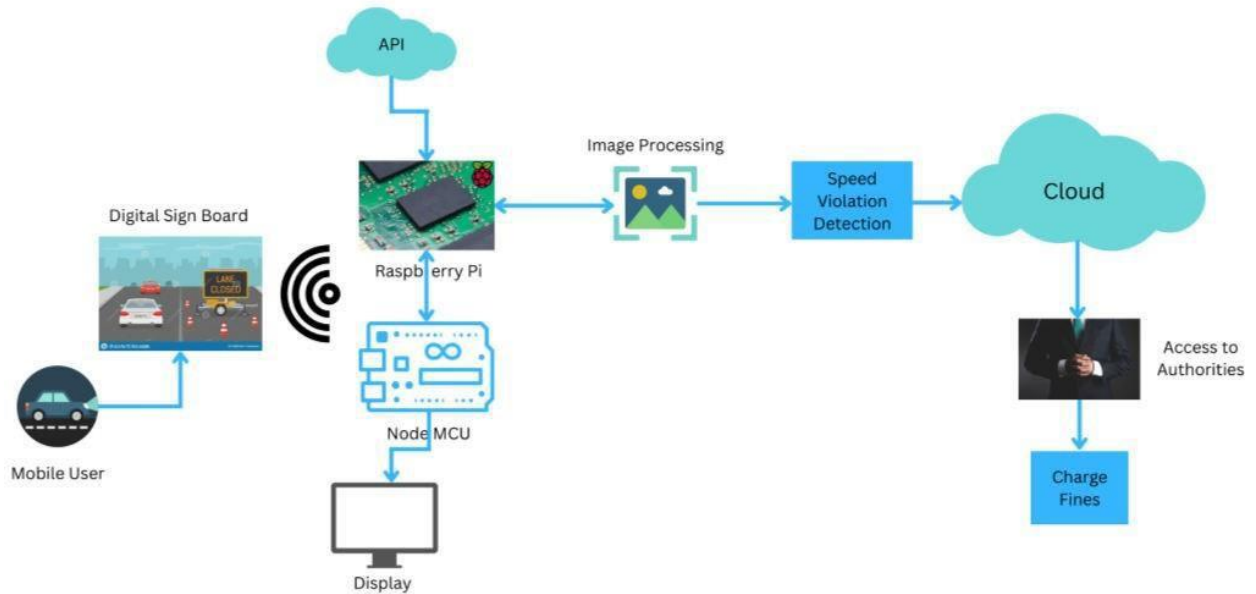
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	For multiple sign display, timestamps will be allocated for each sign. It will be automatic and dynamically changeable. No need for manual operations.
NFR-2	Security	Only required can will be showed. No chance of security vulnerability.
NFR-3	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 be 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:

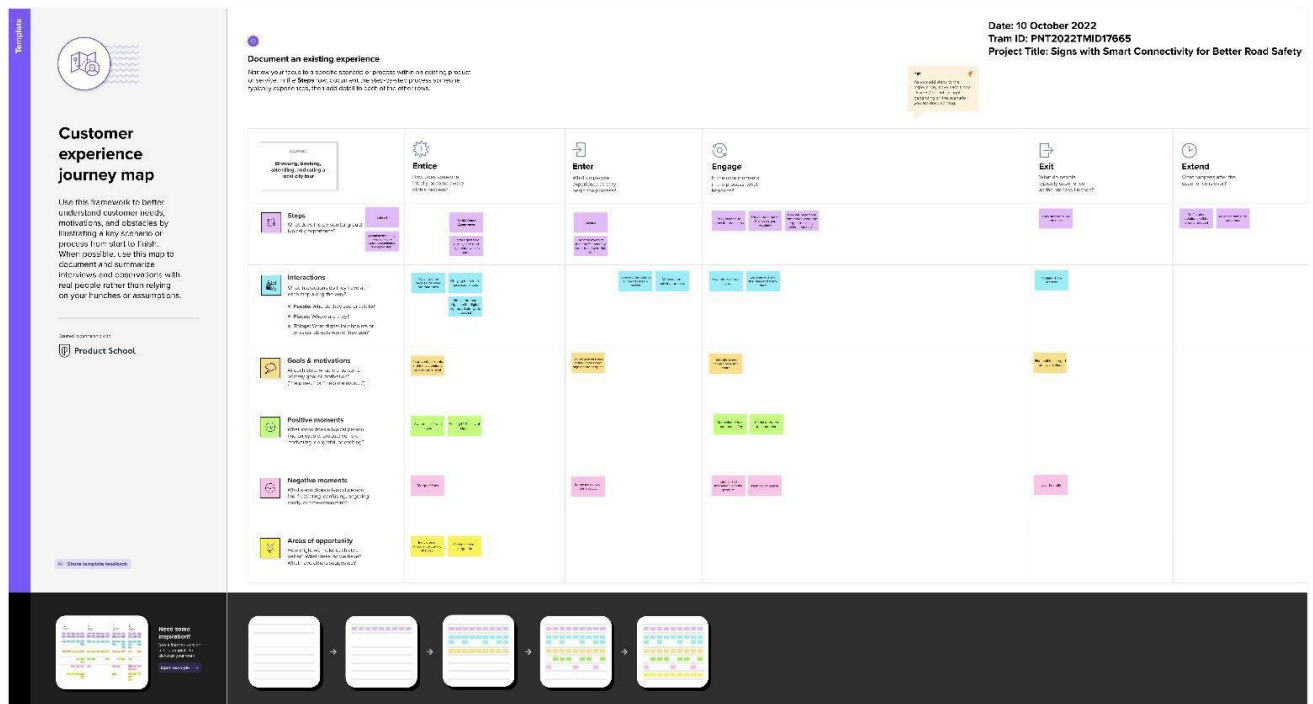
5.1. Data Flow Diagram:



5.2. Solution and Technical Architecture:



5.3. User Stories:



6. Project Planning & Scheduling:

6.1. Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story/Task	Story Points	Team Members
Sprint-1	User Registration	As a user, I can register on the website by entering my email, password, and confirming my password.	3	Surya V
	Admin Registration	As an admin, I can log into the website using my credentials and access the data.	3	Boopathi M
	Login	User and Admin can log into the website by entering email & password.	1	Gowthaman R
	Dashboard	Develop a dashboard for the website for knowledge about road rules.	3	Manikandan S
Sprint	Functional Requirement (Epic)	User Story/Task	Story Points	Team Members
Sprint-2	Node-Red UI	Develop a Node-Red UI Flow.	2	Boopathi M
	Node-Red Dashboard	Develop a Node-Red UI Dashboard.	2	Manikandan S
	Node-Red Webpage	Develop a Node-Red Webpage for displaying the data.	3	Surya V
	Node-Red Data Check	Check the data displayed on the Node-Red Dashboard UI.	3	Gowthaman R

Sprint	Functional Requirement (Epic)	User Story/Task	Story Points	Team Members
Sprint-3	API Integration	Integrate the necessary API's.	3	Gowthaman R
	Develop Python Code	Develop Python code to integrate the necessary API's.	2	Boopathi M

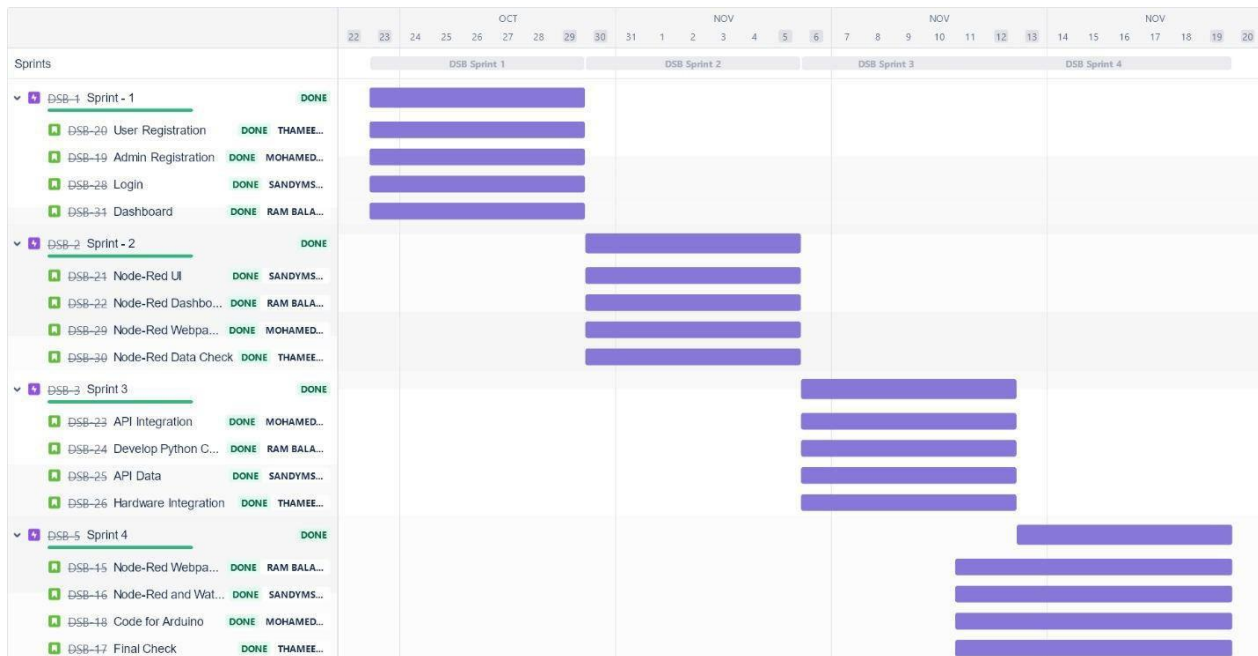
Sprint	Functional Requirement(Epic)	User Story/Task	Story Points	Team Members
	API Data	Check the data from weather API.	2	Manikandan S
	Hardware Integration	Integrate Arduino with TFT Display via simulation.	3	Surya V

Sprint	Functional Requirement(Epic)	User Story/Task	Sprint Points	Team Members
Sprint-4	Node-Red Webpage Data	Develop code to display data on the webpage and check the necessary.	2	Boopathi M
	Node-Red and Watson	Connect Node-Red with IBM Watson platform for data processing (Random Data Generation).	3	Surya V
	Code for Arduino	Develop code to display data on the display screen.	3	Gowthaman R
	Final Check	Check all the simulation and services working perfectly and display data and final submission of project.	2	Manikandan R

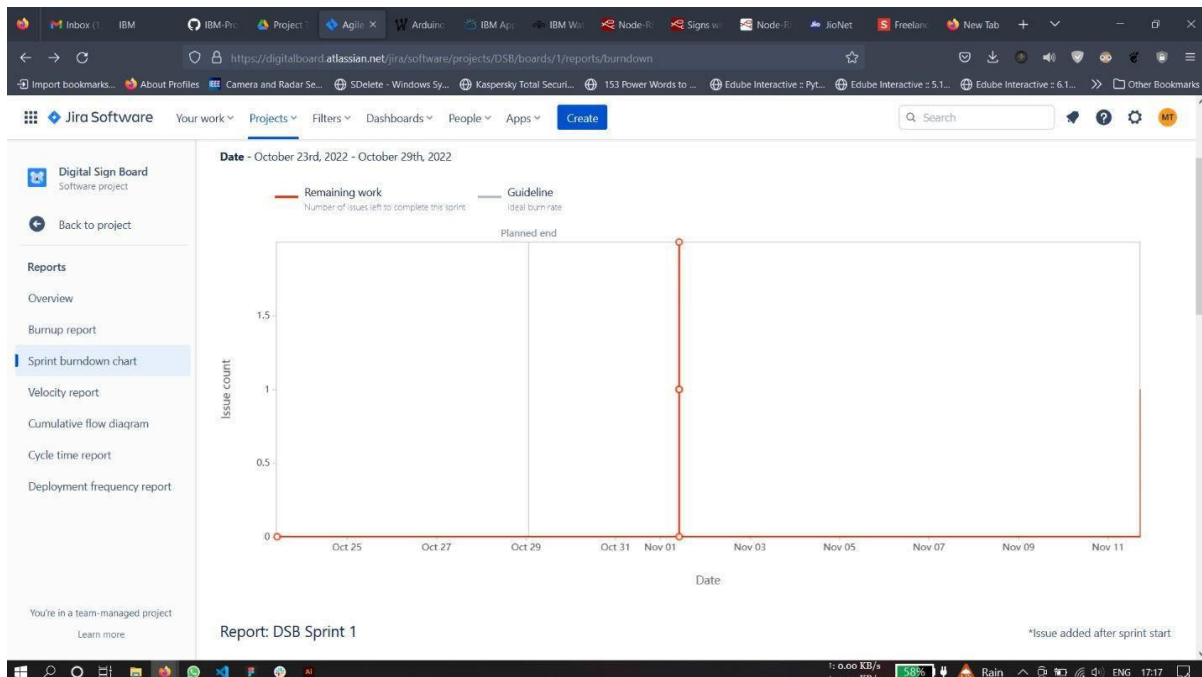
6.2.Sprint Delivery Schedule:

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	10	6 Days	24 Oct 2022	29 Oct 2022	10	29 Oct 2022
Sprint-2	10	6 Days	31 Oct 2022	05 Nov 2022	10	05 Nov 2022
Sprint-3	10	6 Days	07 Nov 2022	12 Nov 2022	10	12 Nov 2022
Sprint-4	10	6 Days	14 Nov 2022	19 Nov 2022	10	19 Nov 2022

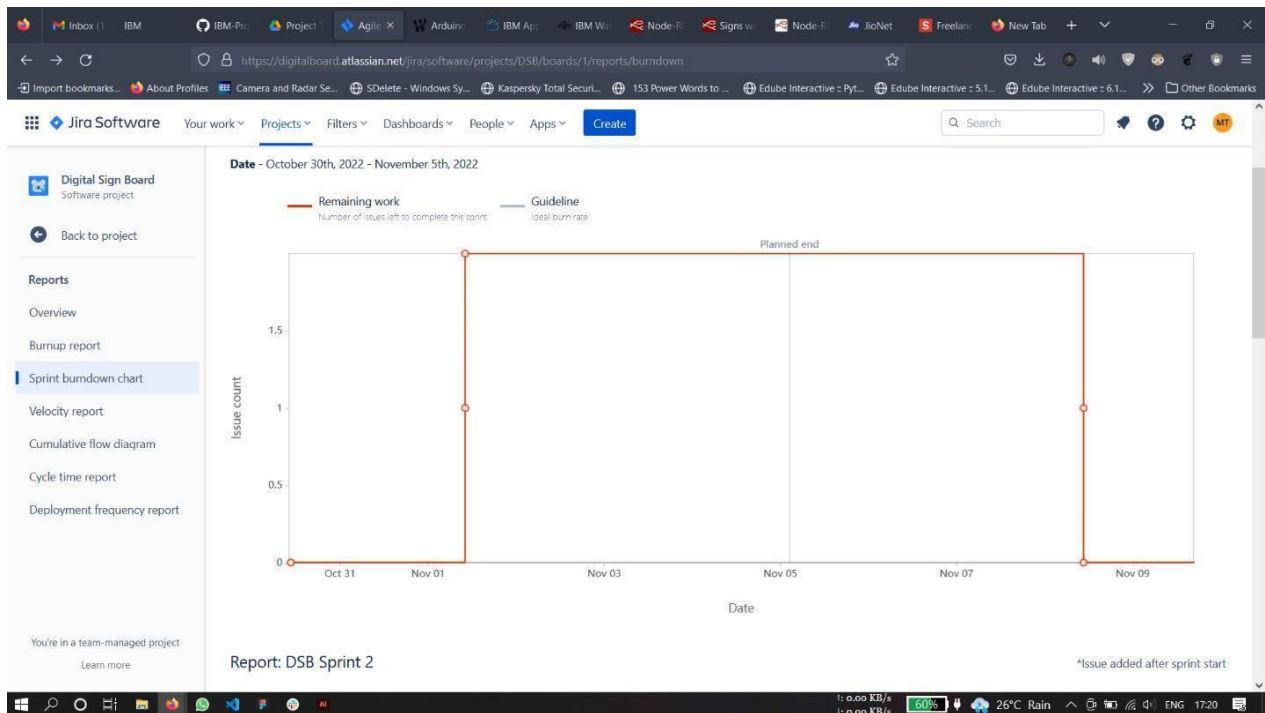
6.3.ReportfromJira:



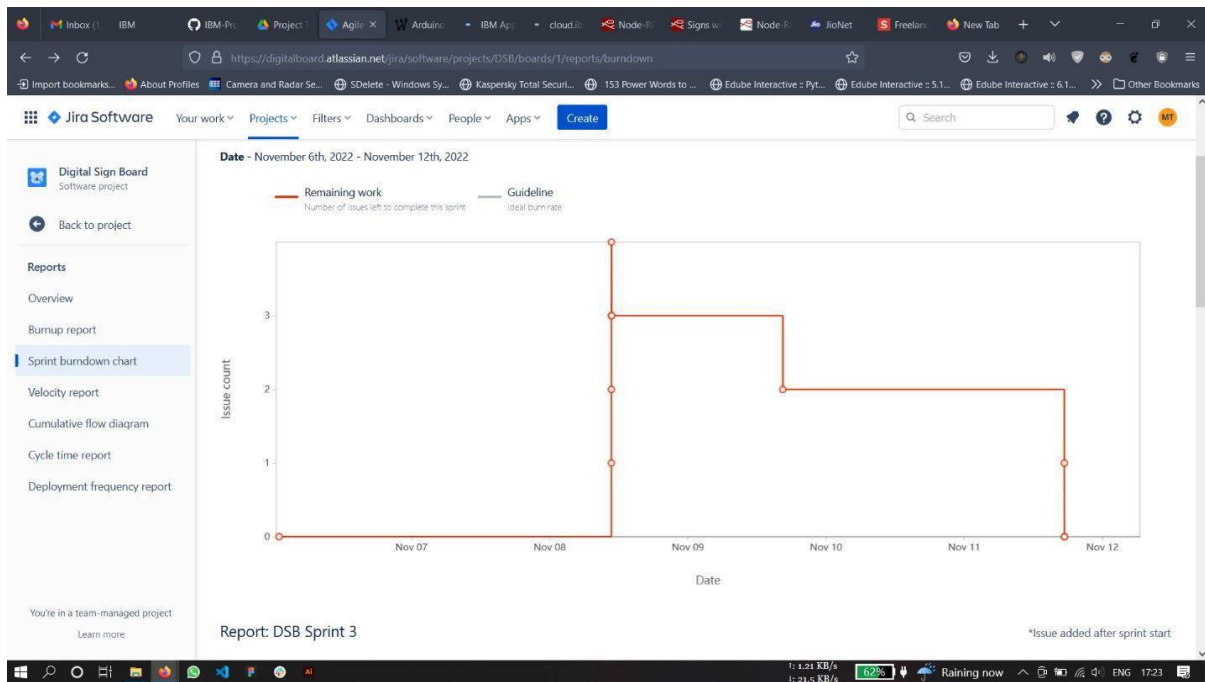
Sprint-1Burndown chart:



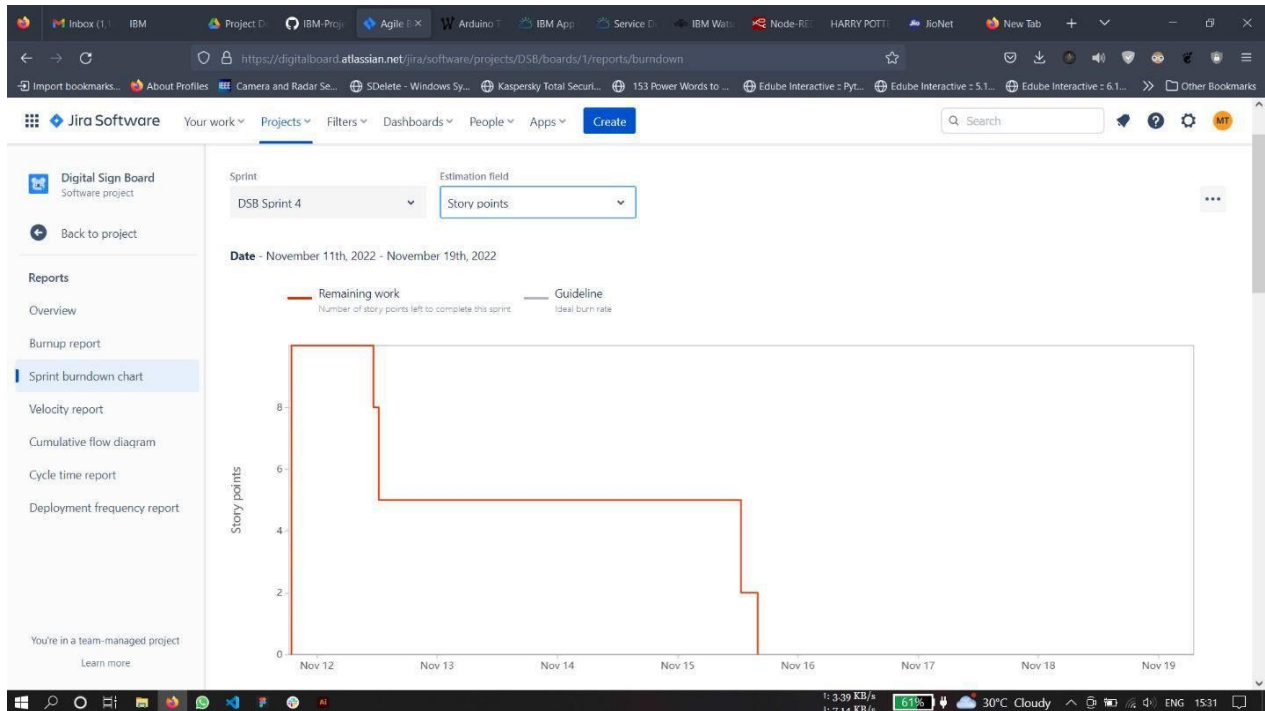
Sprint-2Burndown Chart:



Sprint-3Burndown Chart:



Sprint–4BurndownChart:



7. Coding&Solutioning:

7.1. Feature1:

Climatepredictionisdonefromtemperaturedatafromtheopeanweatherapi.

Butasfornowrandomvaluesareused.

Speedisincreasedordecreasedbasedontheclimateprediction.

```
/*Temperaturefor SpeedControlusingrandom input*/

//Temperature =20;
Temperature=random(-10,35);//(-10)to 10 -- Snow,11 to25 --
Rainspeed(Temperature);
Serial.println(Temperature);

/*Speed Controlprocess..
*/voidspeed(int Temp)
{
    tft.fillScreen(Black);
    if(Temp >=-10 &&Temp <=14) //It's Snow
    {
```



```

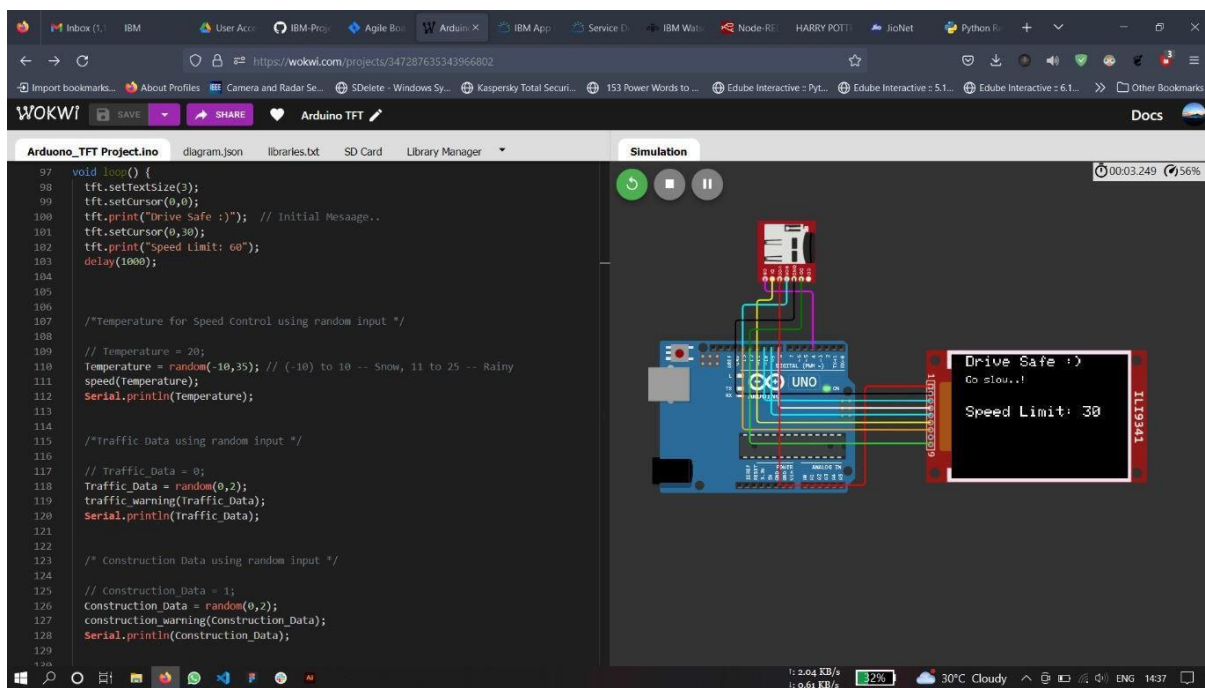
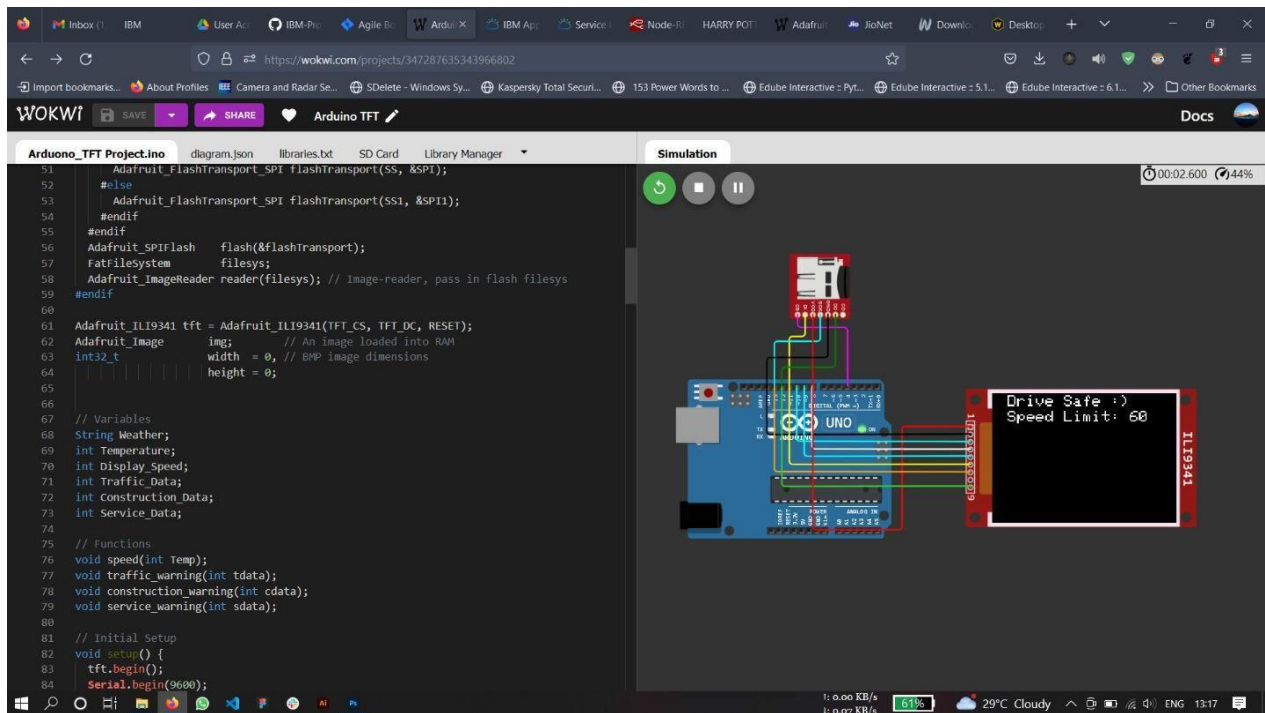
Weather="Snowy";tft.setCursor
(0,0);tft.print("DriveSafe
:");tft.setTextSize(2);tft.s
etCursor(0,40);tft.print("Gos
low..!");tft.setCursor(0,100)
;tft.setTextSize(3);tft.print
("SpeedLimit:
30");delay(3000);tft.fillScre
en(Black);
}
elseif(Temp >=15&&Temp <=25)//It's Rainy
{
Weather="Rainy";tft.setCursor(0,0
);tft.print("DriveSafe:");tft.se
tTextSize(2);tft.setCursor(0,40);
tft.print("SlipperyRoad
Ahead");tft.setCursor(0,70);tft.p
rint("GoSlow..!");tft.setCursor(0
,100);tft.setTextSize(3);tft.prin
t("SpeedLimit:
40");delay(3000);tft.fillScreen(B
lack);
}
else
{
tft.setCursor(0,0);tft.print(
"DriveSafe!!");tft.setCursor(
0,30);tft.print("SpeedLimit:
60");delay(3000);tft.fillScre
en(Black);
}
tft.fillScreen(Black);
}

/*Traffic WarningSystem */

voidtraffic_warning(int tdata)
{

```

```
tft.fillScreen(Black);
if(tdata ==0)
{
    tft.setCursor(0,0);tft.println("DriveSafe :)");
    //tft.setTextSize(2);tft.setCursor(0,40);tft.println("TrafficAhead..");tft.setCursor(0,80);
    //tft.setTextSize(3);tft.println("DriveCarefully!");delay(3000);tft.fillScreen(Black);
}
if(tdata ==1)
{
    tft.setCursor(0,0);tft.println("DriveSafe :)");tft.setTextSize(2);tft.setCursor(0,40);tft.println("TrafficAhead..");tft.setCursor(0,80);
    //tft.setTextSize(3);tft.println("TakeDiversion-->");delay(3000);tft.fillScreen(Black);
}
}
```



Traffic data and Construction warning data are given with random inputs. Based on traffic and construction data, warning are displayed.

```

/*TrafficData using random input*/

//Traffic_Data
=0;Traffic_Data=random(0,2);tra
ffic_warning(Traffic_Data);Serial.pr
intln(Traffic_Data);

/*Construction Data using random input*/

//Construction_Data
=1;Construction_Data=random(0,2);construc
tion_warning(Construction_Data);Serial.pr
intln(Construction_Data);

/*Traffic WarningSystem */

void traffic_warning(int tdata)
{
    tft.fillScreen(Black);i
f(tdata ==0)
    {
        tft.setCursor(0,0);tft.prin
t("DriveSafe :");
        //tft.setTextSize(2);tft.setC
ursor(0,40);tft.print("Traffi
cAhead..");tft.setCursor(0,80
);
        //tft.setTextSize(3);tft.print("D
riveCarefully!");delay(3000);tft.
fillScreen(Black);
    }
    if(tdata ==1)
    {
        tft.setCursor(0,0);tft.print(
"DriveSafe
:");tft.setTextSize(2);tft.s
etCursor(0,40);tft.print("Tra
fficAhead..");tft.setCursor(0
,80);
        //tft.setTextSize(3);tft.print("T
akeDiversion--
>");delay(3000);tft.fillScreen(Bl
ack);
    }
}

```

```

    }
}

/*Construction WarningSystem

*/void construction_warning(int
cdata)
{
    tft.fillScreen(Black);
    if(cdata ==0)
    {
        tft.setCursor(0,0);tft.print("Drive
Safe
:");tft.setTextSize(2);tft.setCursor(0,40);tft.print("ConstructionA
head..");tft.setCursor(0,80);tft.s
etTextSize(3);tft.print("DriveCare
fully..!");delay(2000);tft.fillScr
een(Black);
    }
    if(cdata ==1)
    {
        tft.setCursor(0,0);tft.print("Drive
Safe
:");tft.setTextSize(2.5);tft.setC
ursor(0,40);tft.print("Constructio
nAhead..");tft.setCursor(0,80);tft
.setTextSize(2.5);tft.print("TakeD
iversion <--
");delay(2000);tft.fillScreen(Blac
k);
    }
}
}

```

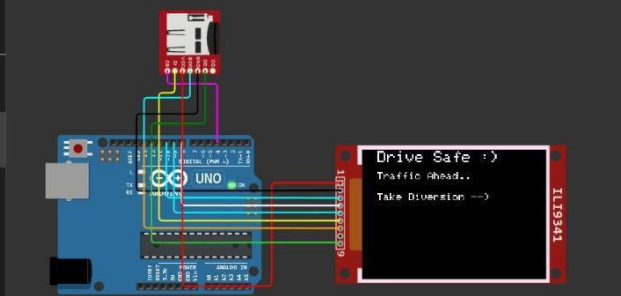
WOKWI

Arduino_TFT Project.ino diagram.json libraries.txt SD Card Library Manager

```
101 tft.setCursor(0,30);
102 tft.print("Speed Limit: 60");
103 delay(1000);
104
105
106 /*Temperature for Speed Control using random input */
107
108 // Temperature = 20;
109 Temperature = random(-10,35); // (-10) to 10 -- Snow, 11 to 25 -- Rainy
110 speed(Temperature);
111 Serial.println(Temperature);
112
113
114 /*Traffic Data using random input */
115
116 // Traffic_Data = 0;
117 Traffic_Data = random(0,2);
118 traffic_warning(Traffic_Data);
119 Serial.println(Traffic_Data);
120
121
122 /* Construction Data using random input */
123
124 // Construction_Data = 1;
125 Construction_Data = random(0,2);
126 construction_warning(Construction_Data);
127 Serial.println(Construction_Data);
128
129
130 /* Service Warning Data using random input */
131
132 // Service_Data = 1;
133 Service_Data = random(0,2);
134
```

Simulation

00:06.649 99%



12

1: 0.05 KB/s
1: 0.05 KB/s

32% 30°C Cloudy ENG 14:37

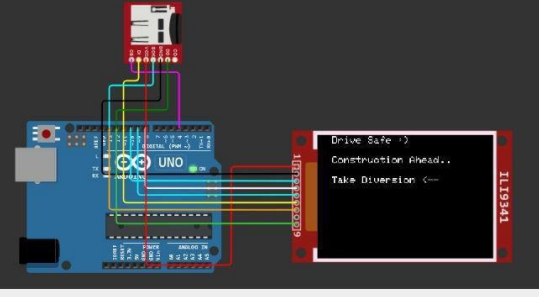
WOKWI

Arduino_TFT Project.ino diagram.json libraries.txt SD Card Library Manager

```
101 tft.setCursor(0,30);
102 tft.print("Speed Limit: 60");
103 delay(1000);
104
105
106 /*Temperature for Speed Control using random input */
107
108 // Temperature = 20;
109 Temperature = random(-10,35); // (-10) to 10 -- Snow, 11 to 25 -- Rainy
110 speed(Temperature);
111 Serial.println(Temperature);
112
113
114 /*Traffic Data using random input */
115
116 // Traffic_Data = 0;
117 Traffic_Data = random(0,2);
118 traffic_warning(Traffic_Data);
119 Serial.println(Traffic_Data);
120
121
122 /* Construction Data using random input */
123
124 // Construction_Data = 1;
125 Construction_Data = random(0,2);
126 construction_warning(Construction_Data);
127 Serial.println(Construction_Data);
128
129
130 /* Service Warning Data using random input */
131
132 // Service_Data = 1;
133 Service_Data = random(0,2);
134
```

Simulation

00:09.866 40%



12
1

1: 0.19 KB/s
1: 0.19 KB/s

32% 30°C Cloudy ENG 14:37

Service warnings like schools, hospitals and holy places are displayed.

```
/*ServiceWarningData using random input*/

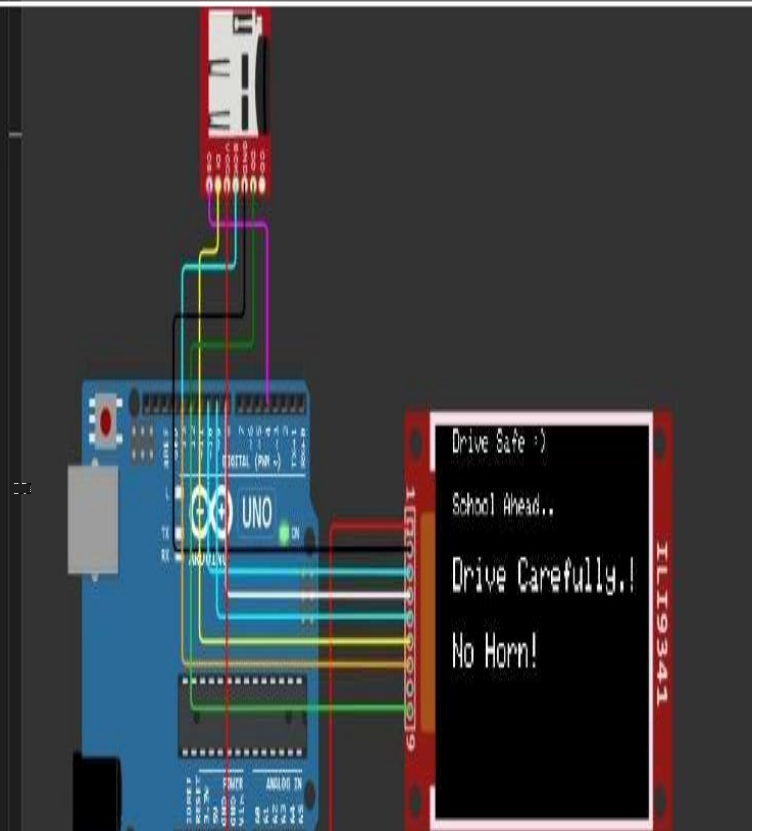
//Service_Data
=1;Service_Data=random(0,2);service_warning(Service_Data);Serial.println(Service_Data);

/*School, HospitalWarning
System*/void service_warning(int
sdata)
{
  tft.fillScreen(Black);
  if(sdata ==0)
  {
    tft.setCursor(0,0);tft.print
    ("DriveSafe
    :");tft.setTextSize(2);tft.
    setCursor(0,40);tft.print("S
    choolAhead..");tft.setCursor
    (0,80);tft.setTextSize(3);
    tft.print("DriveCarefully.!\nNoHorn!");delay(2000);
    tft.fillScreen(Black);
  }
  if(sdata ==1)
  {
    tft.setCursor(0,0);tft.print("
    DriveSafe
    :");tft.setTextSize(2.5);tft.
    setCursor(0,40);tft.print("Hos
    pitalAhead..");tft.setCursor(0
    ,80);tft.setTextSize(2.5);
    tft.print("DriveCarefully.!\nNoHorn!");delay(2000);
    tft.fillScreen(Black);
  }
}
```

```

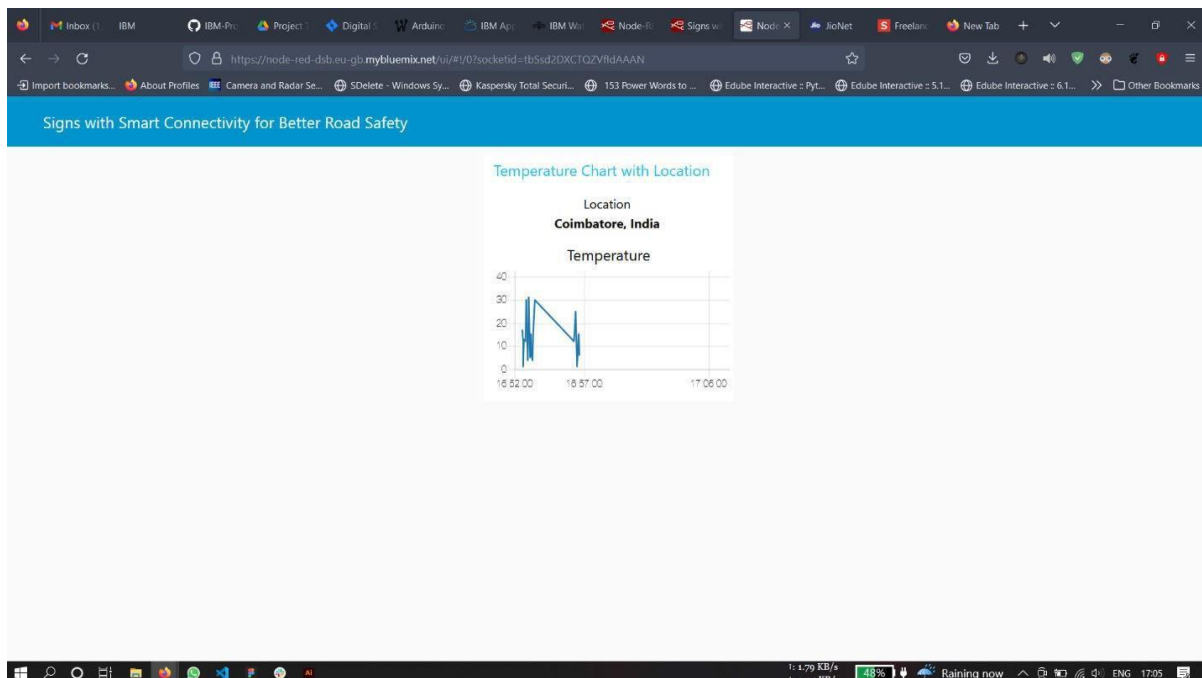
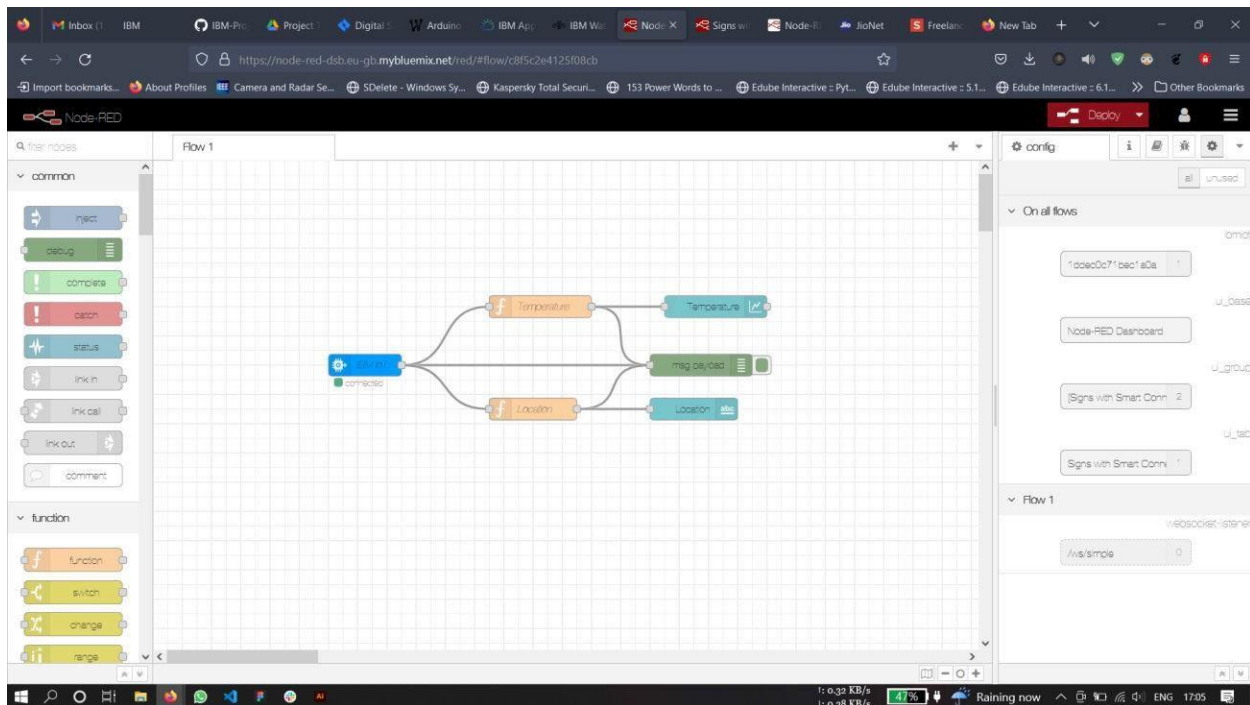
105
106
107 /*Temperature for Speed Control using random input */
108
109 // Temperature = 20;
110 Temperature = random(-10,35); // (-10) to 10 -- Snow, 11 to 25 -- Rainy
111 speed(Temperature);
112 Serial.println(Temperature);
113
114
115 /*Traffic Data using random input */
116
117 // Traffic_Data = 0;
118 Traffic_Data = random(0,2);
119 traffic_warning(Traffic_Data);
120 Serial.println(Traffic_Data);
121

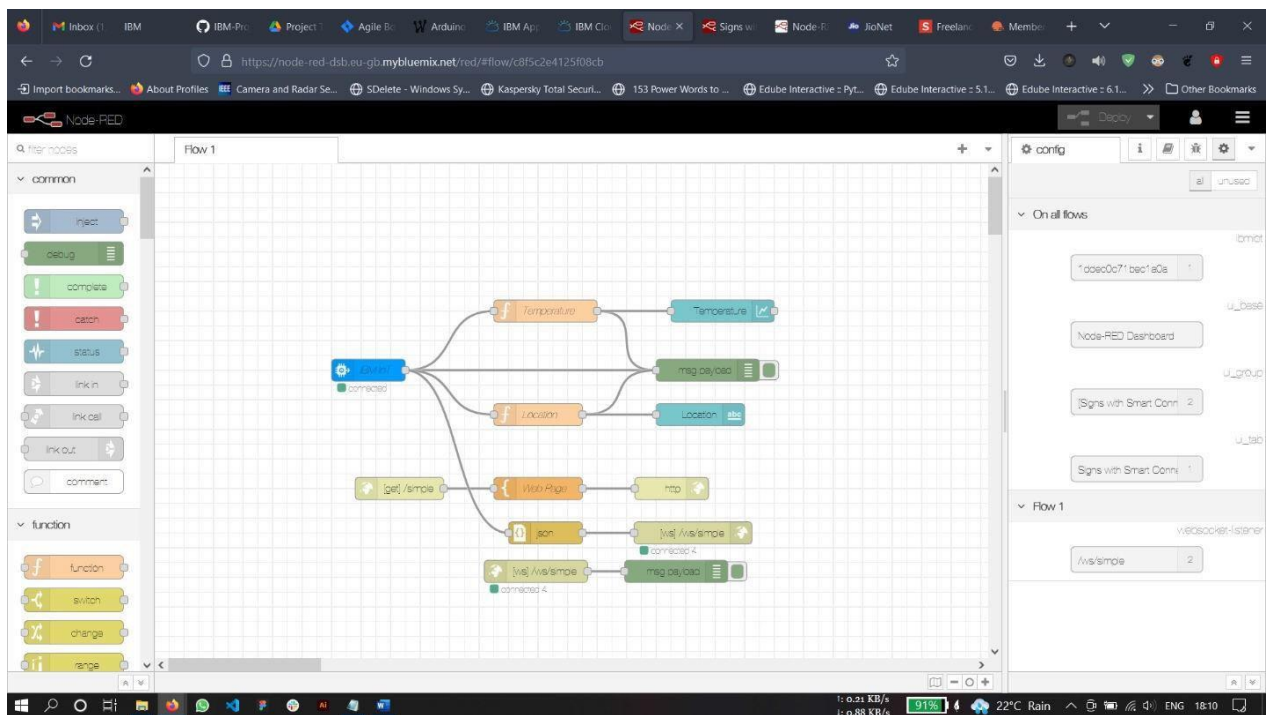
```



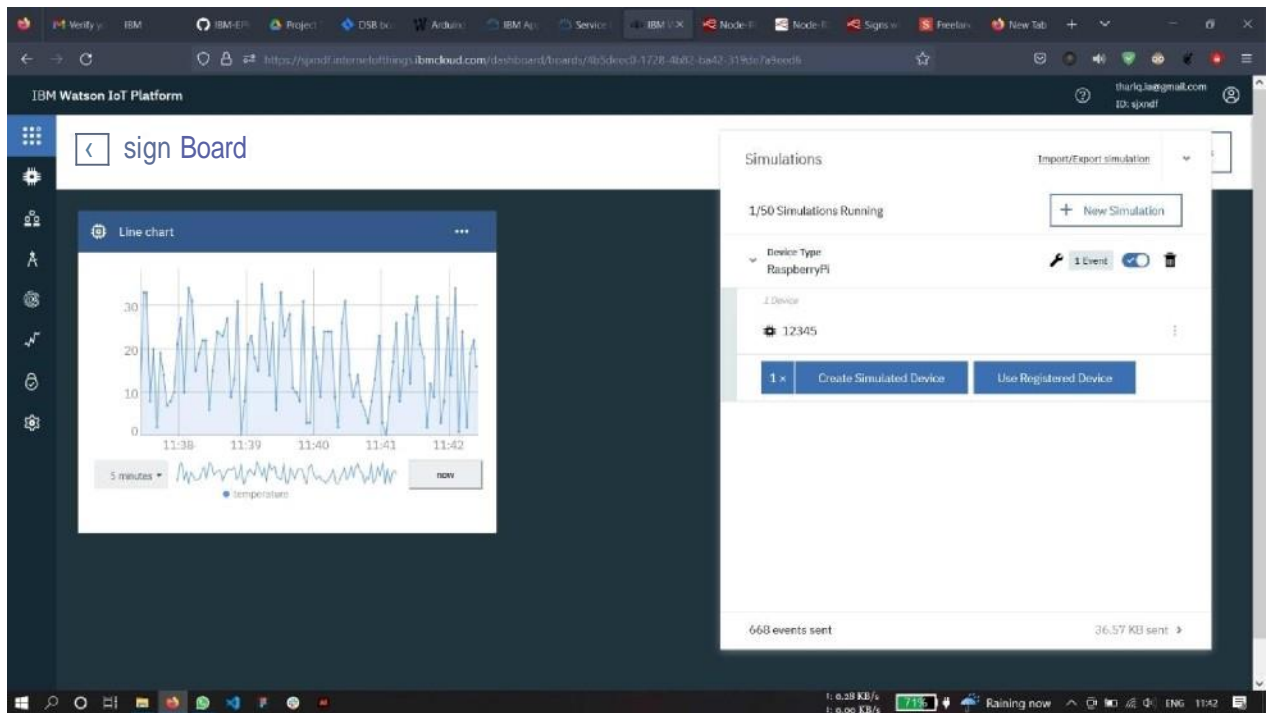
7.2. Feature2:

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





```
1 <!DOCTYPE HTML>
2 <html>
3 <head>
4 <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/materialize/1.0.0/css/materialize.min.css">
5 <script src="https://cdnjs.cloudflare.com/ajax/libs/materialize/1.0.0/js/materialize.min.js"></script>
6 <link href="https://fonts.googleapis.com/css?family=Montserrat:400,700" rel="stylesheet" type="text/css" />
7 <link href="https://fonts.googleapis.com/css?family=Lato:400,700,400italic,700italic" rel="stylesheet" type="text/css" />
8 <title>Signs with Smart Connectivity</title>
9 <script type="text/javascript">
10 var ws;
11 var wsUrl = "ws:";
12 var loc = window.location;
13 console.log(loc);
14 if (loc.protocol === "https:") { wsUrl = "wss:"; }
15 // This needs to point to the web socket in the Node-RED flow
16 // ... in this case it's ws/simple
17 wsUrl += "://" + loc.host + loc.pathname.replace("simple", "ws/simple");
18
19 function wsConnect() {
20   console.log("connect", wsUrl);
21   ws = new WebSocket(wsUrl);
22   //var line = ""; // either uncomment this for a building list of messages
23   ws.onmessage = function(msg) {
24     var line = ""; // or uncomment this to overwrite the existing message
25     // parse the incoming message as a JSON object
26     var data = JSON.parse(msg.data);
27     var data = JSON.parse(data);
28     // console.log(data["temperature"]);
29     // document.getElementById('messages-1').innerHTML = "Temperature: " + data["temperature"];
30     if (data["temperature"] > 0 && data["temperature"] < 15) {
31       document.getElementById('messages-1').innerHTML = "Temperature: " + data["temperature"] + "<br/>Climate: Snowy";
32     }
33   }
34 }
```



IBM Watson IoT Platform

Browse Devices

All Devices Diagnose

This table shows a summary of all devices that have been added. It can be filtered, organized, and searched on using different criteria. To get started, you can add devices by using the Add Device button, or by using API.

Search by Device ID

	Device ID	Status	Device Type	Class ID	Date /
>	12345	Disconnected	RaspberryPi	Device	Nov 16

Items per page: 50 | 1-1 of 1 item

Simulations

1/50 Simulations Running

+ New Simulation

device type: RaspberryPi

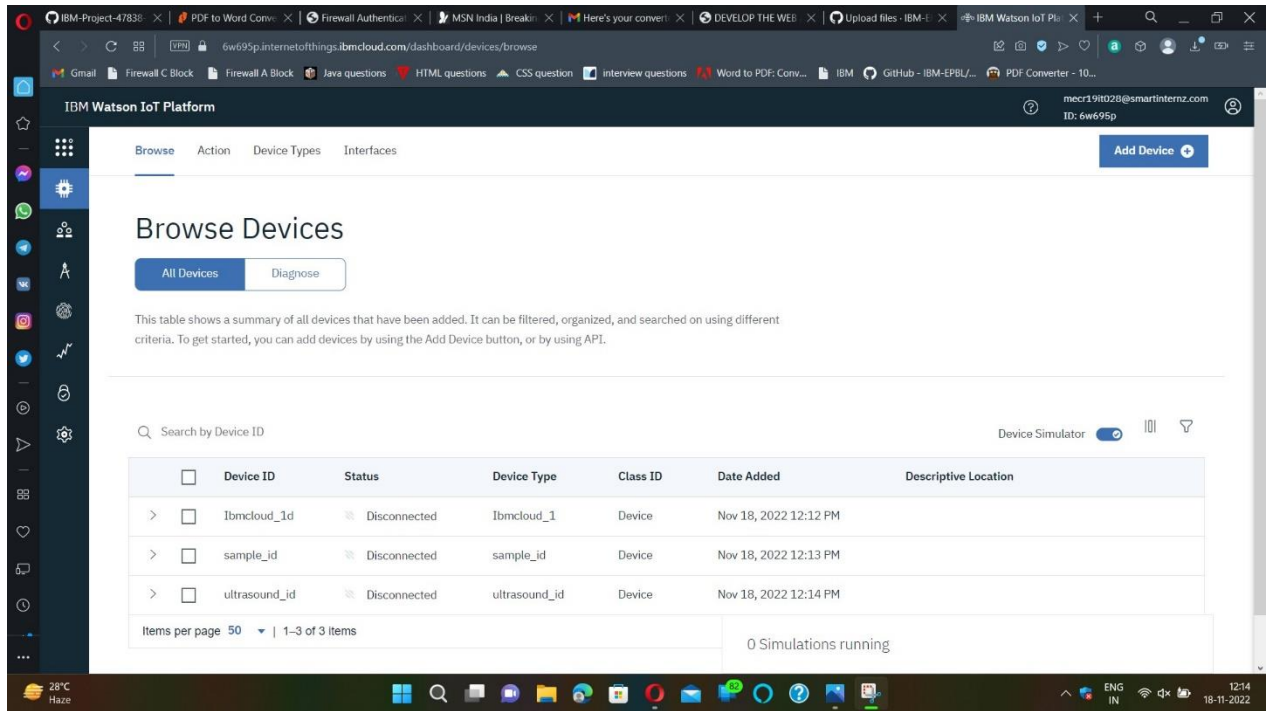
1 Event

1 Device

12345

1 x Create Simulated Device Use Registered Device

451 events sent 24.7 KB sent



The following features are some ideas we decided to implement but we didn't have much time...

Additionally, a speed cam will be integrated with the digital sign board which uses Image processing & AI, to get the detail of the driver who breaks the traffic rules (especially speed) will be updated in the cloud database.

Also, for No parking and One way rule violations can also be detected and appropriate action can be taken. Violation of stop signs in intersection will also be detected using AI.

8. Testing:

8.1. TestCases:

1	Date	17-Nov-22								
2	Team ID	PNT2022TMDI9258								
3	Project Name	Project - Signs with Smart Conne								
4	Maximum Marks	4 marks								
5	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
6	IBM Cloud Login ID & Password	1.Go to IBM Cloud signup page 2.Enter e-mail id and other credentials 3.Enter a password	https://cloud.ibm.com/login	User should sign up IBM cloud and details should be verified	Working as expected	Pass	Results verified	No		R.Gowthaman,M.Boopathi,S.Manikandan,V.Surga
7	IBM Cloud Login ID & Password	1.Go to Cloud login 2.Enter user ID & Password 3.Verify login by the popup display	https://cloud.ibm.com/login	User login to IBM Cloud and should be navigated to IBM Cloud dashboard page	Working as expected	Pass	Results verified	No		R.Gowthaman,M.Boopathi,S.Manikandan,V.Surga
8	IBM Watson IoT Platform Login ID & Password	1.Login to IBM Cloud 2.Click Catalog 3.Search IoT and click create 4.Go to resource list and search Internet of Things platform 5.Press Launch and click Sign in IBM Watson Platform	https://cloud.ibm.com/catalog/devices/browse	User should be navigated to IBM IoT Watson Platform	Working as expected	Pass	Results verified	No		R.Gowthaman,M.Boopathi,S.Manikandan,V.Surga
9	IBM Watson IoT Platform Login ID & Password	1.Login to IBM Watson Platform 2. Click Add Device 3.Enter the details and click Finish. Create Device ID & Device type 4.Turn on Device Simulator and click simulation running. Enter the values of temperature & Location 5.Click Send & Save. Verify the displayed result of the levels	Temperature sensor values and Location are generated randomly in simulation	Temperature sensor values and Location are generated randomly in simulation	Working as expected	Pass	Results verified	No		R.Gowthaman,M.Boopathi,S.Manikandan,V.Surga
	Node Red Installation	1.Install node red and open node red in command prompt 2.Select IBM input in IoT	https://node-red.dsb.eu-gb.mybluemix.net/red/#flow/8f5c2e4125f08cb	User should be able to see the Node Red page	Working as expected	Pass	Results verified	No		R.Gowthaman,M.Boopathi,S.Manikandan,V.Surga

Date	17-Nov-22								
Team ID	PNT2022TMDI9258								
Project Name	Project - Signs with Smart Conne								
Maximum Marks	4 marks								
Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
Node Red Installation	1.Select IBM IoT input in Node. In IBM IoT Watson Platform, go to apps and click on generate API keys. 2.Copy & paste generated API key and token in the IBM IoT input. After entering all details, click the done button. 3.Add debug to the IBM IoT and rename as Msg.payload and click on done. Click chart from the dashboard and fill the details & add functions to the chart. Check the generated values from the debug message. 4.Edit function node, connect them, add another chart and functions, name them as "Temperature" & "Location" 5.Finally add light ON/OFF buttons to the IBM IoT and debug. Verify the output from NODE RED.	Values of sensors and button for light ON/OFF is displayed	Values of sensors and button for light ON/OFF should be displayed	Working as expected	Pass	Results verified	No		R.Gowthaman,M.Boopathi,S.Manikandan,V.Surga
Python 3.7.0(64 bit) installation	1.Download and install Python 3.7.0 2.Develop python code	https://www.python.org/downloads/release/python-370/	User should be able to develop a python code	Working as expected	Pass	Results verified	No		R.Gowthaman,M.Boopathi,S.Manikandan,V.Surga
Python 3.7.0(64 bit) installation	1.Download Python 3.7.0 2.After python code	Get the output from the code	User should be able to get the results from the developed code	Working as expected	Pass	Results verified	No		R.Gowthaman,M.Boopathi,S.Manikandan,V.Surga

8.2. User Acceptance Testing:

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [Product Name] project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity1	Severity2	Severity3	Severity4	Subtotal
By Design	10	4	2	3	20
Duplicate	0	2	2	0	4
External	2	3	0	1	6
Fixed	11	2	4	17	34
Not Reproduced	0	0	1	0	1
Skipped	0	0	0	1	1
Won't Fix	0	1	0	3	4
Totals	23	12	9	25	70

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	20	0	0	20
Client Application	38	0	0	38
Security	3	0	0	3

OutsourceShipping	3	0	0	3
ExceptionReporting	5	0	0	5
FinalReportOutput	10	0	0	10
VersionControl	3	0	0	3

9. Results:

9.1. PerformanceMetrics:

10. Advantages&Disadvantages:

The main advantage of this project is that it is a dynamic system which can change different modes of operations automatically.

It gathers weather data from open weather API and displays speed according based on the climate.

Display service warnings like schools, hospitals and holy places and warn to slow down and be silent.

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

Additionally, a speed cam will be integrated with the digital sign board which uses Image processing & AI, to get the detail of the driver who breaks the traffic rules (especially speed) will be updated in the cloud database.

Also, for 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.

11. Conclusion:

The project concluded by replacing the static sign boards 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. FutureScope:

- Inthefuture aspeedcam willbeintegratedwiththedigitalsign board.
- UsingImageprocessing&AI, thedetailsof thedriverwhobreaksthetrafficruleswillbe updatedintheclouddatabase.
- NoparkingandOnewayruleviolationscanalsobe detectedandappropriateactioncanbetaken.
- Violationsofstopsignsinintersectionwill also bedetectedusingAI.

13. Appendix:

Code:

```
/*tft.setTextColor(ILI9341_RED);Futur
```

```
eScope:
```

```
Image
```

```
Processing:Spee
```

```
dCam
```

```
NoParking
```

```
One-Way
```

```
Stopsigninintersection
```

```
*/
```

```
//NodeMcUPinsConnection
```

```
//#defineTFT_MOSID7
```

```
//#defineTFT_SCLKD5
```

```
//#defineTFT_CSD2
```

```
//#defineTFT_DCD4
```

```
//#defineTFT_RSTD3
```

```
//LibraryFuctions
```

```
#include"SPI.h"
```

```
#include"Adafruit_GFX.h"
```

```
#include"Adafruit_ILI9341.h"
```

```
#include<SdFat.h>
```

```
#include<Adafruit_SPIFlash.h>
```

```
#include<Adafruit_ImageReader.h>
```

```
//Colours
```

```
#defineBlack0x000000
```

```
#defineWhite0xfffff
```

```
//ArduinoPinsConnection
```

```
#defineUSE_SD_CARD
```

```
#defineSD_CS 4 //SDcardselectpin
```

```
#defineTFT_DC9
```

```
#defineTFT_CS10
```

```
#defineRESET 8
```

```
//ImageInitalization..
```

```
#ifdefined(USE_SD_CARD)
```

```
    SdFat          SD;      //SDcardfilesystem
```

```
    Adafruit_ImageReaderreader(SD);//Image-readerobject, passinSDfilesys
```

```
#else
```

```
    //SPIor QSPIflashfilesystem(i.e. CIRCUITPYdrive)
```

```
    #ifdefined(__SAMD51__) ||
```

```
        defined(NRF52840_XXAA)Adafruit_FlashTransport_QSPIflash
```

```
        Transport(PIN_QSPI_SCK,  
PIN_QSPI_CS,
```

```
        PIN_QSPI_IO0,PIN_QSPI_IO1, PIN_QSPI_IO2,PIN_QSPI_IO3);
```

```
#else
```

```
    #if (SPI_INTERFACES_COUNT== 1)
```

```
        Adafruit_FlashTransport_SPIflashTransport(SS,&SPI);
```

```
#else
```

```
        Adafruit_FlashTransport_SPIflashTransport(SS1, &SPI1);
```

```
#endif
```

```
#endif
```

```
Adafruit_SPIFlash
```

```
flash(&flashTransport);F
```

```
atFileSystem    filesystem;
```

```
Adafruit_ImageReaderreader(filesys);//Image-reader,passin flash filesystem
```

```
#endif
```

```
Adafruit_ILI9341tft= Adafruit_ILI9341(TFT_CS, TFT_DC,RESET);
```

```
Adafruit_Image    img;
```

```
    //AnimageloadedintoRAMint32_t
```

```
    width=0,//BMPimagedimensions
```

```
    height=0;
```

```
//VariablesString
```

```
Weather;intTem
```

```
perature;
```

```
intDisplay_Speed;int
```

```
Traffic_Data;
```

```
intConstruction_Data;int
```

```
Service_Data;
```

```
//Functions
```

```
void normal_signs(); void  
speed(int Temp);  
void traffic_warning(int tdata);  
void construction_warning(int cdata); vo  
id service_warning(int sdata);
```

```
//Initial Setup void  
setup() {  
  ImageReturnCode stat; t  
  ft.begin(); Serial.begin(  
  9600); tft.setRotation(1)  
  ;  
  tft.setTextColor(ILI9341_WHITE);  
}
```

```
//Normal signs with wordings
```

```
//Weather --Speed change
```

```
//Traffic
```

```
//Construction
```

```
//School, Hospital Warnings
```

```

void loop()

{ tft.setTextSize(3); tft.setCursor(0,0);

tft.print("Drive Safe:");

//Initial Message.. tft.setCursor(0,30);

tft.print("Speed Limit: 60"); delay(1000);

/*Normal Signs Display*/ normal_signs();

/*Temperature for Speed Control using random input*/

//Temperature = 20;

Temperature = random(-10,35); //(-10) to 10 -- Snow, 11 to 25 -- Rain

Rainyspeed(Temperature);

Serial.println(Temperature);

```

```
/*TrafficDatausing randominput*/
```

```
//Traffic_Data =0;Traffic_Data
```

```
=
```

```
random(0,2);traffic_warning(Tr
```

```
affic_Data);Serial.println(Traffi
```

```
c_Data);
```

```
/*ConstructionDatausingrandominput*/
```

```
//Construction_Data
```

```
=1;Construction_Data=
```

```
random(0,2);construction_warning(Constru
```

```
ction_Data);Serial.println(Construction_Dat
```

```
a);
```

```
/*ServiceWarningDatausingrandominput*/
```

```
//Service_Data
```

```
=1;Service_Data =
```

random(0,2);


```
service_warning(Service_Data);Serial.printl  
n(Service_Data);  
}
```

```
/*NormalSignsImageDisplaywithwordingsfor  
awareness*/voidnormal_signs()  
{  
stat= reader.drawBMP("/wokwi.bmp",tft, 0,  
0);reader.printStatus(stat);  
}
```

```
/*SpeedControl process..  
*/voidspeed(intTemp)  
{  
tft.fillScreen(Black);  
if( Temp>=-10&&Temp<=14)//It's Snow  
{  
Weather  
="Snowy";tft.setCursor(0,0);tf  
t.print("DriveSafe:");tft.setTe  
xtSize(2);
```

```

tft.setCursor(0,40);tft.print("G
oslow..!");tft.setCursor(0,100);
tft.setTextSize(3);tft.print("Sp
eedLimit:30");delay(3000);tft.
fillScreen(Black);
}
elseif(Temp>=15&&Temp<=25)//It'sRainy
{
Weather =
"Rainy";tft.setCursor(0,0);tft.prin
t("DriveSafe:");tft.setTextSize(2
);tft.setCursor(0,40);tft.print("Sli
pperyRoadAhead");tft.setCursor(
0,70);
tft.print("GoSlow..!");tft.setCu
rsor(0,100);tft.setTextSize(3);t
ft.print("SpeedLimit:40");

```

```

    delay(3000);tft.fillScr
    een(Black);
}
else
{
    tft.setCursor(0,0);tft.print("Dr
    iveSafe!!");tft.setCursor(0,30)
    ;tft.print("SpeedLimit:60");del
    ay(3000);tft.fillScreen(Black);
}
tft.fillScreen(Black);
}

```

```

/*TrafficWarningSystem*/

```

```

voidtraffic_warning(inttdata)
{
    tft.fillScreen(Black);
}

```

```
if (tdata ==0)
{
    tft.setCursor(0,0);tft.print("DriveSafe:");
    //tft.setTextSize(2);tft.setCursor(0,40);tft.print("TrafficAhead..");tft.setCursor(0,80);
    //tft.setTextSize(3);tft.print("DriveCarefully!");delay(3000);tft.fillScreen(Black);
}
if (tdata ==1)
{
    tft.setCursor(0,0);tft.print("DriveSafe:");tft.setTextSize(2);tft.setCursor(0,40);tft.print("TrafficAhead..");tft.setCursor(0,80);
```

```
//tft.setTextSize(3);tft.print("Take  
Diversion--  
>");delay(3000);tft.fillScreen(Black);  
}  
}
```

```
/*ConstructionWarningSystem*/
```

```
void construction_warning(int cdata)  
{  
  tft.fillScreen(Black);  
  if (cdata == 0)  
  {  
    tft.setCursor(0,0);tft.print("Drive  
Safe:");tft.setTextSize(2);tft.setCursor(0,40);tft.print("Construction  
Ahead..");tft.setCursor(0,80);
```

```

tft.setTextSize(3);tft.print("Dr
iveCarefully..!");delay(2000);t
ft.fillScreen(Black);
}
if (cdata ==1)
{
tft.setCursor(0,0);tft.print("Drive
Safe:");tft.setTextSize(2.5);tft.se
tCursor(0,40);tft.print("Construct
ionAhead..");tft.setCursor(0,80);t
ft.setTextSize(2.5);tft.print("Tak
eDiversion<--
");delay(2000);tft.fillScreen(Blac
k);
}
}

```

```
/*School, HospitalWarningSystem*/
```

```
voidservice_warning(intsdata)
```

```
{
```

```
    tft.fillScreen(Black);i
```

```
    f (sdata == 0)
```

```
{
```

```
    tft.setCursor(0,0);tft.print("Dr
```

```
iveSafe:");tft.setTextSize(2);t
```

```
ft.setCursor(0,40);tft.print("Sc
```

```
hoolAhead..");tft.setCursor(0,
```

```
80);tft.setTextSize(3);
```

```
tft.print("DriveCarefully.!\nNoHorn!");dela
```

```
y(2000);
```

```
tft.fillScreen(Black);
```

```
}
```

```
if (sdata == 1)
```

```
{
```

```
    tft.setCursor(0,0);
```

```
tft.print("DriveSafe:");tft.setTextSi  
ze(2.5);tft.setCursor(0,40);tft.print("  
HospitalAhead..");tft.setCursor(0,80  
);tft.setTextSize(2.5);  
tft.print("DriveCarefully.!\nNoHorn!");dela  
y(2000);  
tft.fillScreen(Black);  
}  
}
```


Node–RedDashboard(Flow)Link-<https://node-red-dsb.eu-gb.mybluemix.net/red/#flow/c8f5c2e4125f08cb>

Node–RedDashboard(UI)Link-<https://node-red-dsb.eu-gb.mybluemix.net/ui/#!/0?socketid=fsJfHymZb0JMNE0bAAAD>

Node–RedDashboard(Webpage)Link-<https://node-red-dsb.eu-gb.mybluemix.net/simple>

GitHubProjectLink-<https://github.com/IBM-EPBL/IBM-Project-43785-1660719573>

VideoDriveLink-
https://drive.google.com/drive/folders/1KnLe_wOO9nI6Aw2jGRKzIU6zvHhYKSt3?usp=sharing