ProjectReport

Date	17Nov2022
TeamID	PNT2022TMID19258
Project	Signs with Smart Connectivity for Better Road Safety

1. INTRODUCTION:

1.1 ProjectOverview:

- TheObjectiveofthisistoreplacethestaticsignboards. Instead,smartconnectedsignboardsare used.
- ThesesmartconnectedsignboardsgetthespeedlimitationsfromawebappusingweatherAPIandupdateautomatically.Basedontheweatherchanges thespeedmayincrease ordecrease.
- Basedonthetrafficandfatalsituationsthediversionsignsaredisplayed.Guide(forSchools),Warning,andService (Hospitals,Restaurants)signsarealsodisplayedaccordingly.

1.2 Purpose:

ThePurposeofthisprojectistodevelopadigitalsignboardsystemwherethenormalsignsaredisplayedwiththeiractualnames.Andalso,tocreateawarenessoftheroadsafetytoeveryoneandobeythetrafficrules.Tocreateabetterviewandwarninthenighttime.

2. LiteratureSurvey:

2.1:ExistingProblem:

- Damagecriteriainstaticsignboards:
  - Paintdeterioration
  - FoldedSheets
  - PoleBent
  - ConcealmentbyVegetation
- Driverscanfaceconfusingroadsignsat certaincircumstances.
- TheNationalCrimeRecordsBureau(NCRB)2022reportstatesthattherewere155, 622fatalities, highestsince2014,out ofwhich69,240deathswereduetotwo-wheelers.
- AstudybyIITDelhipointsoutthatthenationalhighwaysconstituteonly2%ofthe lengthof roadsinIndia,buttheyaccountfor30.3%of totalroadaccidentsand36%ofdeaths.
- Deathsbyaccidentsonroadsincreasedbyalmost17per centin2021,indicatinganincreaseintherateof deathsper1,000vehicles.

S.No.	Title andAuthor	YearandPublication	Inferences
1.	**Wirelessdigitaltrafficsignsofthefuture.** ChaiK.Toh,Juan-CarlosCano,CarlosFernandez-Laguia,PietroManzoni,CarlosT. Calafate.	2018,Institutionof EngineeringandTechnology(IET).	Theissuesandchallengesfacingcurrenttrafficsigns, andhowitwillevolveintoa next-generationtrafficsignarchitectureusingadvancedwirelesscommunicationstechnologies.
2.	**TrafficSignBoardDetectionandRecognitionusingAugmented**	2020,International ResearchJournalof	Real-timeapproachforfastan

	Reality. AkshataAnantPrabhu,Deepika V.D.,Muralikrishna.N,P.Vaishna viAcharya,A.R.Manjula	Engineeringand Technology(IRJ ET).	Frame work for traffic sign recognition Which super imposes virtual object sonto a realsceneunderalltypesof drivingsituations,includi ngunfavorableweatherco nditionsandgivesavoiceal ertwiththehelpofspeakers .
3.	**AutomaticSignboardDetectionS ystem bythe Vehicles** Anushree.A.S,HimanshuKumar,Id ahIram,KumarDivyam,Rajeshwari .J	2019,IJESC.	Signboarddetectionsyst eminthevehiclewhichw illdetectthesignboardan dwarnthedriveraboutit. Itdisplaysthealertmessa georinformationonprov idedLCDandvoicealertt hroughspeakers.
4.	**DevelopmentandTestingofRoad Si gnsAlertSystem Us ing aSmartMobilePhone** EricM.Masatu,RamadhaniSinde,an dAnaelSam	2022,HindawiJourna lofAdvancedTransp ortation).	Thepaperisbasedonthere searchaboutAdvancedDr iverAssistancesystemwh ichisoneofthesalientfeatu resofintelligentsystemint ransportation.
5.	**AWi-FibasedElectronicRoadSignforEn hancingtheAwarenessofVehicle.** ABhawiyuga,RASabriansyah,WYa hya,REPutra.	2016, IOP PublishingLtd.	Employmentof vehicularnetworkconcept inwhichavehiclecancom municatewithothervehicl esorwiththeinfrastructure installedalongtheroad.
6.	**AutomaticDetectionofRoadSignst o ControlVehicleSpeed** AnujaNanal,PoojaMotwani,	2019,InternationalJo urnalofComputerAp plications.	ElectronicDisplaycontrol lermeantforcontrollingve hiclespeedandmonitorsth ezones,

	PragatiPawar,RajatNirhale,RahulPatil.		andwhichcanalsodisplay thespeedtotherfreaderwithhelpofunitattachedin thecar.

2.2. References

1. Torralba, J. P.García-Martín, J. M. González-Romo, M.García-Castellano,J.Peral-LópezandV. Pérez-Mira, "AnAutonomous, IntelligentSignControlSystemUsingWirelessCommunicationandLEDSignsfor RuralandSuburbanRoads,"inIEEEIntelligentTransportationSystemsMagazine, vol.14,no.2, pp. 115-128,March-April2022, doi:10.1109/MITS.2021.3049375.

2. Toh, C.K., Cano, J.-C.,Fernandez-Laguia, C.,Manzoni, P. andCalafate, C.T.(2019), Wirelessdigitaltrafficsignsofthe future.IETNetw., 8:74-78.https://doi.org/10.1049/iet-net.2018.5127

3. A., Aparna& Shiravale, Sankirti. (2016).RealTimeTrafficSignboardDetectionandRecognitionfrom StreetLevelImageryfor SmartVehicle.InternationalJournalof ComputerApplications. 135. 18-22.10.5120/ijca2016908267.

4. A BhawiyugaRA Sabriansyah, W YahyaandREPutra*etal*“AWi-FibasedElectronicRoadSignfor EnhancingtheAwarenessofVehicleDriver”, inIOPPublishingLtd2017*J. Phys.: Conf. Ser*.801012085

5. KarthikeyanD,Enitha C, BharathiS,DurkadeviK,2020, TrafficSignDetectionandRecognitionusingImageProcessing, INTERNATIONALJOURNALOF

ENGINEERINGRESEARCH&TECHNOLOGY(IJERT)NCICCT– 2020
(Volume8– Issue08)

6. BhawnaSaini1, RachnaDevi2, Shilpi Dhankhar 3, Mohammad-ziaul-Haque4,JagandeepKaur 5, SmartLEDDisplayBoards, InternationalJournalofElectronicandElectricalEngineering. ISSN0974-2174Volume7,Number 10(2014), pp.1057-1067.

7. Ramalingam, Mritha& chandrasegar,&gowrishankar,. (2014).Asurveyoflightemittingdiode(LED)DisplayBoard.IndianJournalof ScienceandTechnology. 7. 185-188.10.17485/ijst/2014/v7i2.3.

8. EricM. Masatu, RamadhaniSinde, AnaelSam,Development andTestingofRoadSignsAlertSystemUsinga SmartMobile Phone, Journalof AdvancedTransportation, 10.1155/2022/5829607,**2022**, (1-14), (2022).

9. ZoltánFazekas, GáborBalázs, CsabaGyulai, PéterPotyondi,PéterGáspár,Road-TypeDetection BasedonTrafficSignandLane Data,JournalofAdvancedTransportation, 10.1155/2022/6766455,**2022**, (1-19), (2022).

10. JuanhongXie,GuojianShi, WeizhiZhu,IntelligentRecognitionTechnologyfor theSegmentationof TrafficIndicationImagesConcerningDifferentPavementMaterials,AppliedBionicsandBiomechanics,10.1155/2022/6278240,**2022**, (1-7), (2022).

2.3. ProblemStatementDefinition:

Toreplacethestaticsignboards, withsmart connecteddigitalsignboards.Thesesmartconnectedsignboardsgetthespeedlimitationsfromweather API

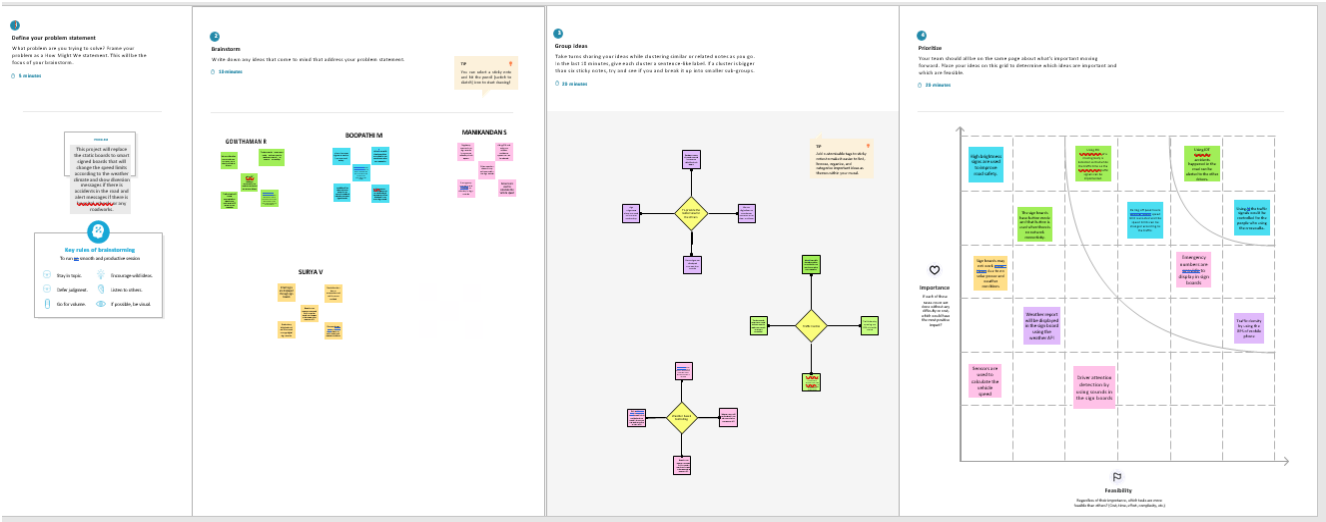
andupdateautomatically.

Basedontheweatherchangesthespeedmayincreaseordecrease.Itwilldisplaythenormalsignsinnecessaryplaceswithwordingstobeawareofthe signs.Based onthetraffic andfatalsituationsthediversion signs aredisplayed. Guide(Schools), WarningandService(Hospitals, Restaurant)signsare alsodisplayedaccordingly.Changeofmodeswilltakeplaceautomatically.

3. IdeationandProposedSolution:

3.1. EmpathyMapCanvas:

3.2. Ideation&Brainstorming:

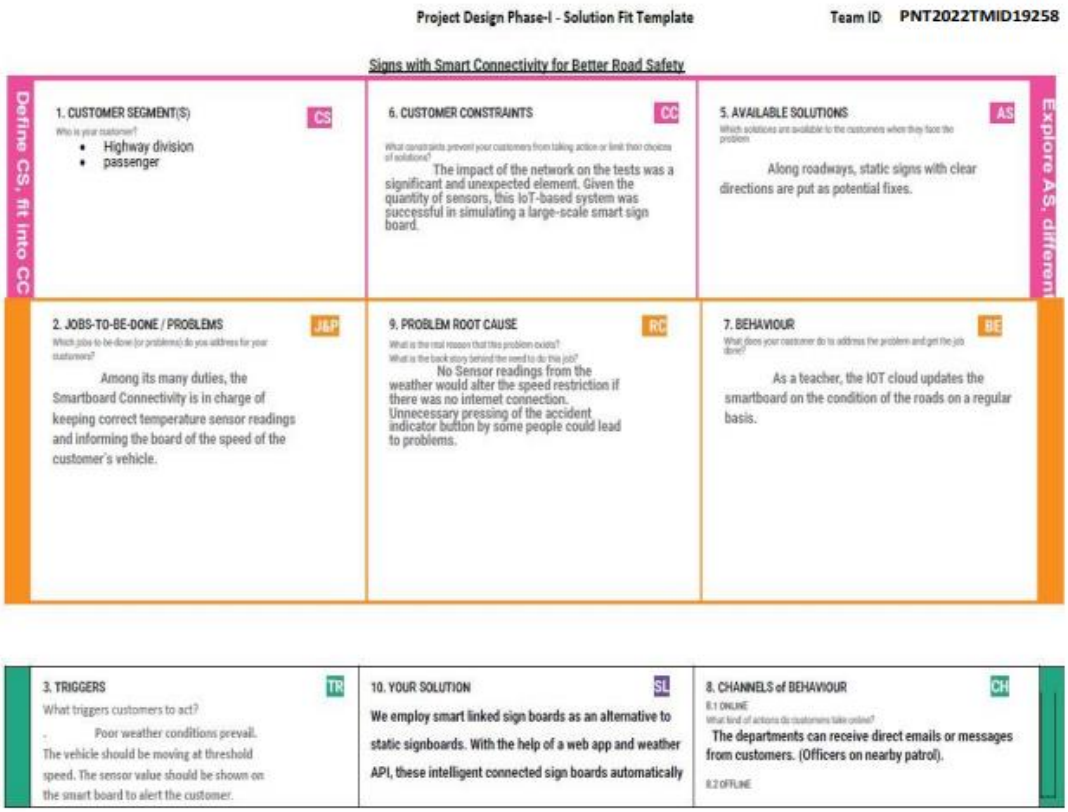


3.3. ProposedSolution:

S.No.	Parameter	Description
1.	ProblemStatement(Problemtobesolved)	InpresentSystemstheroadsignsandthespeed limitsareStatic.Buttheroadsignscanbechang edinsomecases.Wecanconsidersomecases whentherearesomeroaddiversionsduetohea vytrafficorduetoaccidentsthenwecanchang etheroadsignsaccordingly,iftheyaredigitaliz ed.Thisprojectproposesasystemwhichhasdi gitalsignboardsonwhichthesignscanbechan geddynamically.Ifthereisrainfallthentheroa dswillbeslipperyandthespeedlimitwouldbe decreased.Thereisawebappthroughwhichy oucanenterthedataoftheroaddiversions,acci dentproneareasandtheinformationsignboar dscanbeenteredthroughwebapp.Thisdataisr etrievedanddisplayedonthesignboardsaccor dingly.
2.	Idea/Solutiondescription	TheIdeaistoreplacethestaticsignboards.Inst ead,smartconnectedsignboardsareused.The sesmartconnectedsignboardsgetthespeedli mitationsfromawebappusingweatherAPIan dupdate

		automatically.Basedontheweatherchange sthespeedmayincreaseordecrease.Basedo nthetrafficandfatalsituationsthediversions ignsaredisplayed.Guide(forSchools),War ningandService(Hospitals,Restaurant)sig nsarealsodisplayedaccordingly. Additionally,Speedcameraintegratedwithi mageprocessingtechniqueisaddedtodetect anytrafficspeedviolationsandchargefines.
3.	Novelty/Uniqueness	UsageofspeedcameraintegratedwithImag eProcessingtechniquefordetectionofspeed violation.
4.	SocialImpact/CustomerSatisfaction	DiversionIndicationSystemiftrafficorconstr uctionsahead.SpeedlimitInstructions.Guide (forSchools),WarningandService(Hospitals ,Restaurant)signsaredisplayed.
5.	BusinessModel(RevenueModel)	SinceImageProcessingandAPIsareusedfor monitor,thisprojectemploysadecentbusines sstrategyandenhanceservices.
6.	ScalabilityoftheSolution	Low-costImplementationandMaintenance.Dur abilityisoftheproductishigh.

3.4. ProblemSolutionFit:



4. Requirements:

4.1. FunctionalRequirement:

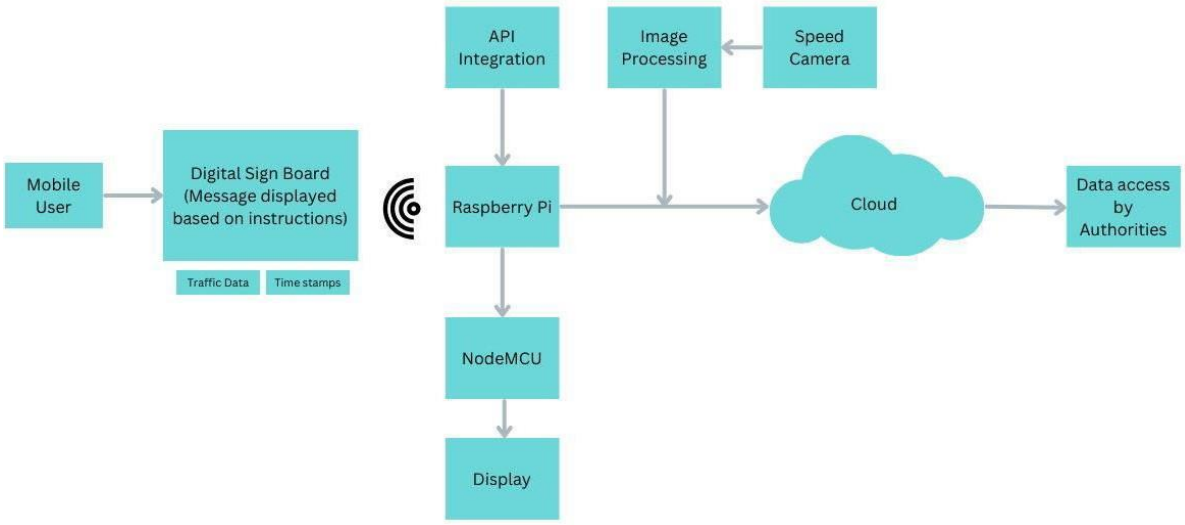
FR No.	FunctionalRequirement(Epic)	SubRequirement(Story/Sub-Task)
FR-1	UserVisibility	SignBoardwillhaveand clearandinteractiveUIsothatitwillbeclearlyvisibletoal
FR-2	UserUnderstanding	Thesignsthataretobedisplayedinthesignboardwillbewithitsrespectivenames,sothattheuserscanclearlyunderstandeverything
FR-3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

4.2. Non-FunctionalRequirement:

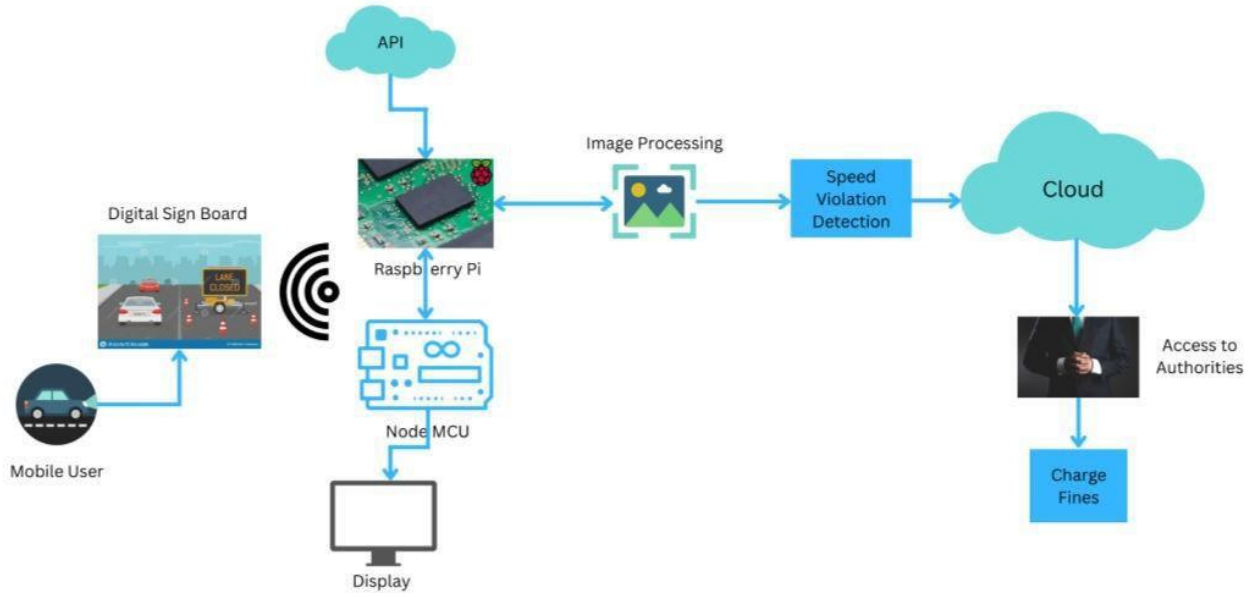
FR No.	Non-FunctionalRequirement	Description
NFR-1	**Usability**	Formultiplesigndisplay,timestampswillbeallocatedforeachsign. It willautomaticanddynamicallychangeable.Noneedformanualoperations.
NFR-2	**Security**	Onlyrequiredcanwillbeshowed.Nochanceofsecurityvulnerability.
NFR-3	**Reliability**	Morereliablethantheexistingsystem
NFR-4	**Performance**	Acceptableperformancewithdynamicupdatingofdataregardingweather,traffic,etc.
NFR-5	**Availability**	Itwillavailableforworkingevery24/7.
NFR-6	**Scalability**	ImplementationandMaintenancecostwillbeless,sothattheproductishighlyscalable.

5. ProjectDesign:

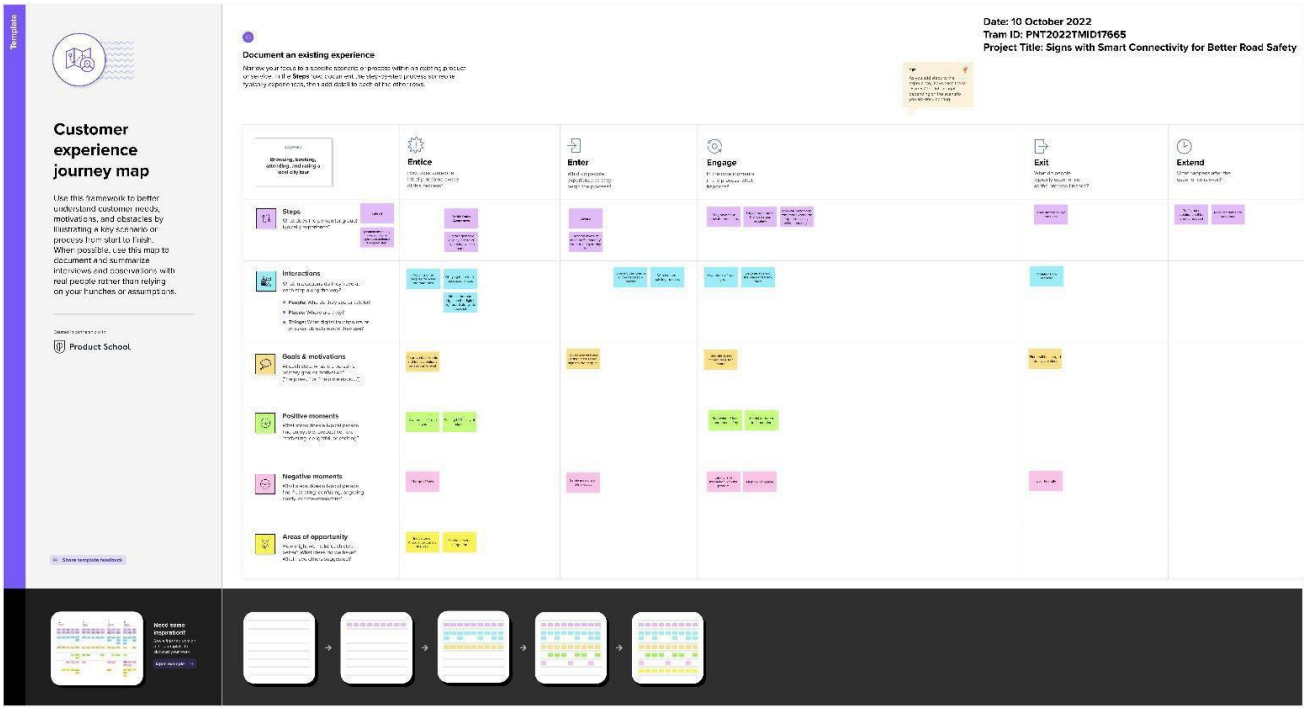
5.1. DataFlowDiagram:



5.2. SolutionandTechnicalArchitecture:



5.3. UserStories:



6. ProjectPlanning&Scheduling:

6.1. SprintPlanning&Estimation:

Sprint	FunctionalRequirement(Epic)	UserStory/Task	Story Points	TeamMembers
Sprint-1	UserRegistration	Asauser,Icanregisterontheweb sitebyenteringmyemail,password,andconfirmingmypassword.	3	Surya V
	AdminRegistration	Asanadmin,Icanlogintothewebsiteusingmycredentialsandaccessthedata.	3	Boopathi M
	Login	UserandAdmincanlogintothewebsitebyenteringemail&password.	1	Gowthaman R
	Dashboard	Developadashboardforthewebsiteforknowledgeaboutroadrules	3	Manikandan S
Sprint	**FunctionalRequirement(Epic)**	**UserStory/Task**	**Story Points**	**TeamMembers**
Sprint-2	Node-RedUI	DevelopaNode-RedUIFlow.	2	Boopathi M
	Node-RedDashb	DevelopaNode-RedUIDashboard.	2	Manikandan S
	Node-RedWebpage	DevelopaNode-RedWebpagefordisplayingthedata.	3	Surya V
	Node-RedDataCheck	ChecktheDatadisplayedontheNode-RedDashboardUI.	3	Gowthaman R

Sprint	FunctionalRequirement(Epic)	UserStory/Task	Story Points	TeamMembers
Sprint-3	APIIntegration	Integratethenecessary API's.	3	Gowthaman R
	DevelopPython Code	DevelopPythoncodetointegratethenecessaryAPIs.	2	Boopathi M

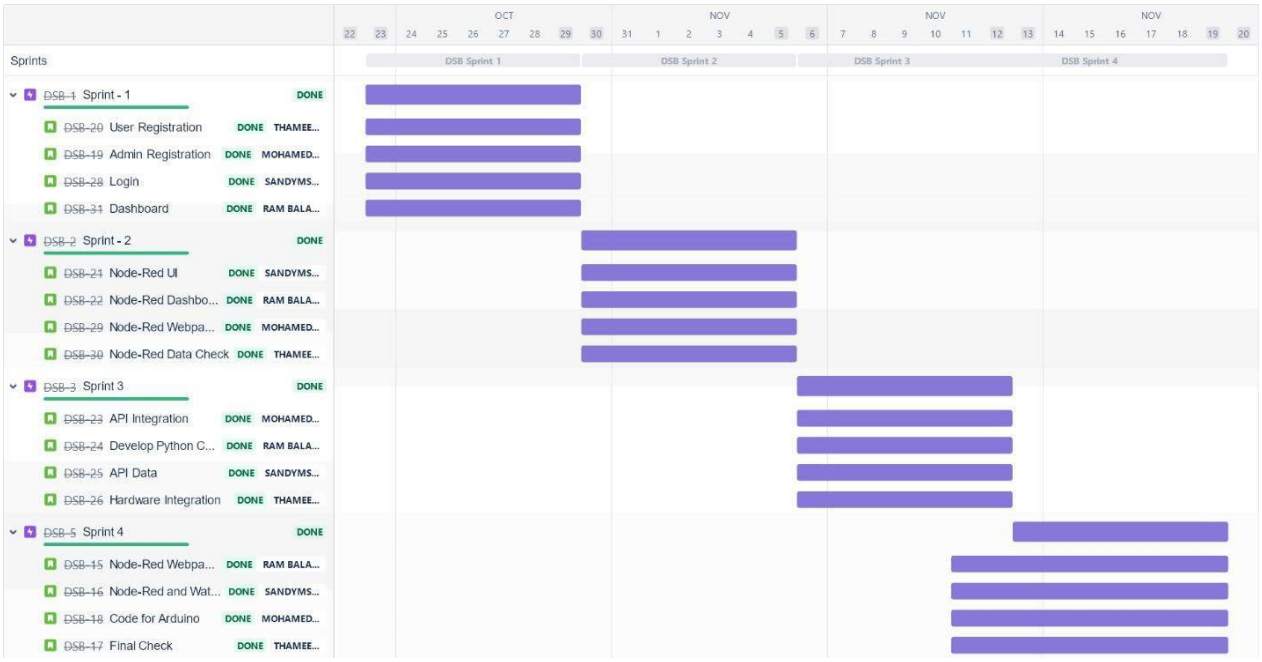
Sprint	FunctionalRequirement(Epic)	UserStory/Task	Story Points	TeamMembers
	APIData	Checkthedatafromweather API.	2	Manikandan S
	HardwareIntegration	IntegrateArduinowithTFTDisplayviasimulation.	3	Surya V

Sprint	FunctionalRequirement(Epic)	UserStory/Task	Sprint Points	Team Members
Sprint-4	Node-RedWebpage Data	Developcodetodisplaydataonthewebpageandcheckthenecessary.	2	Boopathi M
	Node-RedandWatson	ConnectNode-RedwithIBMWatsonplatformfordataprocessing(RandomDataGeneration).	3	Surya V
	CodeforArduino	Developcodetodisplaydatainthedisplayscreen.	3	Gowthaman R
	FinalCheck	Checkingallthesimulationandservicesworkingperfectlyanddisplaydataandfinalsubmissionofproject.	2	Manikandan R

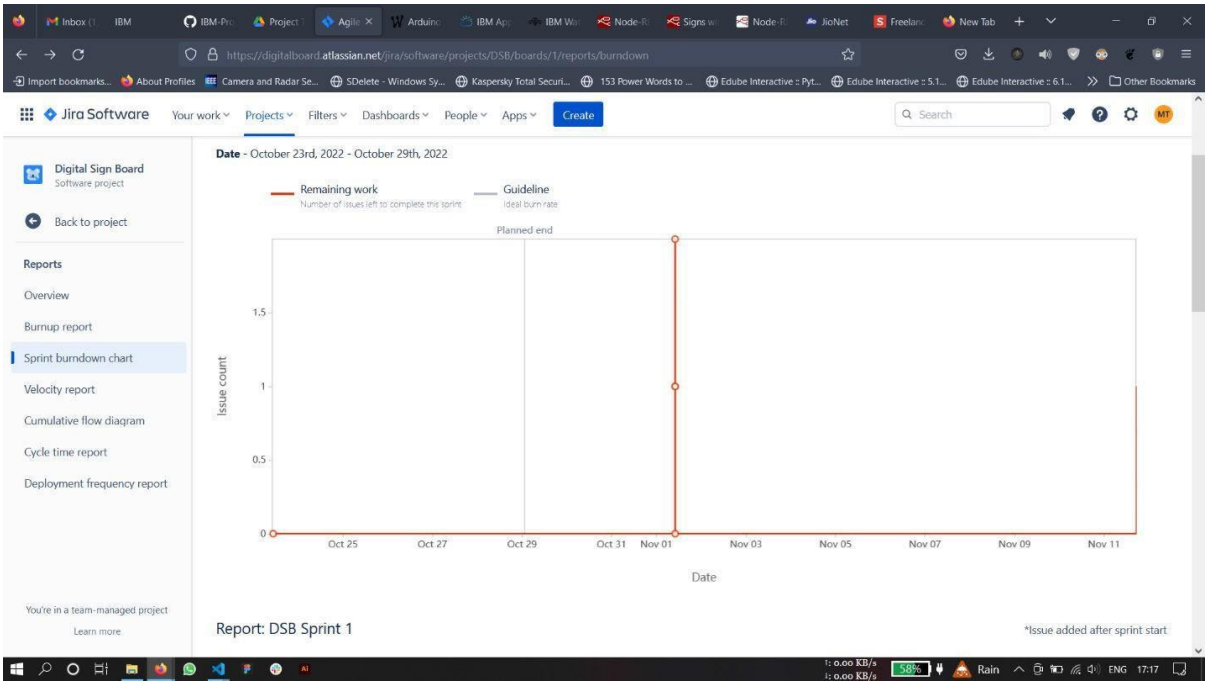
6.2.SprintDeliverySchedule:

Sprint	Total Story Points	Duration	SprintStart Date	SprintEnd Date(Planned)	StoryPointsCompleted(asonPlannedEnd 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

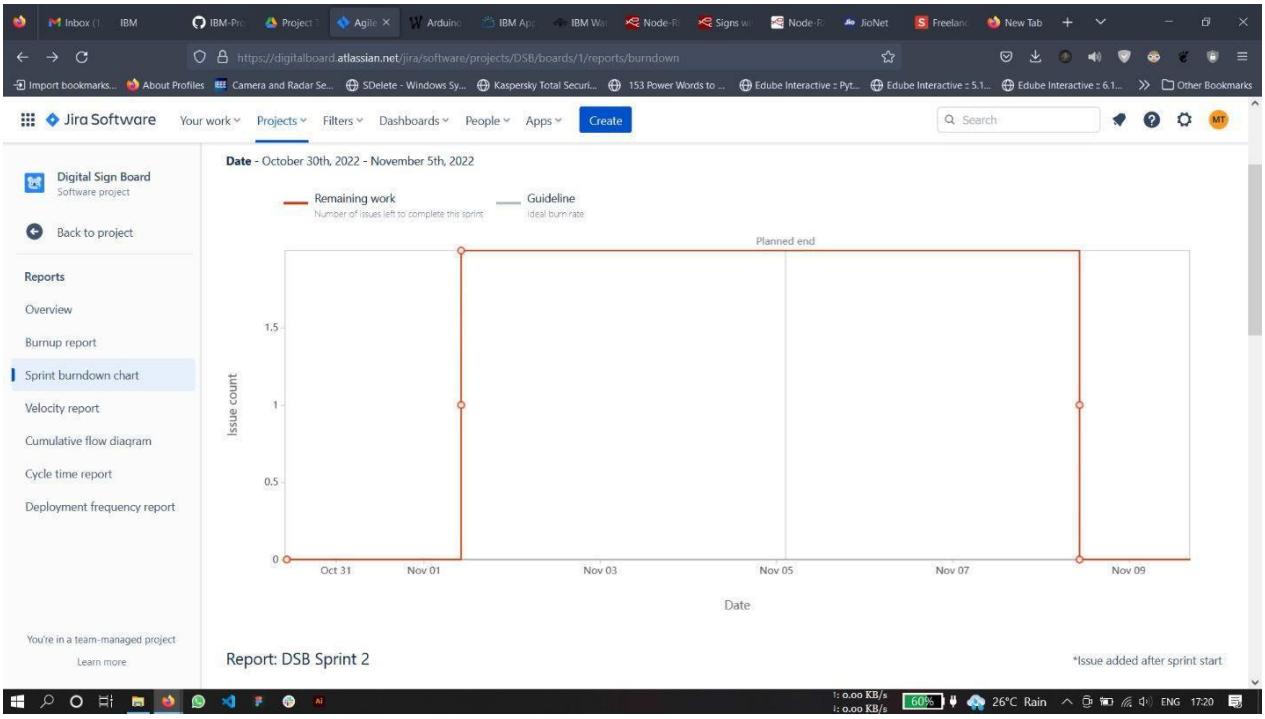
6.3.ReportfromJira:



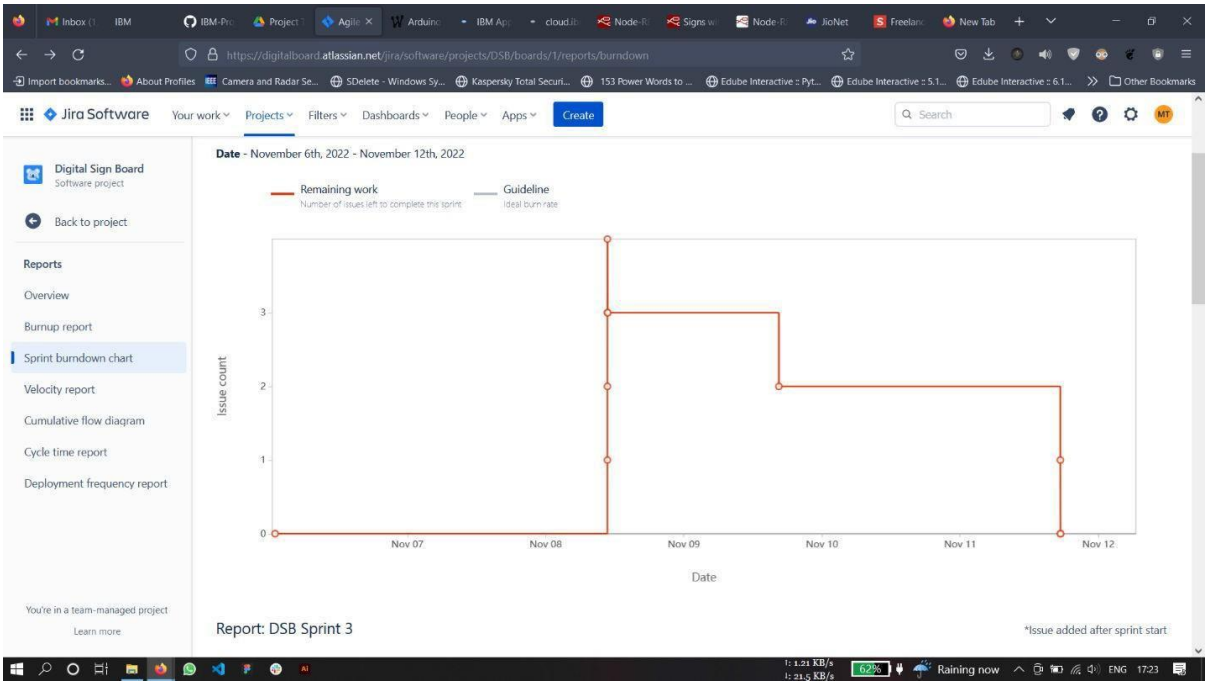
Sprint–1Burndown chart:



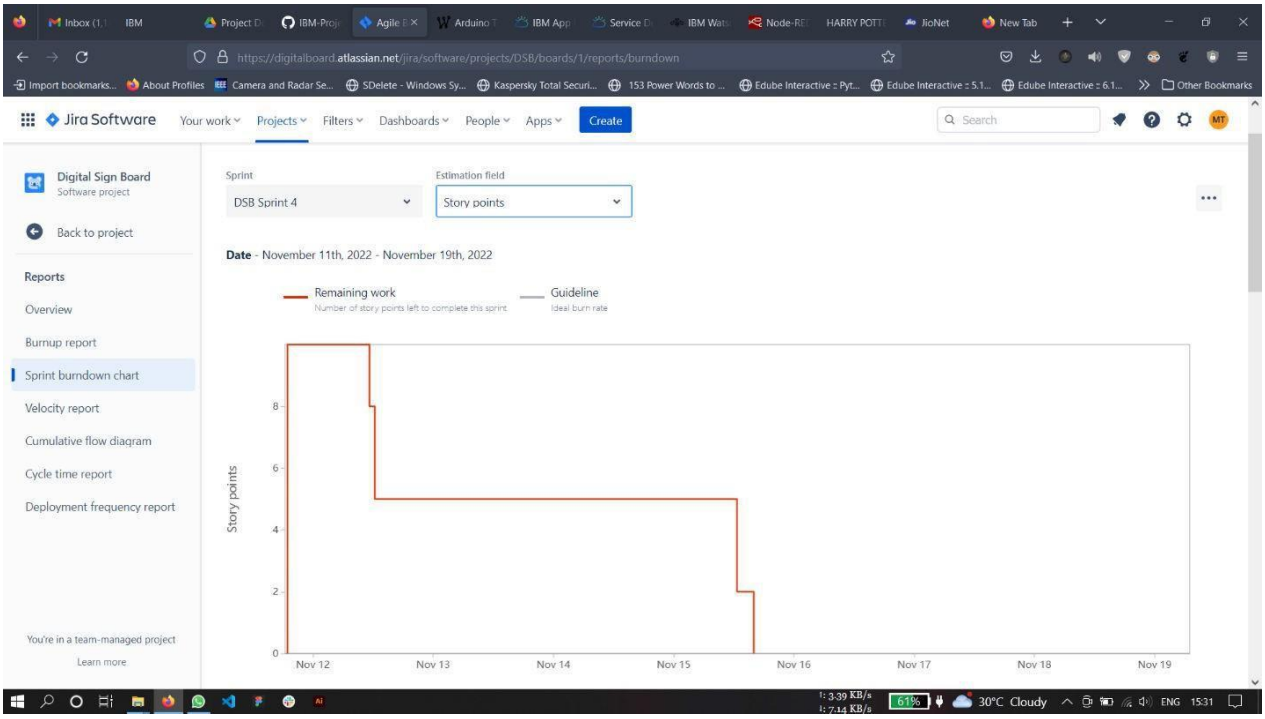
Sprint–2Burndown Chart:



Sprint–3Burndown Chart:



Sprint–4BurndownChart:



7. Coding&Solutioning:

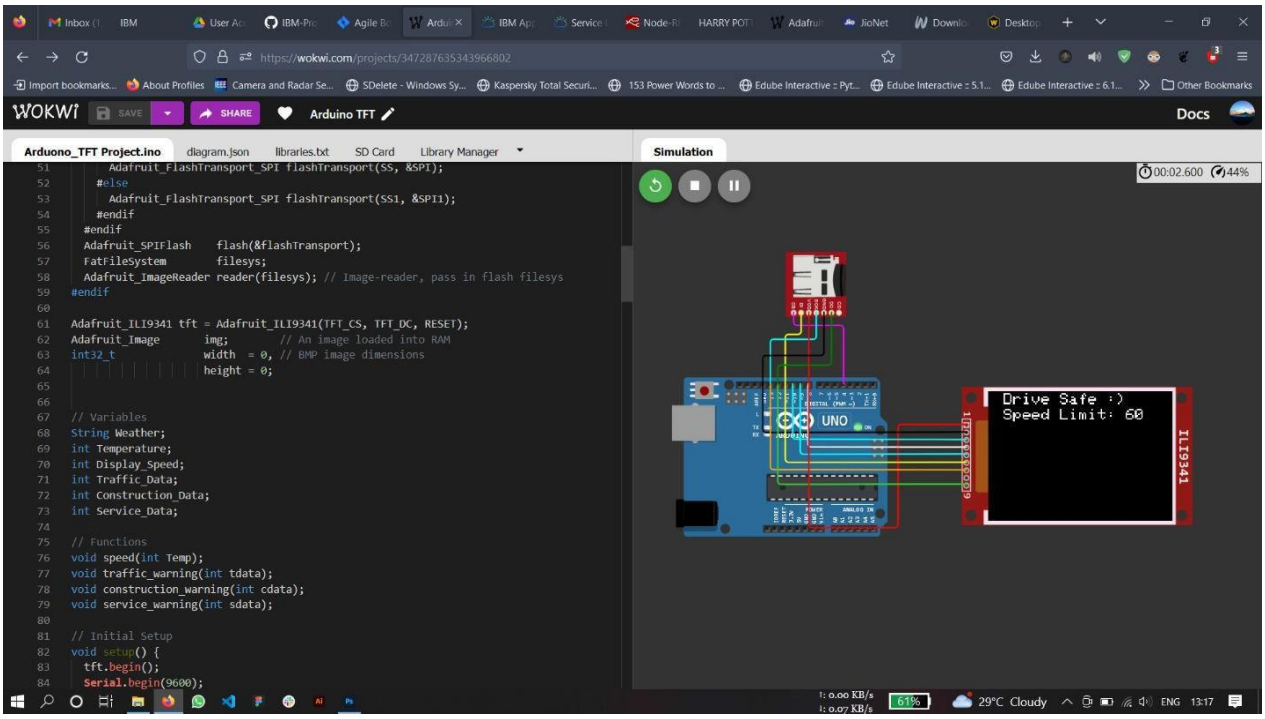
7.1. Feature1:

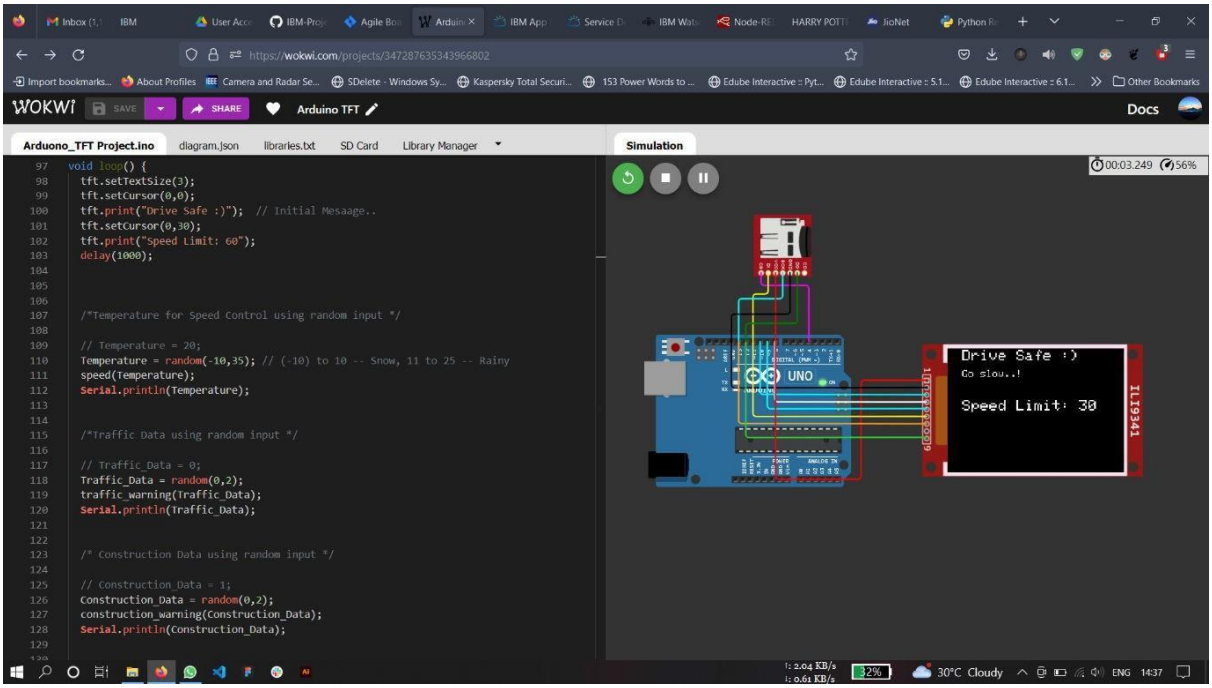
Climatepredictionisdonefromtemperaturedatafromtheopeanweatherapi.
Butasfornowrandomvaluesareused.
Speedisincreasedordecreasedbasedontheclimateprediction.

```
  /*Temperaturefor SpeedControlusingrandom input*/

  //Temperature =20;
  Temperature=random(-10,35);//(-10)to 10 -- Snow,11 to25 --
  Rainyspeed(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.prin
    t("DriveSafe :)");
    //tft.setTextSize(2);tft.setC
    ursor(0,40);tft.print("Traffi
    cAhead..");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.s
    etCursor(0,40);tft.print("Tra
    fficAhead..");tft.setCursor(0
    ,80);
    //tft.setTextSize(3);tft.print("
    TakeDiversion--
    >");delay(3000);tft.fillScreen(B
    lack);
  }
}
```

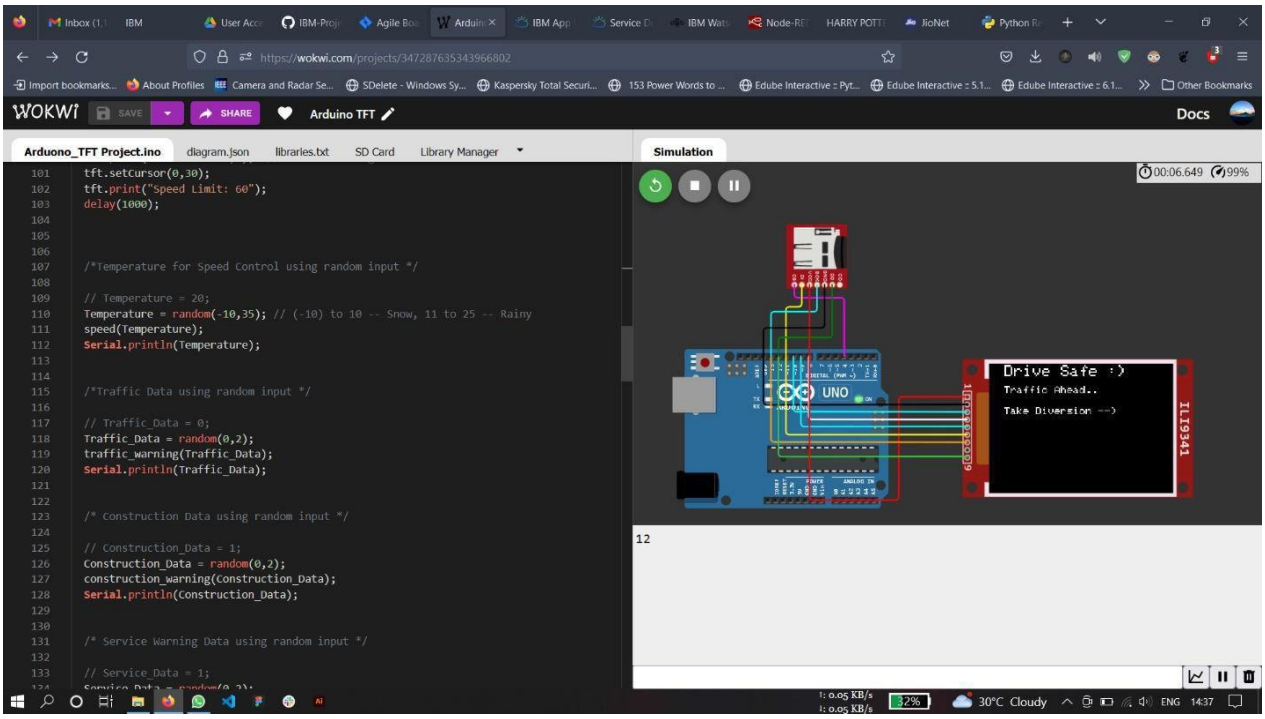


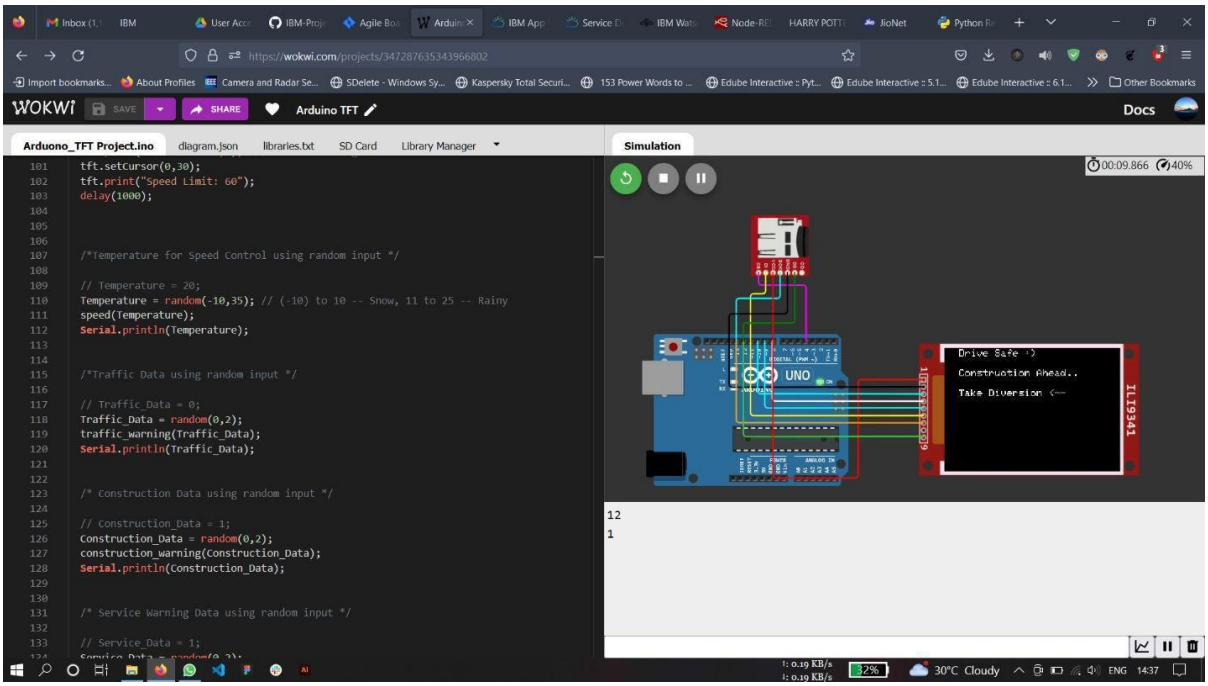


TrafficdataandConstructionwarningdataare givenwithrandominputs. Basedontrafficandconstructiondata, warningaredisplayed.

```
  /*TrafficData usingrandom input*/

  //Traffic_Data
  =0;Traffic_Data=random(0,2);tra
  ffic_warning(Traffic_Data);Seri
  al.println(Traffic_Data);


  /*Construction Datausing randominput*/

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

/*Traffic WarningSystem */

voidtraffic_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

*/voidconstruction_warning(int

cdata)
{
  tft.fillScreen(Black);
  if(cdata ==0)
  {
    tft.setCursor(0,0);tft.print("Driv
    eSafe
    :)");tft.setTextSize(2);tft.setCur
    sor(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("Driv
    eSafe
    :)");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
SAVE
SHARE
Arduino TFT
Docs
Arduono_TFT Project.ino
diagram.json
libraries.txt
SD Card
Library Manager
Simulation
00:06.649
99%
Drive Safe :)
Traffic Ahead..
Take Diversion --)
ILI9341
UNO
12


WOKWI
SAVE
SHARE
Arduino TFT
Docs
Arduono_TFT Project.ino
diagram.json
libraries.txt
SD Card
Library Manager
Simulation
00:09.866
40%
Drive Safe :)
Construction Ahead..
Take Diversion <--
ILI9341
UNO
12
1

Servicewarningslikeschools, hospitalsandholyplacesaredisplayed.

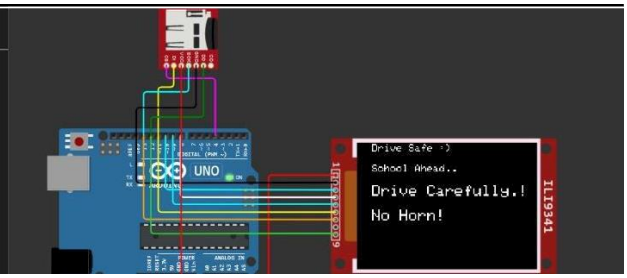
```
  /*ServiceWarningData usingrandom input*/

  //Service_Data
  =1;Service_Data=random(0,2);se
  rvice_warning(Service_Data);Se
  rial.println(Service_Data);

/*School, HospitalWarning

System*/voidservice_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!");del
    ay(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!");del
    ay(2000);
    tft.fillScreen(Black);
  }
}
```

WOKWI Docs

```
tft.setCursor(0,30);
tft.print("Speed Limit: 60");
delay(1000);
```

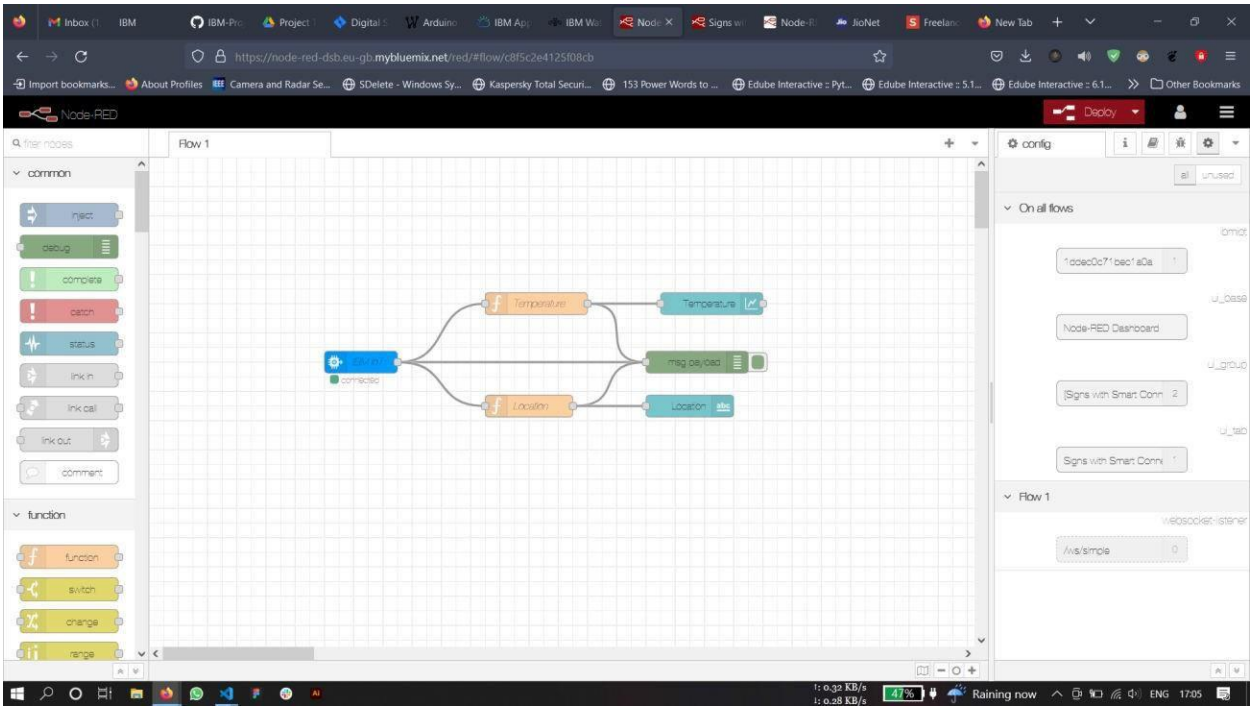
00:13.349 96%

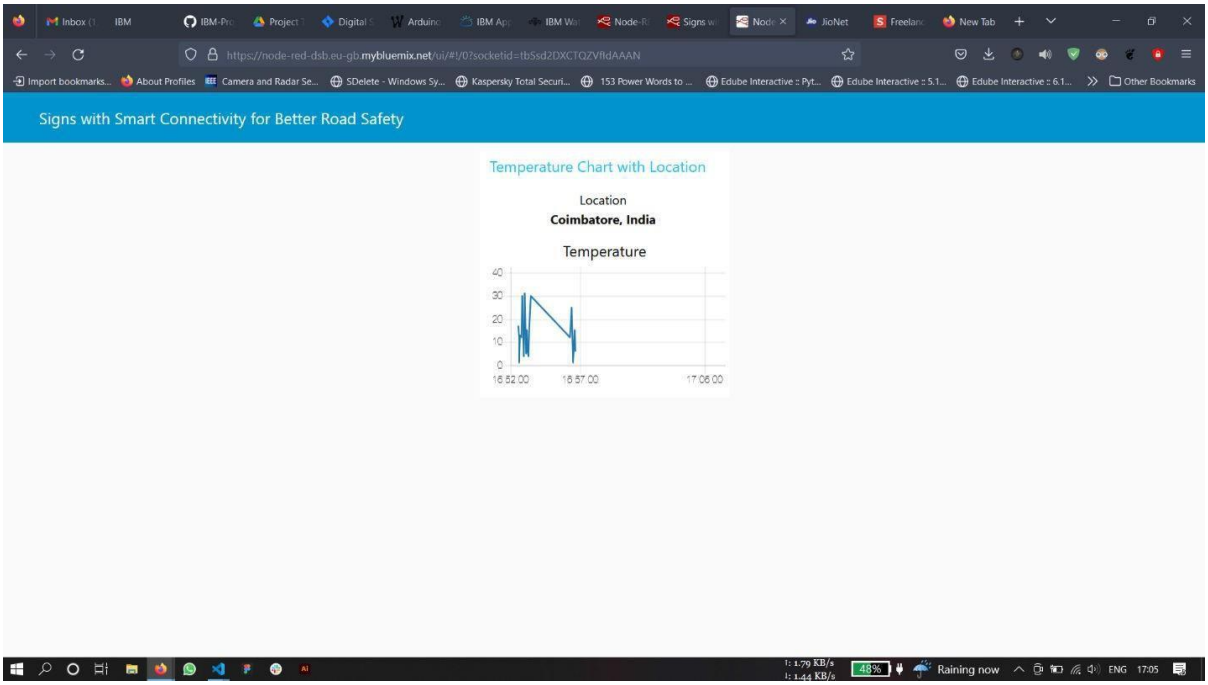
```


/*Temperature for Speed Control using random input */

// Temperature = 20;
Temperature = random(-10,35); // (-10) to 10 -- Snow, 11 to 25 -- Rainy
speed(Temperature);
Serial.println(Temperature);


/*Traffic Data using random input */

// Traffic_Data = 0;
Traffic_Data = random(0,2);
traffic_warning(Traffic_Data);
Serial.println(Traffic_Data);

```

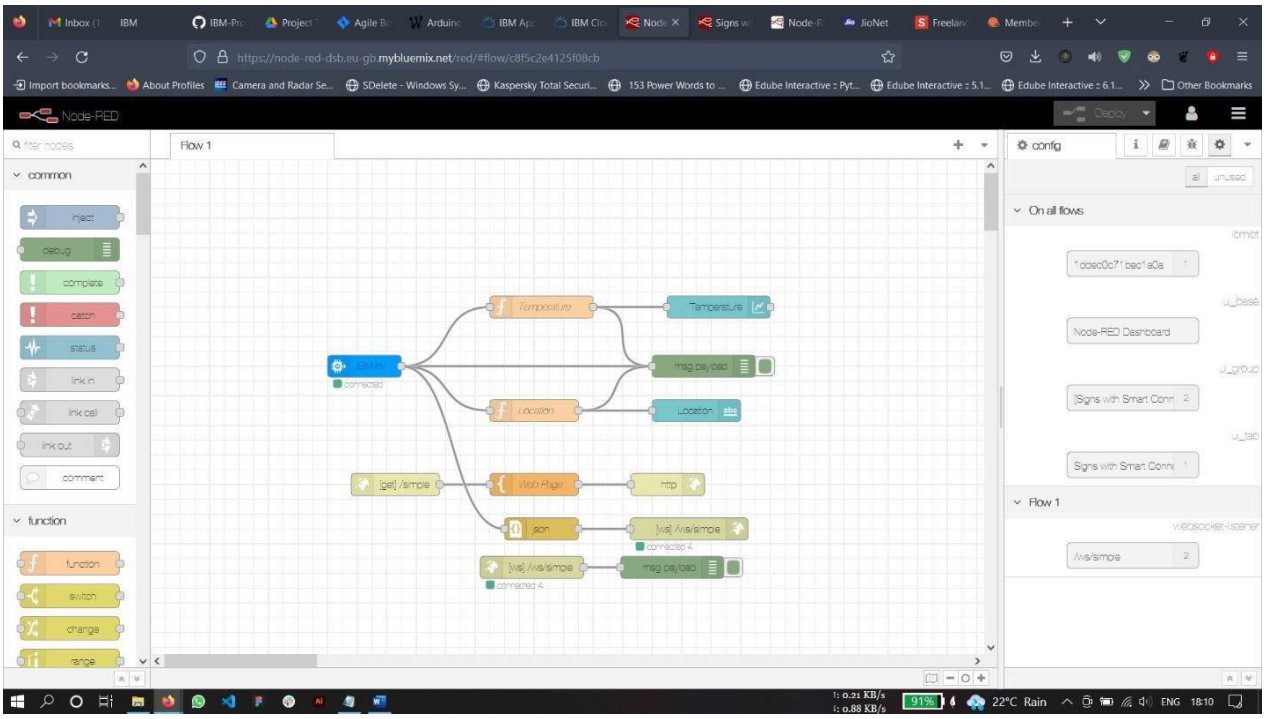


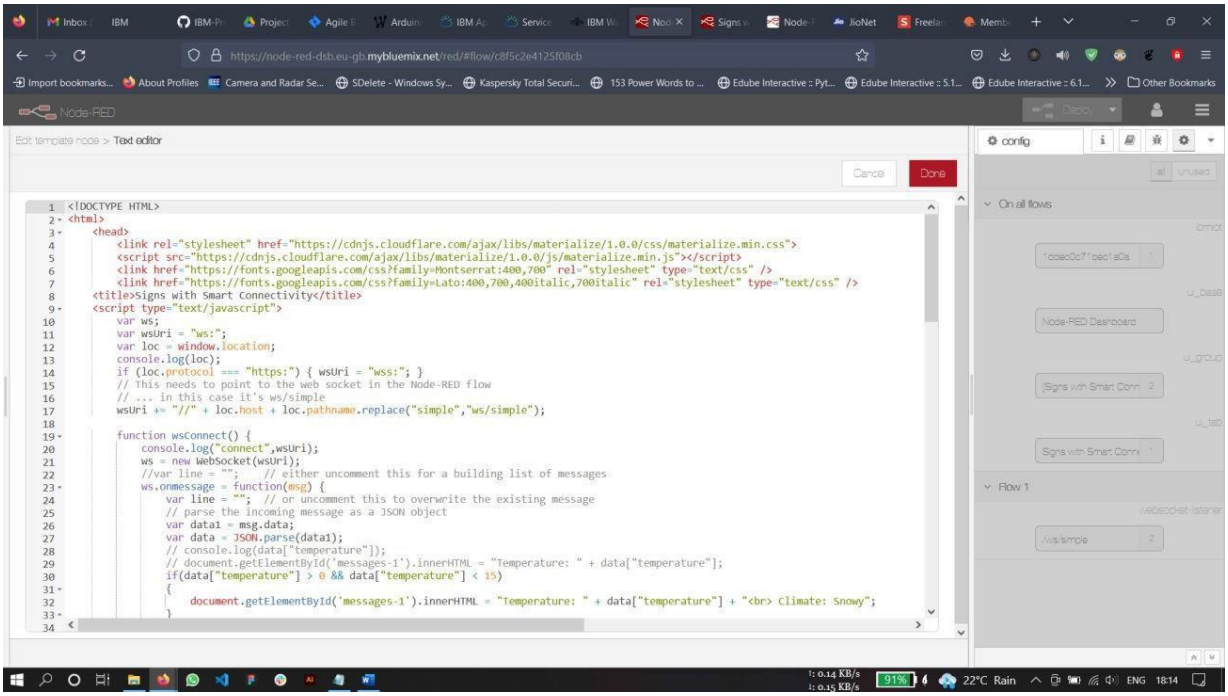
7.2. Feature2:

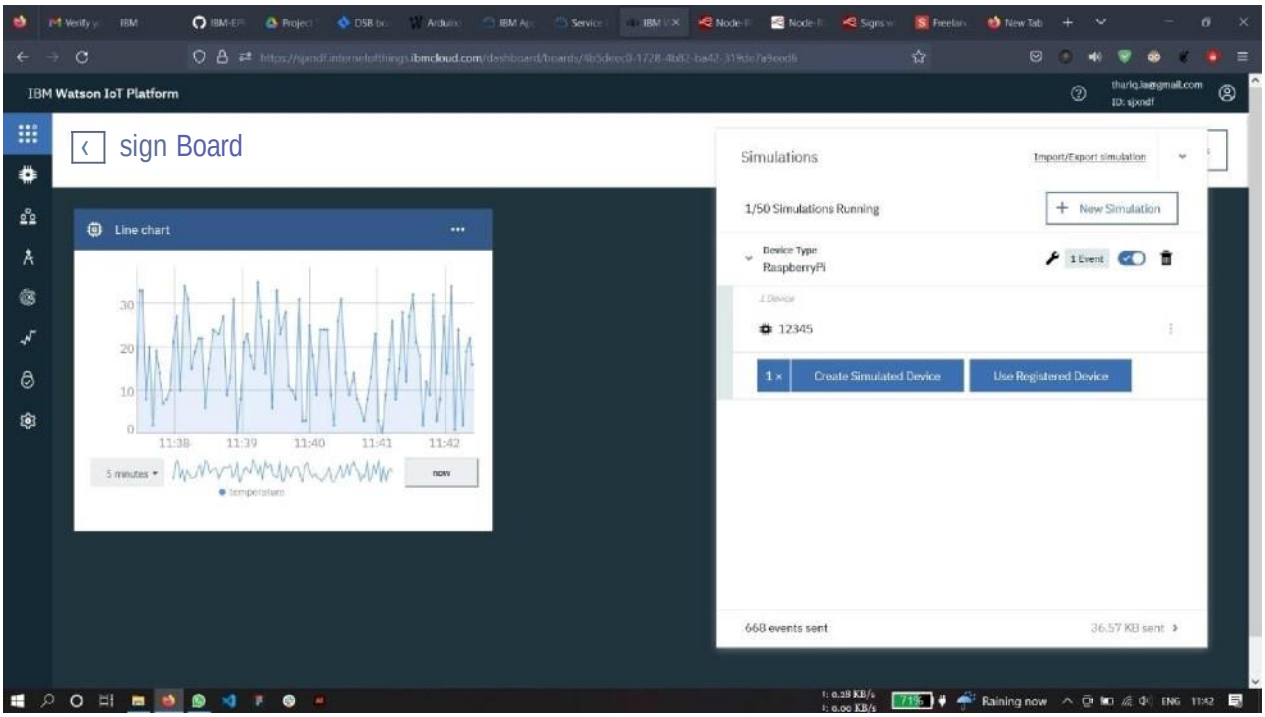
Thetemperatureandthelocationdata areexactlydisplayedinthewebpageusingNode–RedandtheforthatisrandomizedusingIBMWatson.Adeviceiscreated forthatpurposeandissimulatedto senddatatonode– red.

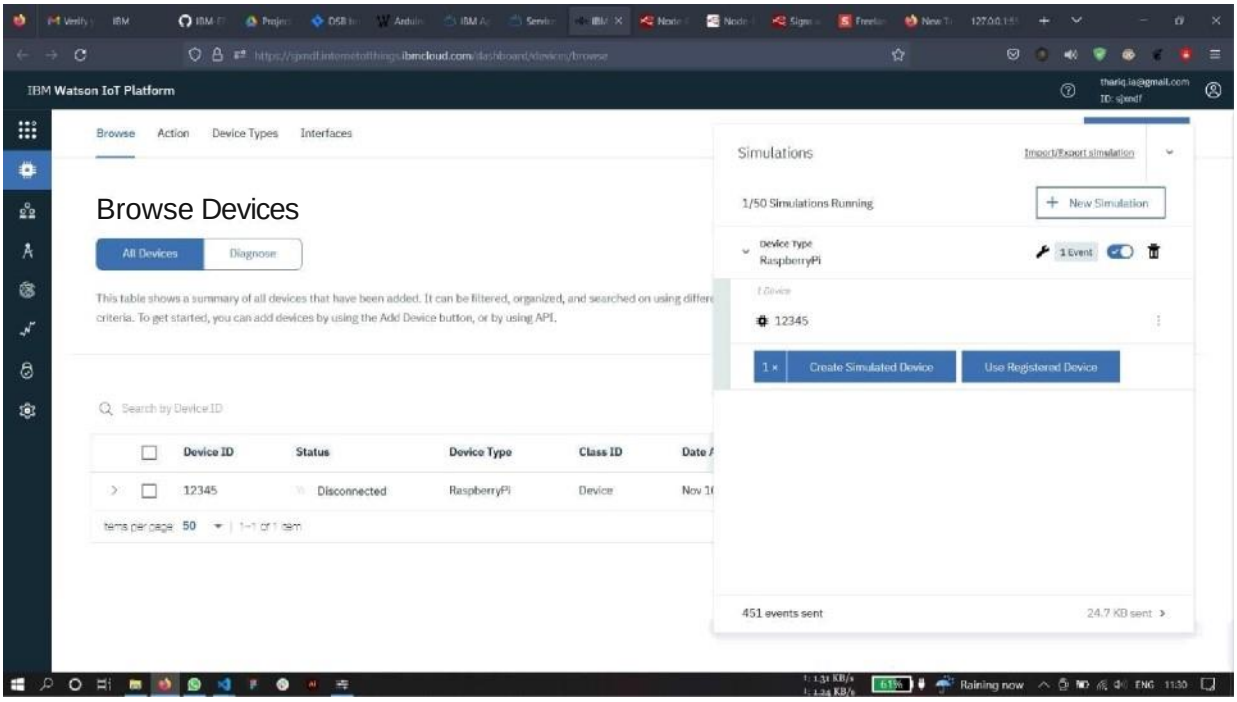


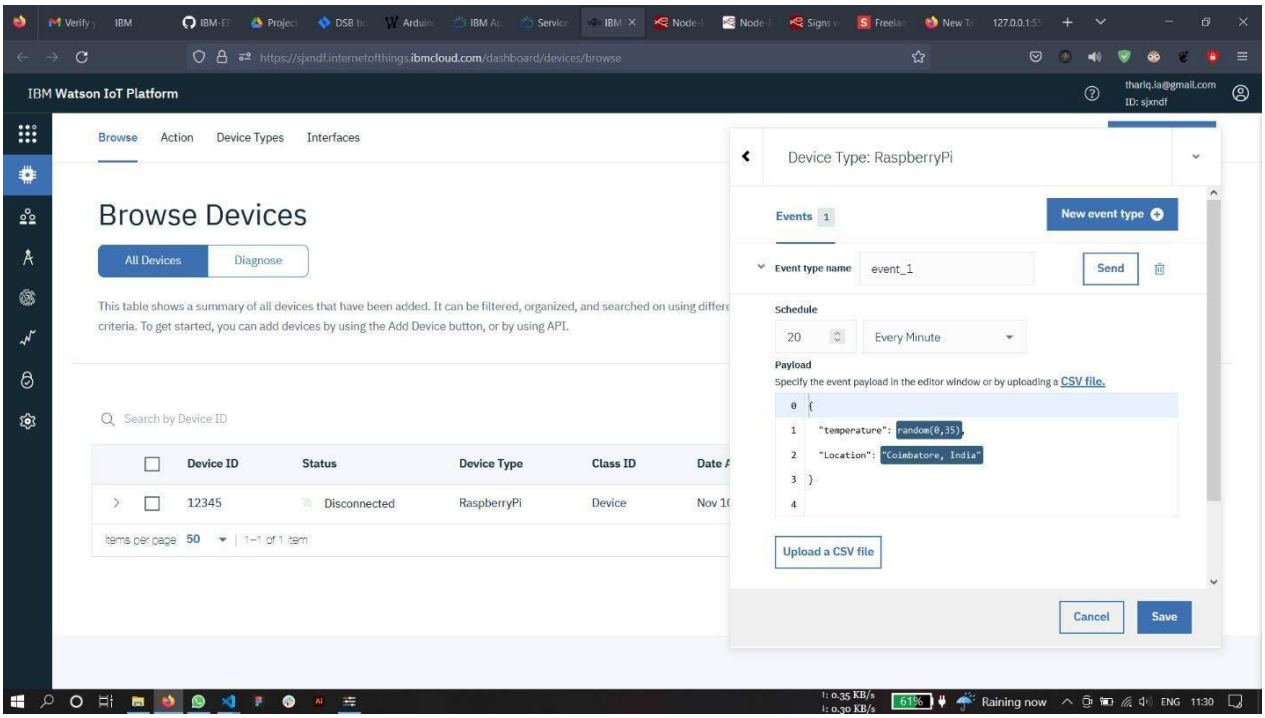



Node-RED
Flow 1
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
change
range
Temperature
Temperature
msg.payload
Location
Location
[get] /simple
Web Page
http
json
[ws] /ws/simple
connected 4
[ws] /ws/simple
msg.payload
connected 4
config
On all flows
Node-RED Dashboard
Signs with Smart Conn
Flow 1
websocket-listener
/ws/simple


Edit template node > Text editor
Cancel
Done
<!DOCTYPE HTML>
<html>
<head>
<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/materialize/1.0.0/css/materialize.min.css">
<script src="https://cdnjs.cloudflare.com/ajax/libs/materialize/1.0.0/js/materialize.min.js"></script>
<link href="https://fonts.googleapis.com/css?family=Montserrat:400,700" rel="stylesheet" type="text/css" />
<link href="https://fonts.googleapis.com/css?family=Lato:400,700,400italic,700italic" rel="stylesheet" type="text/css" />
<title>Signs with Smart Connectivity</title>
<script type="text/javascript">
var ws;
var wsUri = "ws:";
var loc = window.location;
console.log(loc);
if (loc.protocol === "https:") { wsUri = "wss:"; }
// This needs to point to the web socket in the Node-RED flow
// ... in this case it's ws/simple
wsUri += "//" + loc.host + loc.pathname.replace("simple","ws/simple");
function wsConnect() {
console.log("connect",wsUri);
ws = new WebSocket(wsUri);
//var line = ""; // either uncomment this for a building list of messages
ws.onmessage = function(msg) {
var line = ""; // or uncomment this to overwrite the existing message
// parse the incoming message as a JSON object
var data1 = msg.data;
var data = JSON.parse(data1);
// console.log(data["temperature"]);
// document.getElementById('messages-1').innerHTML = "Temperature: " + data["temperature"];
if(data["temperature"] > 0 && data["temperature"] < 15)
{
document.getElementById('messages-1').innerHTML = "Temperature: " + data["temperature"] + "
 Climate: Snowy";
}


IBM Watson IoT Platform
sign Board
Line chart
Simulations
Import/Export simulation
1/50 Simulations Running
New Simulation
Device Type
RaspberryPi
1 Event
12345
1 ×
Create Simulated Device
Use Registered Device
668 events sent
36.57 KB sent


IBM Watson IoT Platform
Browse
Action
Device Types
Interfaces
Browse Devices
All Devices
Diagnose
Search by Device ID
Device ID
Status
Device Type
Class ID
12345
Disconnected
RaspberryPi
Device
Simulations
Import/Export simulation
1/50 Simulations Running
New Simulation
Device Type
RaspberryPi
1 Event
12345
1 ×
Create Simulated Device
Use Registered Device
451 events sent
24.7 KB sent



Thefollowingfeaturesaresomeideaswedecidedtoimplementbutwedidn’thad muchtime...

Additionally, a speed cam willbeintegratedwiththedigitalsign boardwhichuseImageprocessing&AI,togetthedetailsof thedriverwhobreaksthetrafficrules(especiallyspeed) willbeupdatedintheclouddatabase.

Also, forNoparkingandOnewayruleviolationscanalsobedetectedandappropriateactioncanb etaken. Violationsofstopsignsinintersectionwillalsobedetectedusing AI.

8. Testing:

8.1. TestCases:

1	Date	17-Nov-22
2	Team ID	PNT2022TMID19258
3	Project Name	Project - Signs with Smart Conne
4	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
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.Surya
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.Surya
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://sjpndf.internetofthings.ibmcloud.com/dashboard/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.Surya
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.Surya
Node Red Installation	1.Install node red and open node red in command prompt 2.Select IBM input in IoT	https://node-red-dzb.eu-gb.mybluemix.net/red/#flow/c9f5c2e4125f08cb	User should be able to see the Node Red page	Working as expected	Pass	Results verified	No		R.Gowthaman,M.Boopathi,S.Manikandan,V.Surya

Date	17-Nov-22
Team ID	PNT2022TMID19258
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 using Local host link	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.Surya
Python 3.7.0(64 bit) installatio	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.Surya
Python 3.7.0(64 bit) installatio	1.Downlinstall Python 3.7.0 2.After python code	Get the output from the cod	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.Surya

8.2. UserAcceptanceTesting:

1. *PurposeofDocument*

Thepurposeofthisdocumentistobrieflyexplainthetestcoverageandopenissuesofthe[ProductNam e]project at thetime ofthereleasetoUser AcceptanceTesting(UAT).

2. *DefectAnalysis*

Thisreportshowsthenumberofresolvedorclosedbugsateachseveritylevel,and howtheywere 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
NotReproduced	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. *TestCaseAnalysis*

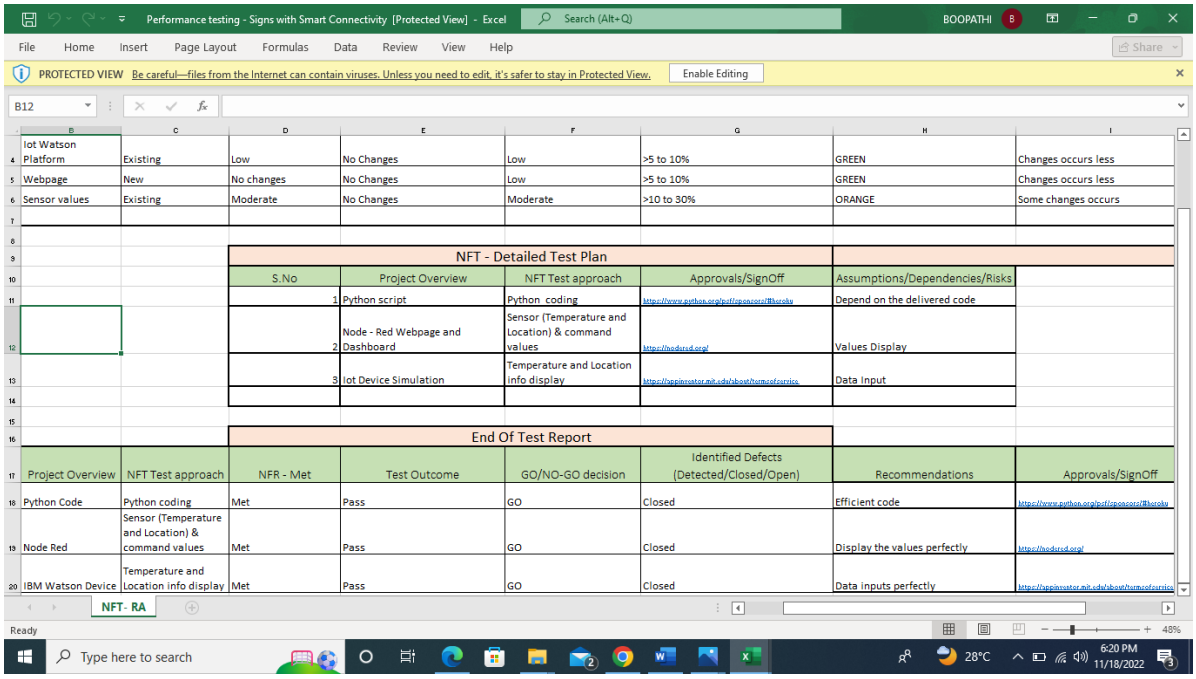
Thisreportshowsthenumberoftestcasesthathavepassed,failed,anduntested

Section	TotalCases	NotTested	Fail	Pass
PrintEngine	20	0	0	20
ClientApplication	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:

Themainadvantageof thisprojectisthatitisadynamicsystemwhichcanchangedifferentmodesofoperationsautomatically.

Itgathersweatherdata fromopenweatherAPIanddisplayspeedaccordingbasedontheclimate.

Displayservicewarningslikeschools, hospitalsandholyplaces andwarntoslowdownandbesilent.

TrafficdataandConstructionwarningdataare givenwithrandominputs. Basedontrafficandconstructiondata, warningsaredisplayed.

Additionally, a speed cam willbeintegratedwiththedigitalsign boardwhichuseImageprocessing&AI,togetthedetailsof thedriverwhobreaksthetrafficrules(especiallyspeed) willbeupdatedintheclouddatabase.

Also, forNoparkingandOnewayruleviolationscanalsobedetectedandappropriateactioncanbetaken. ViolationsofstopsignsinintersectionwillalsobedetectedusingAI.

11. Conclusion:

Theprojectconcludedbyreplacingthestaticsignboardswithsmartconnecteddigitalsignboards.Digitalroad signs are animportant partof moderninfrastructureandare becomingincreasinglycommon. Digitalroadsignsarebecomingmorecommonastechnologyimprovesandmorestatesadoptthem. Theuseofdigitalroadsignsisexpectedtocontinuetogrowinthefuture asitwouldbeobserveduser-friendly,economic, environmentfriendly,profitablepromotingroadsafety.Digitalroadsignsaredesignedtoimproveroadsafetyandefficiencybyprovidingreal-time informationtodrivers.Thesesignscandisplaya varietyofinformation, includingspeedlimits, trafficconditions, andweatherwarnings. Digitalroadsignscan helpdriversbyprovidinginformationthatisnotalwaysavailablefromtraditionalstaticsigns.

12. FutureScope:

- Inthefuture aspeedcam willbeintegratedwiththedigitalsign board.
- UsingImageprocessing&AI, thedetailsof thedriverwhobreaksthetrafficruleswillbe updatedintheclouddatabase.
- NoparkingandOnewayruleviolationscanalsobe detectedandappropriateactioncanbetaken.
- ViolationsofstopsignsinintersectionwillalsobedetectedusingAI.

13. Appendix:

Code:

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

eScope:

  Image

    Processing:Spee

    dCam

    NoParking

    One-Way

    Stopsignінintersection

*/



//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

#defineWhite0xffffff


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

```
voidnormal_signs();void
speed(intTemp);
voidtraffic_warning(inttdata);
voidconstruction_warning(intcdata);vo
idservice_warning(intsdata);

//InitialSetupvoid
setup() {
ImageReturnCodestat;t
ft.begin();Serial.begin(
9600);tft.setRotation(1)
  ;
  tft.setTextColor(ILI9341_WHITE);
}



//Normalsignswithwordings
//Weather --Speedchange
//Traffic
//Construction
//School, HospitalWarnings
```

```
voidloop()
  {tft.setTextSize(3);tft.setCurs
  or(0,0);
  tft.print("DriveSafe:)");
  //InitialMesaage..tft.setCursor(0,30);
  tft.print("SpeedLimit:60");delay(1000
  );

  /*NormalSignsDisplay*/normal_sign
  s();


  /*TemperatureforSpeedControlusingrandominput*/

  //Temperature = 20;
  Temperature = random(-10,35);//(-10)to10-- Snow, 11to25--
  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("Dri
  veSafe:)");
  //tft.setTextSize(2);tft.setCurs
  or(0,40);tft.print("TrafficAhea
  d..");tft.setCursor(0,80);
  //tft.setTextSize(3);tft.print("D
  riveCarefully!");delay(3000);tf
  t.fillScreen(Black);
}
if (tdata ==1)
{
  tft.setCursor(0,0);tft.print("Dri
  veSafe:)");tft.setTextSize(2);tf
  t.setCursor(0,40);tft.print("Tra
  fficAhead..");tft.setCursor(0,8
  0);
```

```
    //tft.setTextSize(3);tft.print("Tak
    eDiversion--
    >");delay(3000);tft.fillScreen(Bl
    ack);
  }
}


/*ConstructionWarningSystem*/

voidconstruction_warning(intcdata)
{
  tft.fillScreen(Black);i
  f (cdata ==0)
  {
    tft.setCursor(0,0);tft.print("Drive
    Safe:)");tft.setTextSize(2);tft.set
    Cursor(0,40);tft.print("Constructi
    onAhead..");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