SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

IBM NALAIYATHIRAN

PROFESSIONAL READINESS FOR INNOVATION , EMPLOYABILITY

AND ENTREPRENEURSHIP

A PROJECT REPORT

Submitted by

TEAM ID : PNT2022TMID40929

TEAM LEADER	**M.BALAJI**	**611819106005**
TEAM MEMBER 1	**M.PRAVEEN**	**611819106038**
TEAM MEMBER 2	**S.SANJAI KUMAR**	**611819106045**
TEAM MEMBER 3	**S.KALAIYARASAN**	**611819106015**

P.S.V COLLEGE OF ENGINEERING AND TECHNOLOGY

KRISHNAGIRI

ANNA UNIVERSITY:: CHENNAI 600025

NOVEMBER-2022

INDUSTRY MENTOR: BHARADWAJ

FACULTY MENTOR: JOTHI

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1.INTRODUCTION:

1.1 PROJECT OVERVIEW

The goal of this project is to replace the static signboards with smart connected sign boards to get the speed limitations from a web app using weather API and update it automatically based on the weather conditions, set diversions through API and warn drivers for school zones and hospital zones.

Purpose

To replace the static signboards, smart connected sign boards are used.

- These smart connected sign boards get the speed limitations from a web app using weather API and update automatically.
- Based on the weather changes the speed may increase or decrease.
- Traffic diversion signs are displayed.
- Messages indicating school ,hospital, police station zones are also displayed.

2.LITERATURE SURVEY:

2.1 EXISTING PROBLEM& REFERENCES

1. Chandrasekhar.m el.al suggested a system that implement image processing algorithm in real time traffic light control which will control the traffic light efficiently.

2. ekinhan eriskin el.al a new method for desinging traffic signal timing at oversaturated intersections was expressed “the elimination pairing system”. an object function with vehicle delay and stop-start numbers has been generated

3. gustav nilsson giacomo como focused on a class of dynamic feedback traffic signal control policies that are based on a generalized proportional allocation rule. there results in a differential inclusion for which there prove existence and, in the special case of orthogonal phases, uniqueness of continuous solutions via a generalization of the reflection principle.

4.huajun chai el.al captured the interaction between travells’ routing choice and traffic signal control in a coherent framework. they tested their algorithm and control strategy by simulation in omnet++ (a network communication simulator) and sumo (simulation of urban mobilty) under several scenarios.

5. dr. pardeep k. gupta [6] proposed to replace existed traffic signals with a system that are monitored the traffic flow automatically in traffic signal and sensors are fixed in which so the time feed are made dynamic and automatic by processed the live detection.

6. mohammad aslani et al [9] utilized rl (reinforcement learning) algorithms to design adaptive traffic signal controllers called actor-critic adaptive traffic signal controllers

https://github.com/IBM-EPBL/IBM-Project-47803-1660802383/tree/main/project%20design%20and%20planning/Ideation%20phase/Literature%20survey

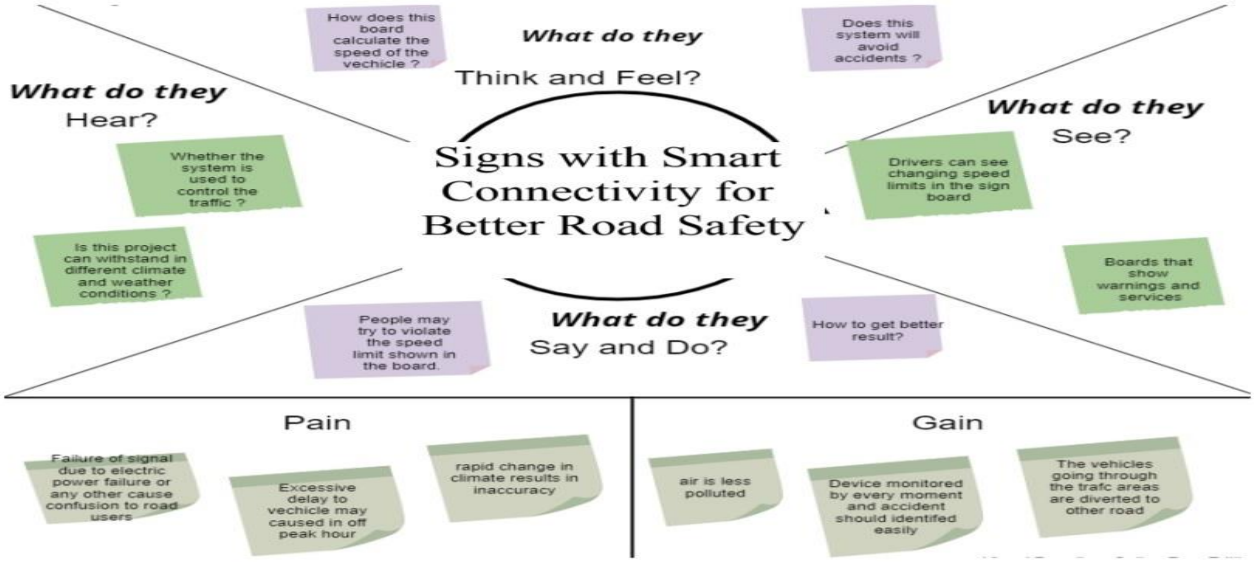
2.3 PROBLEM STATEMENT DEFINITION

This project will replace static signs with smart signs that can adjust speed restrictions based on the weather and climate, display detour instructions in the event of an accident, and display alert messages in the event of hospitals, schools, or roadworks.

https://github.com/IBM-EPBL/IBM-Project-47803-1660802383/tree/main/PROJECT%20DESIGN%20AND%20PLANING/Project%20phase

3.IDEATION AND PROPOSED SOLUTION:

3.1 EMPATHY MAP



3.2 PROPOSED SOLUTION

S.NO	PARAMETER	DESCRIPTION
1.	Problem Statement (Problem to be solved)	Signs with smart connectivity for Better Road Safety are intended to control speed, increase safety, and display the latest weather information.
2.	Idea / Solution description	Replacing traditional roadside signage with IOT-enabled smart ones. Smart signs are built using LED and the Internet of Things.
3.	Novelty / Uniqueness	Due to the use of LEDs, they can be seen from a distance. It is possible to view them from a distance since LEDs are used. These specifics were obtained from a weather-tracking app. Additionally, it gives information about nearby places like hospitals, schools, etc. so that customers may make decisions based on that knowledge, such as speeding.
4.	Social Impact/ Customer Satisfaction	On the department of road safety, these are clearly felt. The avoidance of accidents can be achieved by imposing a user- speed limit.
5.	Business Model (Revenue Model)	The government's implementation of these for common citizens is an excellent endeavor to increase public awareness. This can be funded separately by the government, which lays the groundwork for a safer environment.
6.	Scalability of the Solution	Because it is more visible than conventional signals, it has a better chance of reducing danger and could even save many lives.

3.4 PROBLEM SOLUTION FIT

https://github.com/IBM-EPBL/IBM-Project-47803-1660802383/blob/main/PROJECT%20DESIGN%20AND%20PLANING/project%20design%20phase%201/Problem%20Solution%20Fit.pdf

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

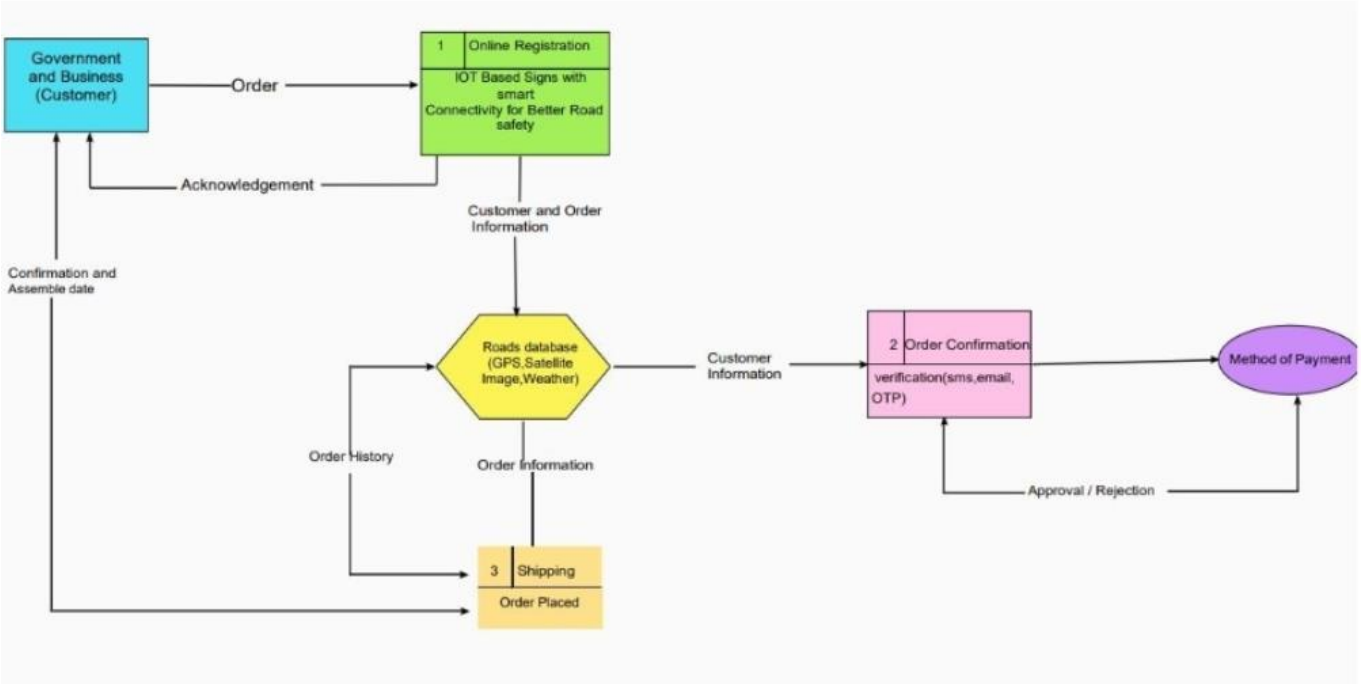
FR.NO	FUNCTIONAL REQUIREMENT(EPIC)	SUB REQUIREMENT(STORY/SUB-TASK
1.	User Requirements	Static signboards will be replaced with smart linked sign boards that meet all criteria.
2.	User Registration	User Registration can be done through a Website or Gmail
3.	User Confirmation	Phone Confirmation Email confirmation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

4.2NON-FUNCTIONAL REQUIREMENTS

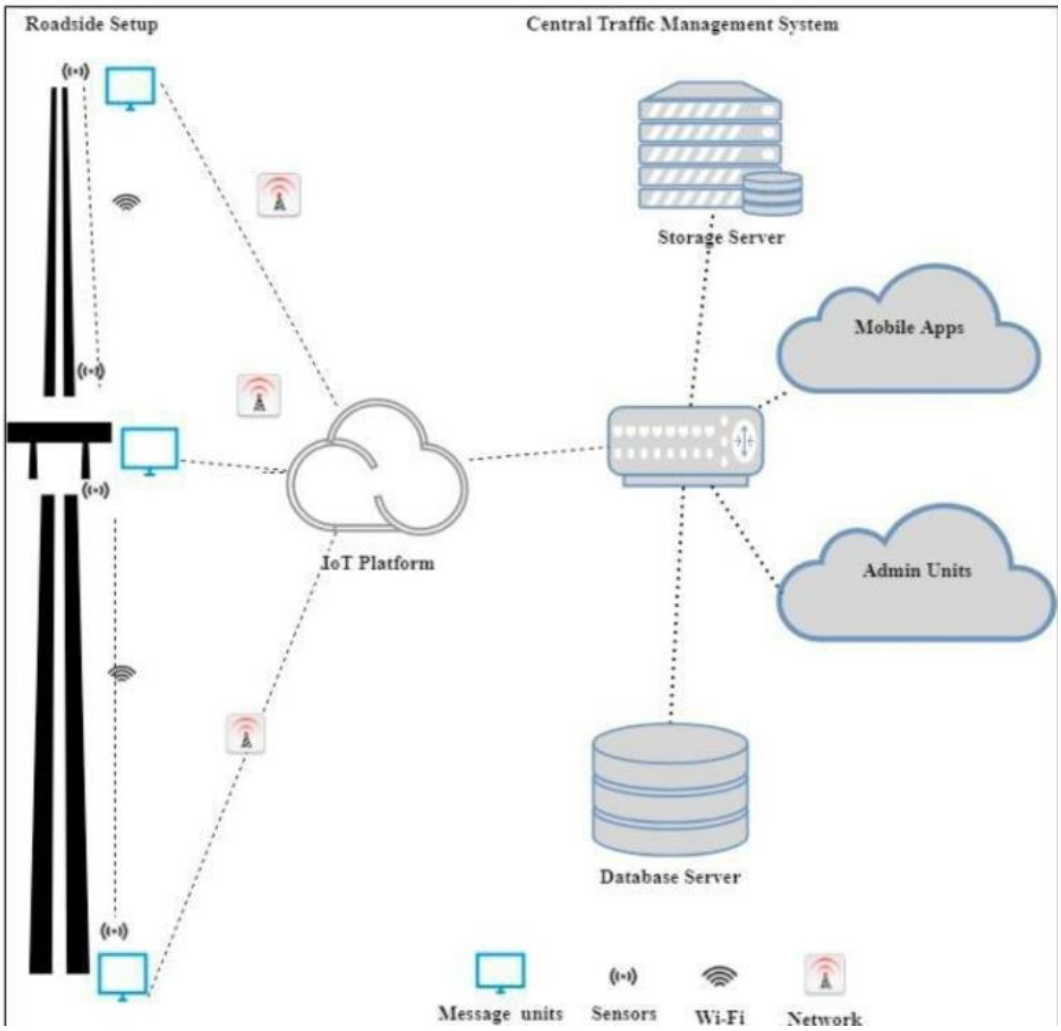
FR.NO	NON FUNCTIONAL REQUIREMENT	DESCRIPTION
1.	Usability	Will provide the clear product instructions and a self-explanatory product which is simple to use.
2.	Security	Cloud data must be contained within the network, collapsing to be the real-time avoidance should be avoided, and the board will be monitored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

5. PROJECT DESIGN

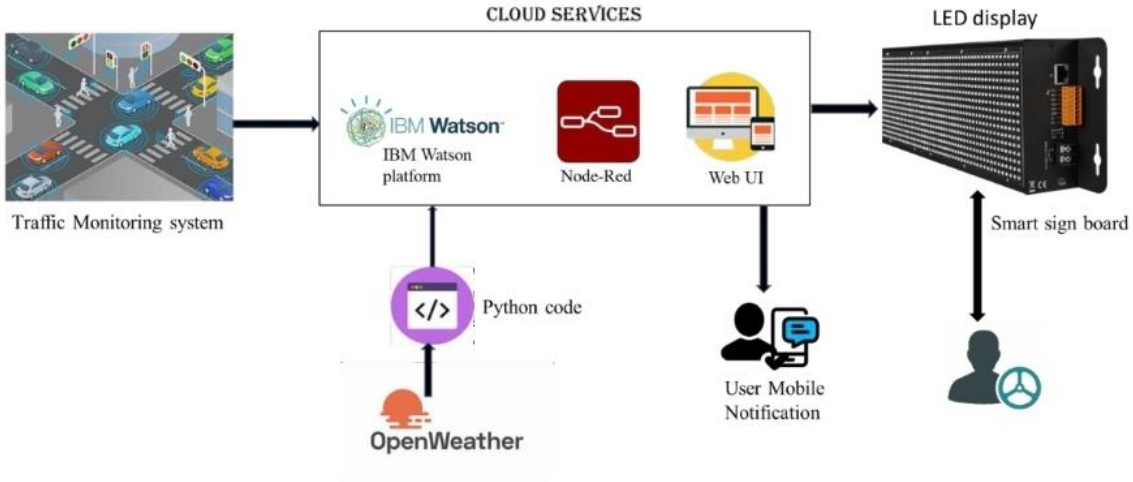
5.1 DATA FLOW DIAGRAM



5.2 SOLUTION ARCHITECTURE



5.2 TECHNICAL ARCHITECTURE



5.3 USER STORIES

USER TYPES	FUNCTIONAL REQUIREMNT(EPIC)	USER STORY NUMBER	USER STORY	ACCEPTANCE CRITERIA	PRIORITY	RELEASE
Customer(Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password	Access my account / dashboard	High	Sprint-1
Weather	Open weather map	USN-2	As a user, I want to check the weather of that location	Get the weather of that location	High	Sprint-1
Iot devices	Automation	USN-3	As a user, I want to use Iot devices for automation purposes	Get the work done without manual effort	High	Sprint-2
Python code	Random data	USN-4	As a user, I want to give some input to the devices for performing some action to complete the tasks very easily	Get the data Work flow	Medium	Sprint-1
IBM Cloud	Cloud services	USN-5	As a user, I want to deploy these application for public version	Useful for all domain users	High	Sprint-1

Node-Red	Integration	USN-6	As a user, I want to integrate the applications withhardware	precise for linear work flow	Medium	Sprint-3
Web UI	Interaction	USN-7	As a user, I want to interact with the digital products	interact with the users	Medium	Sprint-2
Data validation	Checking accuracy	USN - 8	As a user, I can check the ability and accuracy of the model in obtaining the required information	Check the capability of the model	High	sprint - 2
Data extraction	Obtaining thedata	USN - 9	As a user , I can retrieve the result data from the application for data storage fo r further uses	Download the result in the for m of data	High	Sprint - 3

6.PROJECT PLANING AND SCHEDULING:

SPRINT	FUNCTIONAL REQUIREMENT	USER STORY/TASK	STORY POINTS	PRIORITY	TEAM MEMBERS
Sprint-1	Resources Initialization	Create and initialize accounts in various public APIs like Open Weather Map API.	1	LOW	1.Balaji 2.Praveen 3.Kalaiyarasan 4.sanjai kumar
Sprint-1	Local Server/Software Run	Write a Python program that outputs results given the inputs like weather and location.	1	MEDIUM	1.Balaji 2.Praveen 3.Kalaiyarasan 4.sanjai kumar
Sprint-2	Push the server/software to cloud	Push the code from Sprint 1 to cloud so it can be accessed from anywhere	2	MEDIUM	1.Balaji 2.Praveen 3.Kalaiyarasan 4.sanjai kumar
Sprint-3	Hardware initialization	Integrate the hardware to be able to access the cloud functions and provide inputs to the same.	2	HIGH	1.Balaji 2.Praveen 3.Kalaiyarasan 4.sanjai kumar
Sprint-4	UI/UX Optimization & Debugging	Optimize all the shortcomings and provide better user experience.	**2**	LOW	1.Balaji 2.Praveen 3.Kalaiyarasan 4.sanjai kumar

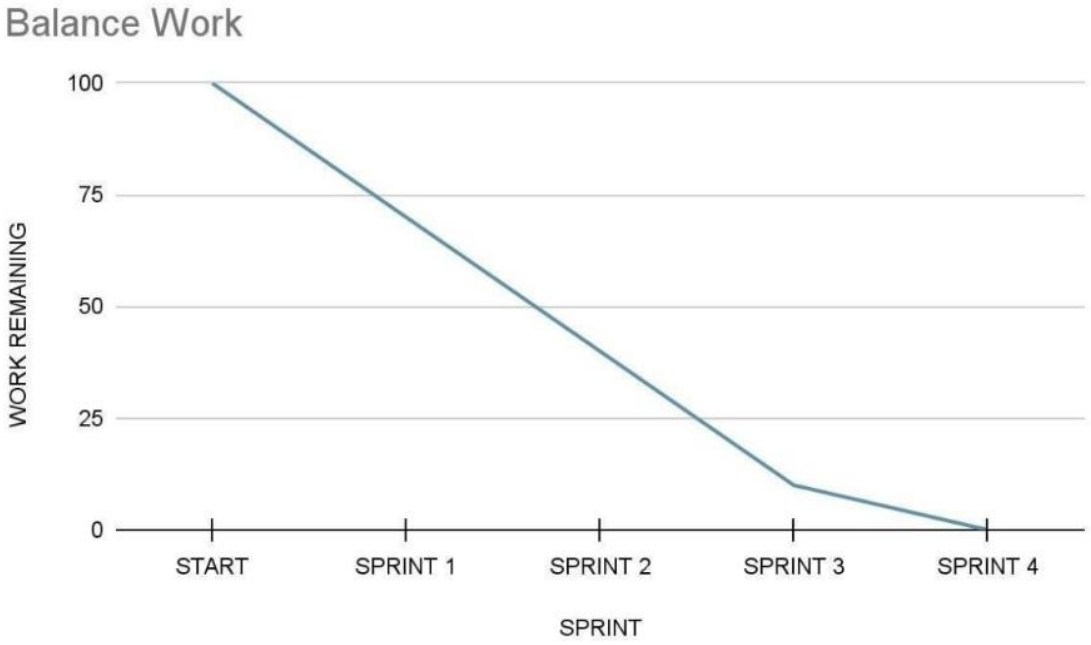
ProjectTracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	31 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	07 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	14 Nov 2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let’s calculate the team’s average velocity (AV) per iteration unit (story points per day)

AV=Sprint duration/velocity=20/10=2



7.CODING AND SOLUTIONING

Feature 1 -GET WEATHER DETAILS FOR GIVEN LOCATION

This part of Node RED flow accepts an http GET end point, from which the location, uid, info are passed. Message parser sets the required APIKEY for OpenWeatherAPI for the next block. This data is then passed onto Decision Maker which makes all the decisions regarding the message to be output at the display and sends it as a http response. This data is displayed at the microcontroller. Thus a lot of battery is saved due to lesser processing time.

Feature 2- GET SPEED LIMITATIONS, MESSAGES, SIGNS

The Node RED flow obtains the data published to the cloud such as speed limitations, messages such as warnings about the zones (schools, hospitals, police stations), signs such as diversions, Uturns etc, and displays them in the dashboard.

8.TESTING

● TEST CASE 1 Temperature': 303.03, 'Humidity': 51, 'Pressure': 1010, 'Message': 'SLOW DOWN , SCHOOL IS NEAR', 'Sign': '', 'Speed': '', 'Visibility': 'Clear Weather'

● TEST CASE 2 Temperature': 303.03, 'Humidity': 51, 'Pressure': 1010, 'Message': '', 'Sign': 'Left Diversion <-', 'Speed': 'SLOW DOWN , Speed Limit Exceeded', 'Visibility': 'Clear Weather'

● TEST CASE 3 Temperature': 303.03, 'Humidity': 51, 'Pressure': 1010, 'Message': 'SLOW DOWN , HOSPITAL NEARBY', 'Sign': 'Left Diversion <-', 'Speed': '', 'Visibility': 'Clear Weather'

● TEST CASE 4 Temperature': 303.03, 'Humidity': 51, 'Pressure': 1010, 'Message': 'NEED HELP, POLICE STATION NEARBY', 'Sign': 'U Turn', 'Speed': 'Moderate Speed', 'Visibility': 'Clear Weather'.

User Acceptance Testing

Dynamic speed & divertion variations based on the weather and traffic helps user to avoid traffic and have a safe journey home. The users would welcome this idea to be implemented everywhere.

9.RESULTS

The performance of the website varies based on the software chosen for implementation . Built upon NodeJS, a light and high performance engine, NodeRED is capable of handling upto 10,000 requests per second. Moreover, since the system is horizontally scalable, a even higher demand of customers can be served.

10.ADVANTAGES AND DISADVANTAGES

- **ADVANTAGES**

○ Lower battery consumption since processing is done mostly by Node RED servers in the cloud.

○ Cheaper and low requirement micro controllers can be used since processing requirements are reduced.

○ Longer lasting systems.

○ Dynamic Sign updation.

○ School/Hospital Zone alerts

- **DISADVANTAGES**

○ The size of the display determines the requirement of the micro controller

○ Dependent on OpenWeatherAPI and hence the speed reduction is same for a large area in the scale of cities.

11.CONCLUSION

Our project is capable of serving as a replacement for static signs for a comparatively lower cost and can be implemented in the very near future. This will help reduce a lot of accidents, traffics and maintain a peaceful environment.

12.FUTURE SCOPE

Introduction of intelligent road sign groups in real life scenarios could have great impact on increasing the driving safety by providing the end-user with the most accurate information regarding the current road and traffic conditions. Even displaying the information of a suggested driving speed and road surface condition (temperature, icy, wet or dry surface) could result in smoother traffic flows and, what is more important, in increasing a driver's awareness of the road situation.

13.APPENDIX

Source code:

```
import wiotp.sdk.device

import time

import random

import requests, json

myConfig = {

"identity": {

"orgId": "ojfcbe",

"typeId": "sulan",

"deviceId":"1234"

},

"auth": {

"token": "RsCA-twpue)2)c8j&r"

}

}

def myCommandCallback(cmd):

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

m=cmd.data['command']

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)

client.connect()

BASE_URL = https://api.openweathermap.org/data/2.5/weather?

CITY = "coimbatore"

URL = BASE_URL + "q=" + "Coimbatore" + "&appid=" + "fbcb52a2a6c7bbea1396de2b6b17ea8a"
```

```
while True:
response = requests.get(URL)
if response.status_code == 200:
data = response.json()
main = data['main']
temperature = main['temp']
humidity = main['humidity']
pressure = main['pressure']
report = data['visibility']
repo=random.randint(0,5)
if repo==1:
prt="SLOW DOWN , SCHOOL IS NEAR"
elif repo==3:
prt="SLOW DOWN , HOSPITAL NEARBY"
elif repo==5:
prt="NEED HELP, POLICE STATION NEARBY"
else:
prt=""
speed=random.randint(0,150)
if speed>=100:
prt3="SLOW DOWN , Speed Limit Exceeded"
elif speed>=60 and speed<100:
prt3="Moderate Speed"
else:
```

```
prt3="Usual speed limit"

sign=random.randint(0,5)

if sign==1:

prt2="Right Diversion ->"

elif sign==3:

prt2="Left Diversion <-"

elif sign==5:

prt2="U Turn"

else:

prt2=""

if temperature<=50:

prt4="Fog Ahead, Drive Slow"

else:

prt4="Clear Weather"

else:

print("Error in the HTTP request")

myData={'Temperature':temperature,'Humidity':humidity,'Pressure':pressure, 'Message':prt, 'Sign':prt2, 'Speed':prt3, 'Visibility':prt4}

client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)

print("Published data Successfully: %s", myData)

client.commandCallback = myCommandCallback time.sleep(5)

client.disconnect()
```

GITHUB LINK :

https://github.com/IBM-EPBL/IBM-Project-47803-1660802383

VIDEO DEMO LINK :

https://drive.google.com/file/d/1df5qb-QGHXlOp9w5diVljppcJp-2U544/view?usp=drivesdk