PROJECT REPORT

PROJECT DOCUMENTATION

Team ID	PNT2022TMID14030
Project Name	Signs with Smart Connectivity for Better Road Safety

1. INTRODUCTION

1.1 Project Overview:

The project aims to replace the static signboards with smartconnected sign boards which can be changed frequently according to the purposes like weather, traffic condition, particular zones, etc.., these smart connected sign boards get the speed limitations for a particular city from a web app using weather API and update automatically. Based on the weather changes the speed may increase or decrease. So, the signboards Will display “slow down”, if the weather is bad. Based on the traffic and fatalsituations the diversion signs are displayed.

The driver can change the location pins in the map to their current location and destination location. The app shows the route and navigation instructions like “turn left on abroad”, “take U turn”. Using the location sensor, it can sense the speed of the vehicle. Sign boards near school zone, hospital zone, construction zone,uneven and narrow roads, and animal zone should display appropriate signs according to the zone. Different modes of operations can be selected with the help of buttons.

1.2 Purpose:

- To replace the static signboards, smart connected sign boards areused.
- 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 ordecrease.
- Based on the traffic and fatal situations the diversion signs aredisplayed.
- Guide (Schools), Warning and Service (Hospitals, Restaurant) signs are also displayed accordingly.

2. LITERATURE SURVEY

2.1 Existing Problem:

- The static signboards which are used to show the speed limits and zones cannot be changed.
- They should be changed from time to time because of the paint deterioration, folded sheet, dullness caused by weather damage.
- Some drivers disobey these signals.

2.2 References:

➢ An IoT based Smart Monitoring System for Vehicles

There is increased adoption of penalty and fine for traffic rule violators in the public sector but there is a tendency for people to evade from those imposed fines and restrictions for their own safety. Our system will completely monitor all the traffic violations namely over speeding, rash driving, drunken driving, driving without a seat belt, and so on right from the starting of the car.

There is an increasing demand to develop a system to check passengers without coming out of the vehicle. A new system for the police force to check the vehicle's details with a smart device placed in the vehicle. The device is equipped with speed monitoring, Alcohol detection, Seat belt checking, etc.

References: C. M. Jacob, N. George, A. Lal, R. J. George, M. Antony and J. Joseph, "An IoT based Smart Monitoring System for Vehicles," 2020 4th International Conference on Trends in Electronics and Informatics (ICOEI)(48184), 2020, pp. 396-401, doi: 10.1109/ICOEI48184.2020.9142936.

➢ An IoT based Weather Information Prototype Using WeMos:

The Internet of Things (IOT) describes the interconnection of devices and people through the traditional internet and social networks for various day-to-day applications like weather monitoring, healthcare systems, smart cities, irrigation field, and smart lifestyle. IOT is the new revolution of today’s internet world which monitors live streaming of the entire world’s status like temperature, humidity, thunderstorm, earthquake, floods etc. that can stagger an alarm to human life.

This paper proposes a low-cost weather monitoring system which retrieves the weather condition of any location from the cloud database management system and shows the output on an OLED display. The proposed system uses an ESP8266-EX microcontroller based WeMos D1 board and it is implemented on Arduino platform which is used to retrieve the data from the cloud. The main objective of this paper is to view weather conditions of any location and allows accessing the current data of any station.

References: R. K. Kodali and A. Sahu, "An IoT based weather information prototype using WeMos," 2016 2nd International Conference on Contemporary Computing and Informatics (IC3I), 2016, pp. 612-616, doi: 10.1109/IC3I.2016.7918036.

- Internet of Things Based Notifications Using Smart Notice Board

Conventional Notice Board employs manual display and monitoring with papers and ledgers. The Target users are unaware of information displayed on the notice board. The objective of the project is to display the message on the notice board from anywhere and anytime, that even provides broadcast alerts to the target users. The system was designed and developed using the Internet of Things.

Arduino board integrates the display unit, Mobile App and SMS Agent through Internet. The message to be displayed on the notice board is sent through a mobile app to the board with Arduino. As soon as the message is displayed, SMS alert is sent to the target users. A system of efficient Notice Board display controlled through the Internet is accomplished and presented in this paper.

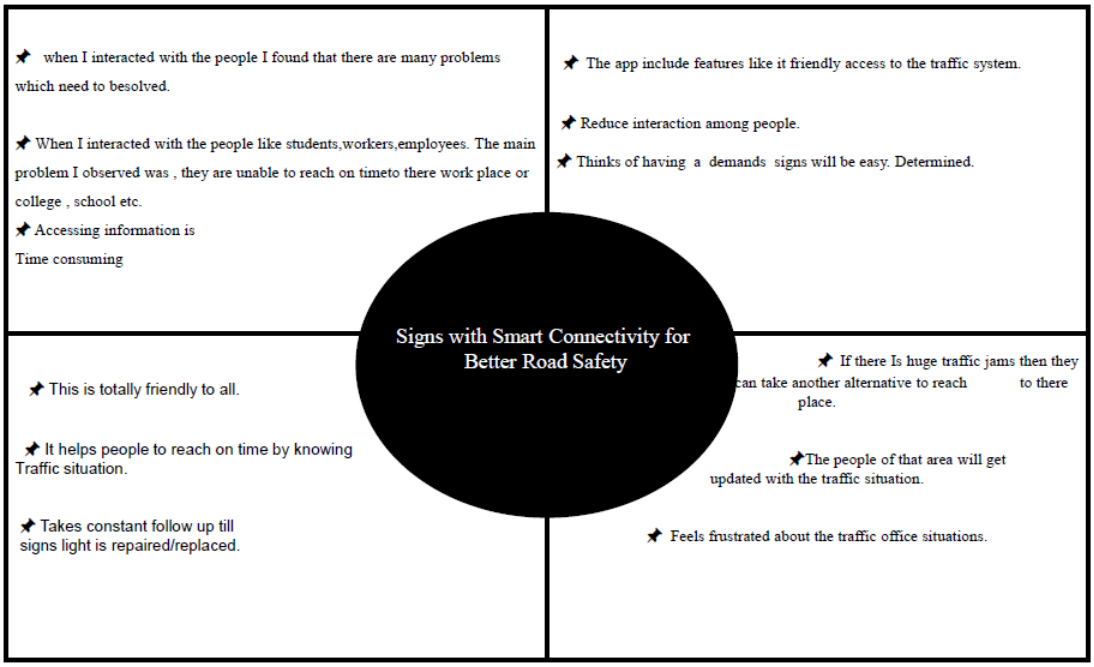
References: P. Chinnasamy, T. S. RajaRajeswari, P. Subhasini, S. K. L. Naik, A. Ashwini and T. Sivaprakasam, "IoT Based Smart Notice Board for Smart Cities," 2022 International Conference on Computer Communication and Informatics (ICCCI), 2022, pp. 1-3, doi: 10.1109/ICCCI54379.2022.9740884.

2.3 Problem Statement Definition:

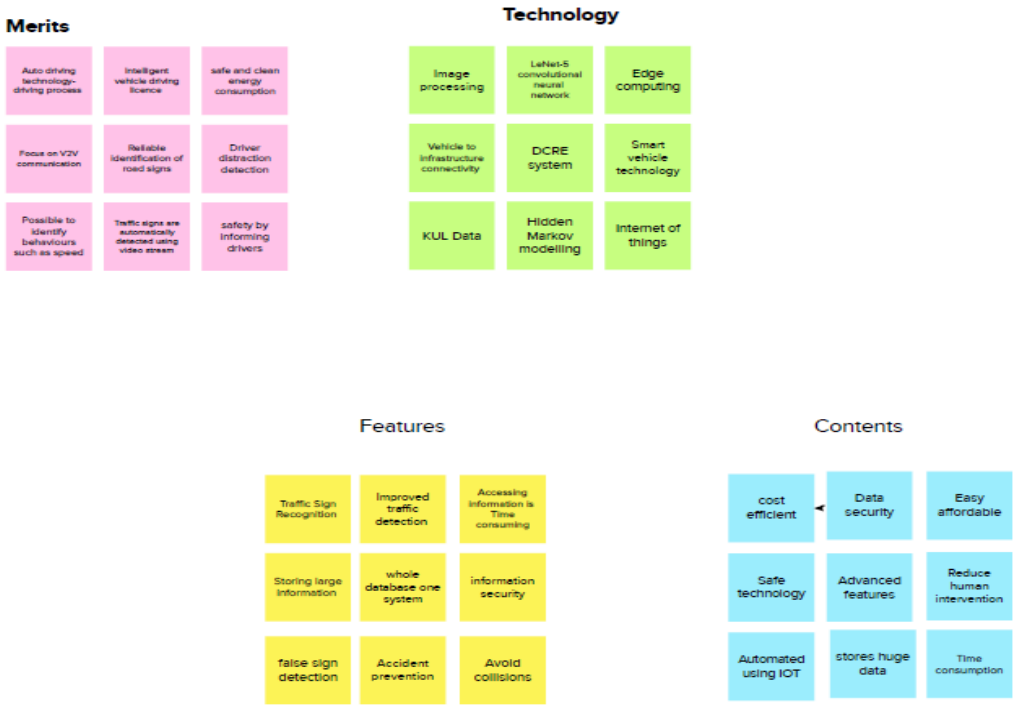
- A driver who wants to drive safely on road but there are many obstacles because of heavy traffic, weather condition, etc..,
- A driver who wants to avoid the heavy traffic roads but they are unpredictable because they change from time to time.
- A passenger who wants to travel safely but there are many road accidents because of some drivers who drive very fast and carelessly.
- A driver who wants to reach the destination but unable to choose the route and turn in wrong direction because there are no navigation instructions.
- To replace the static signboards with smart connected sign boards.
- To get the speed limitations from a web app using weather API.
- It will update automatically based on the weather conditions, set diversions through API and warns drivers for school zones and hospital zones.

3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:



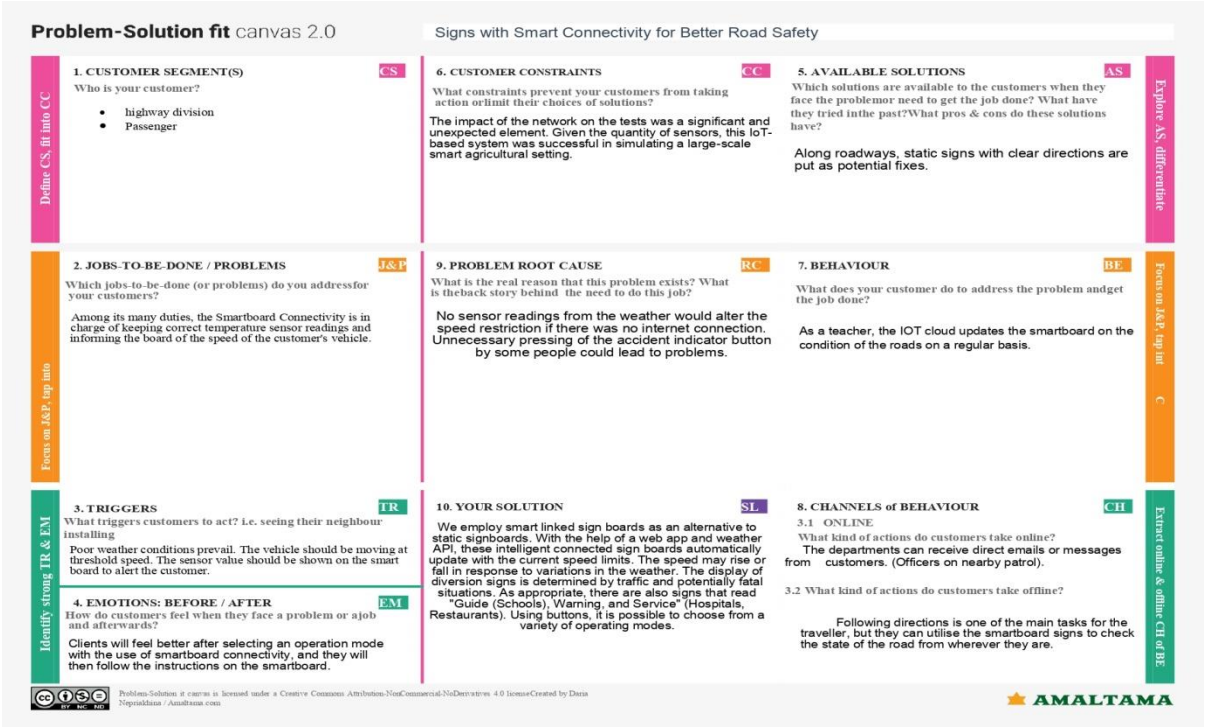
3.2 Ideation & Brainstorming:



3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Replacement of static signboards with smart connected sign boards.
2.	Idea / Solution description	The project includes features about Time consuming and friendly access to the traffic system.
3.	Novelty / Uniqueness	People can take another alternative way to reach their destination during huge traffic hours.
4.	Social Impact / Customer Satisfaction	It helps people to save time by knowing traffic situation.
5.	Business Model (Revenue Model)	This model is completely useful to all. Takes constant follow up till signs light are repaired / replaced. Errors can be easily corrected.
6.	Scalability of the Solution	Feels frustrated about the heavy traffic situations.

3.4 Problem Solution Fit:



4. REQUIREMENT ANALYSIS:

4.1 Functional Requirements:

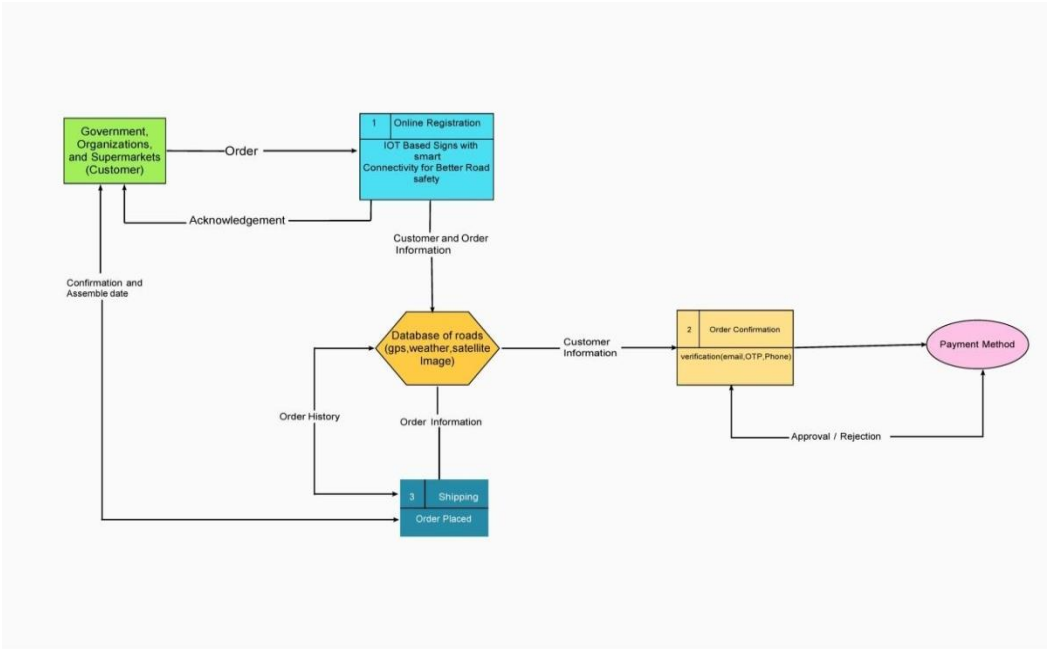
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User approval	Done by mails Done by messages via SMS
FR-4	Testing	Testing is done by API and UI
FR-5	End result	Product features decides the end result

4.2 Non-Functional Requirements:

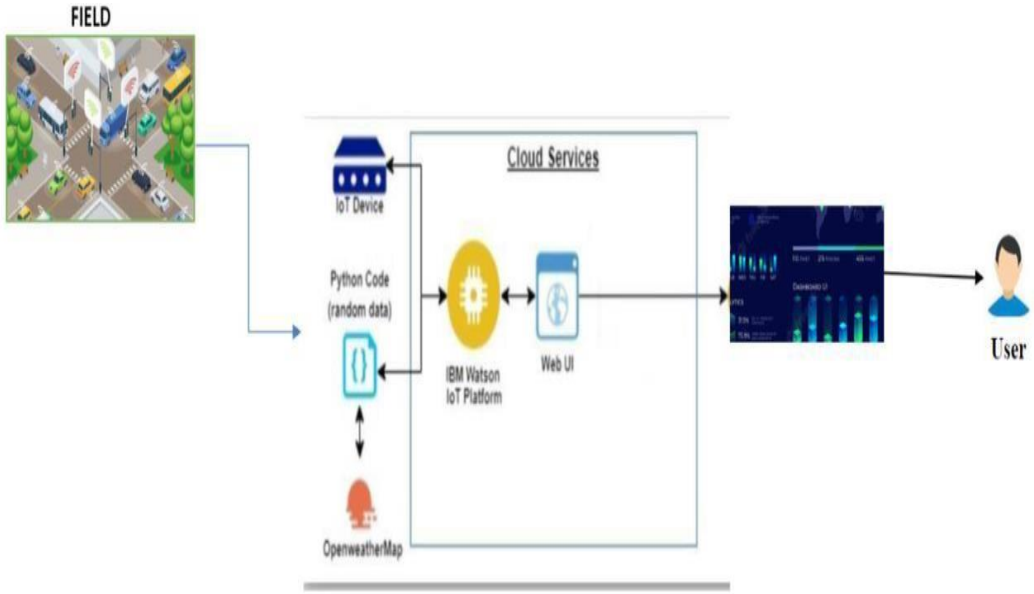
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Will provide the clear product instructions And a self-explanatory product which is simple to use.
NFR-2	**Security**	Cloud data must be contained within the network, collapsing to be the real-time avoidance should be avoided, and the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

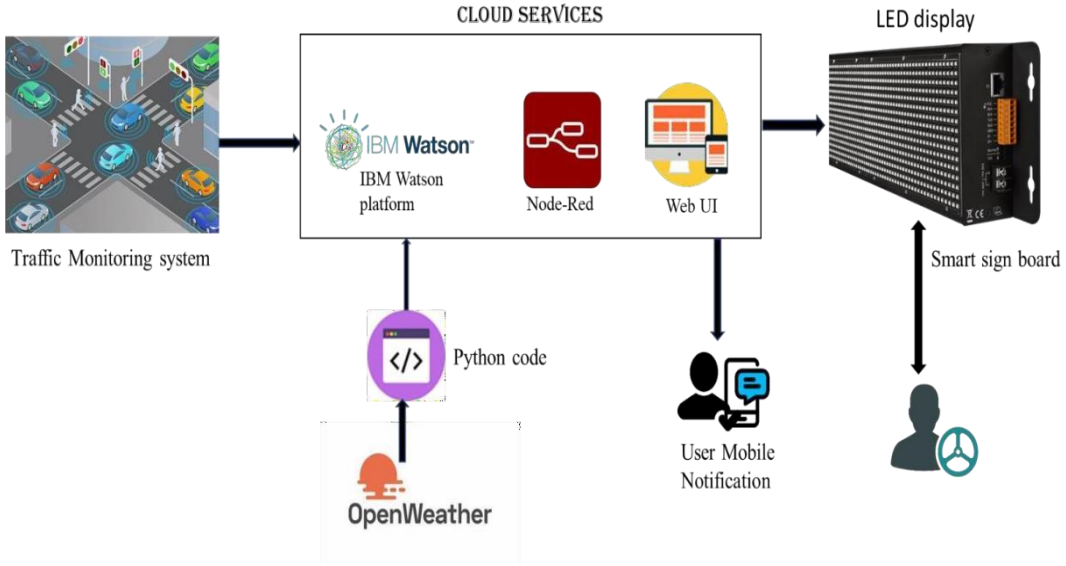
5. PROJECT DESIGN:

5.1 Data Flow Diagrams:



5.2 Solution & Technical Architecture:





5.3 User Stories:

User Story Number	User Story / Task	Story Points	Priority
USN-1	As a weather data controller, I log into my profile and start monitoring the weather updates	3	High
USN-2	I receive all the information about weather at a particular city from webfrom weather API. Whenever there ischange in weather, corresponding updates about speed limits are made. On sign boards.	2	High
USN-3	As an image controller, I keep note ofall the images received from variousareas and detect traffic in that particular area.	3	High

USN-4	With traffic, distance between the vehicles is detected by ultrasonic sensor and the vehicle will be automatically stopped if the distance Is below the limit.	2	Medium
USN-5	As a traffic controller, I keep note of all the vehicle's speed received from Various areas using location sensor.	2	High
USN-6	I ensure that the boards display "slow down" if high speed is Detected.	2	Medium
USN-7	As a user, I move the marker to my current location and the destination Location.	1	Medium
USN-8	I receive the fastest route to the destination and navigation instructions like "Turn left", "Turn Right" will be displayed.	1	Medium
USN-9	As a zonal officer, I ensure that boards near school display "slow down" and near hospitals display "no horn".	3	High
USN-10	As an administrator, I ensure that the boards display "drive carefully" near construction site, narrow and uneven Roads.	2	Medium

6. PROJECT PLANNING & SCHEDULING:

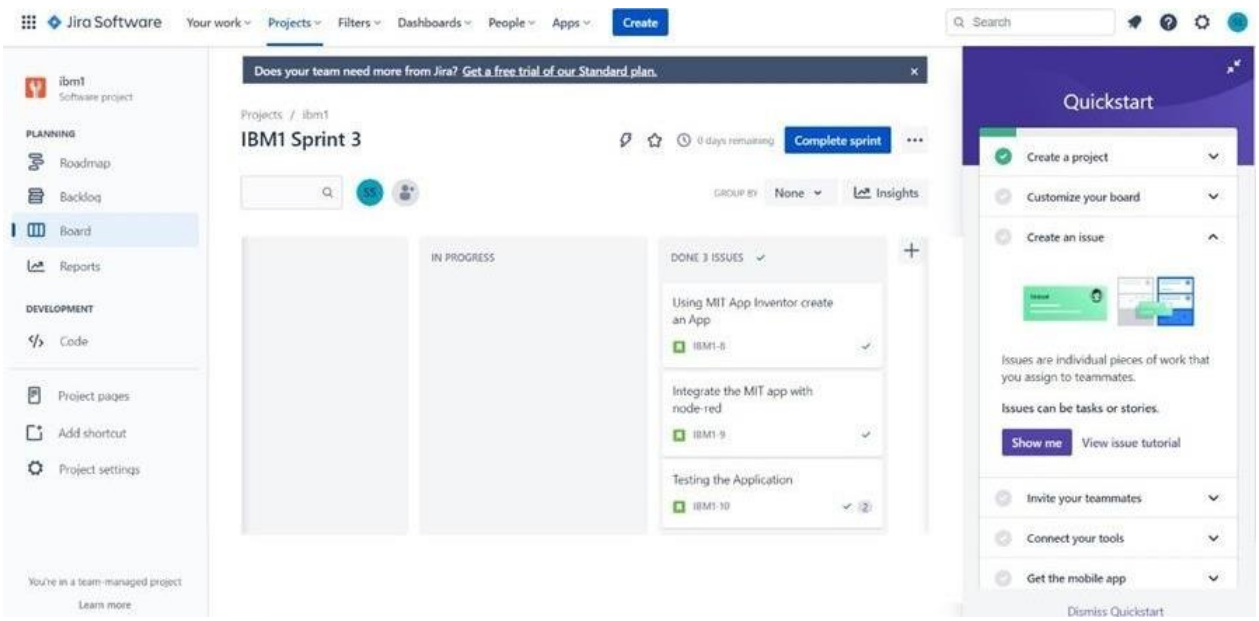
6.1 Sprint Planning & Estimation:

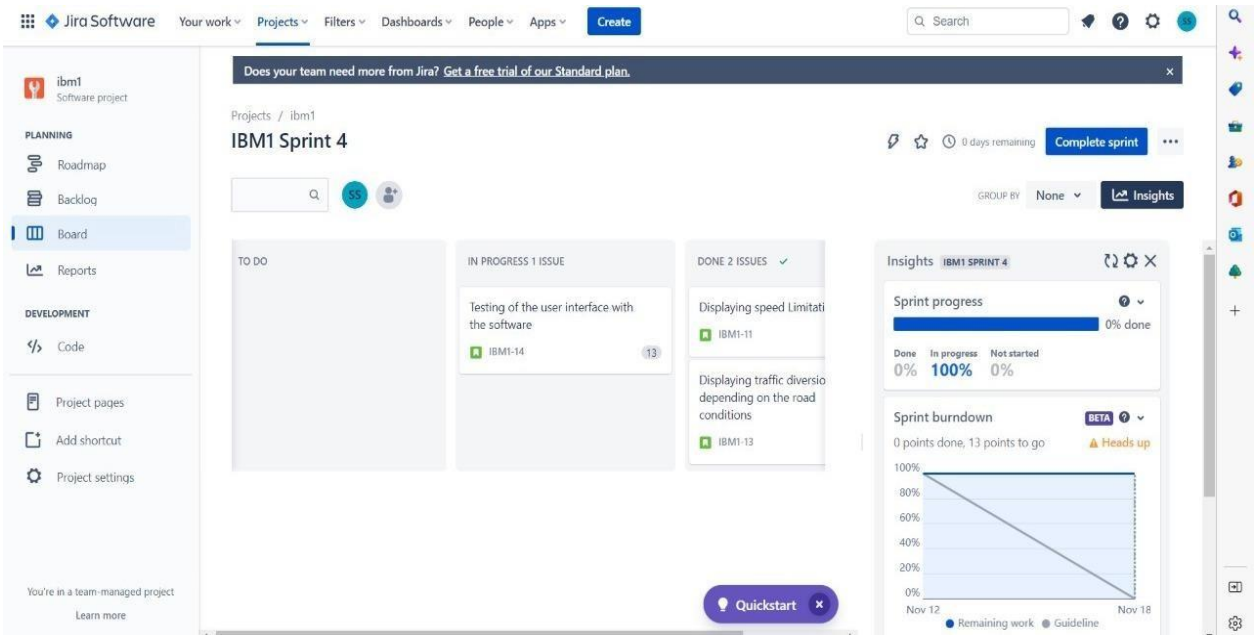
Sprint	Functional Requirement (Epic)	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Initialization ofResources	Create and initialize accounts in various public APIs like Open Weather API.	1	Low	Sakthi S Sanjay A Sanjay M Santhosh Kumar V
Sprint-1	Local Server/Software Run	Write a Python program that outputs results Given the inputs like weather and location.	1	Low	Sakthi S Sanjay A Sanjay M Santhosh Kumar V
Sprint-2	Push the software to cloud	Push the code from Sprint 1 to cloud so it can be accessed from anywhere	2	Medium	Sakthi S Sanjay A Sanjay M Santhosh Kumar V
Sprint-3	Hardware initialization	Integrate the hardware to be able to access the Cloud functions and provide inputs to the same.	2	High	Sakthi S Sanjay A Sanjay M Santhosh Kumar V
Sprint-4	UI/UX Optimization &Debugging	Optimize all the shortcomings and provide betteruser experience	2	Medium	Sakthi S Sanjay A Sanjay M Santhosh Kumar V

6.2 Sprint Delivery Schedule:

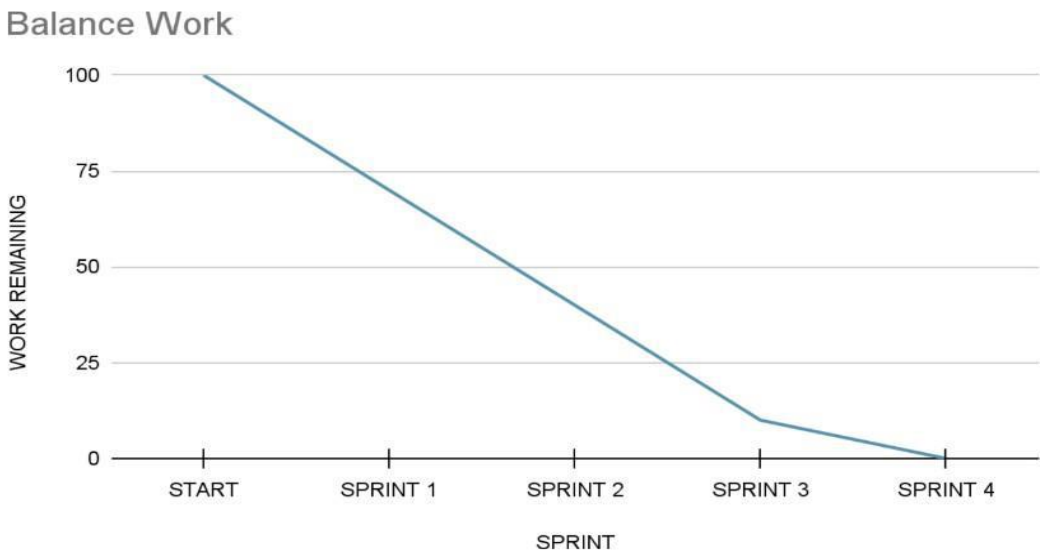
sprint	Total story points	duration	Sprint start date	Sprint end date(planned)	Story points completed (as on planned end date)	Sprint release date (actual)
Sprint-1	20	6 days	24 Oct 2022	25 Oct 2022	20	25 Oct 2022
Sprint-2	20	6 days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 days	14 Nov2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports From JIRA:





BURNDOWN CHART:



7. CODING & SOLUTIONING:

Code Explanation:

PROJECTFINALDND.py - D:/1ibm/PROJECTFINALDND.py (3.7.0)

File Edit Format Run Options Window Help

```
import requests #importing a library
import json
import ibmiotf.application
import ibmiotf.device
import time
import random
import sys




# watson device details

organization = "2s7yy7"
devicType =  "project"
deviceId = "projectid"
authMethod= "token"
authToken= "projecttoken"
```

PROJECTFINALDND.py - D:/1ibm/PROJECTFINALDND.py (3.7.0)

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```
#connect and send a datapoint "temp" with value integer value into the cloud as a type of event for every 10 seconds
deviceCli.connect()

while True:

#get sensor data from DHT11



    a = "https://api.openweathermap.org/data/2.5/weather?q=Chennai,%20IN&appid=e2bea247ed9ad643a04d9a8e55499d5f"
    r=requests.get(url=a)
    data=r.json()

    Temp= data['main']['temp']
    Humd= data['main']['humidity']
    data= {'temp':Temp,'humid':Humd}
    dist=random.randint(0,50)
    dis={'dista':dist}

    if(Humd<100):
        warn={'alert':'PLEASE SLOW DOWN!!!!!!'}
    if(dist<20):
        insta={'inst':'stop'}


def myCommandCallback(cmd):
    global a
    #print("command recieved:%s" %cmd.data['command'])
    #status=cmd.data['command']
    print("command recieved:%s" %cmd.data['command'])
    control=cmd.data['command']
    print(control)


try:
        deviceOptions={"org": organization, "type": devicType,"id": deviceId,"auth-method":authMethod,"auth-token":authToken}
        deviceCli = ibmiotf.device.Client(deviceOptions)
except Exception as e:
        print("caught exception connecting device %s" %str(e))
        sys.exit()
```

Main Body:

- Connecting to IBM IoT device.
- Getting temperature and humidity values in json format from OpenWeatherMap as inputs.
- Accessing the values using their corresponding keys.
- Generating random values for distance since hardware sensors arenot implemented.
- Passing a warning “stating please slow down” when humidity is lessthan 100 in order to promote safe driving experience.
- Passing instruction when distance is less than 20 in order to avoidaccidents and clashes.

7.1 Features 1 -GET WEATHER DETAILS FOR GIVEN LOCATION

This part of Node RED flow accepts an http GET end point, from which the location, aid, info are passed. Message parser sets the required APIKEY for OpenWeatherMap 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.

7.2 Feature 2- GETS SPEED LIMITATIONS, MESSAGES, and 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, U- turns etc, and displays them in the dashboard.

8. TESTING

8.1 Test Cases

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'.

8.2 User Acceptance Testing

Dynamic speed & diversion 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.

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9. RESULTS

9.1 Performance Metrics

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

10. ADVANTAGES:

- Signs with smart connectivity are an inexpensive and flexible medium that can help transmit information according to particular situation and entertain passengers.
- The digital signboards help in reducing the air pollution due the emission of vehicles in heavy traffic area.
- The drivers can able to know about the weather condition and accordingly follow the speed limit displayed on the sign boards.
- The increased flexibility of these digital sign boards makes it easy for any private or government department to change the message as per the need of the hour.
- The driver can easily find the route and navigation instructions to reach the destination.
- The speed of the vehicle can be identified using location sensor.
- The digitals sign boards and the app is user-friendly.
- 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 updating.
- School/Hospital Zone alerts

DISADVANTAGES:

- The digital signboards involve high Installation Costs.
- Getting digital signboards up and running is a far more involvedprocess than print media.
- If the people managing the screens are not graphic designers, it can bedifficult to update the content regularly on the screen.
- The digital signboards are still new and developing technology in theroad safety sector,
- While digital sign boards require power and therefore can’t claim tobe green, there is high energy use in the printing, erecting and replacement of traditional print media.

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. 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 signs.

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.

One of the benefits of digital road signs is that they can be updated in real-time, which means that they can be used to provide motorists with up-to-the-minute information about conditions on the road ahead. This can be particularly useful in the case of accidents or other incidents that might cause delays. In the future, digital road signs could also be used to provide information about alternative routes that might be available in the event of a problem on the road. This could be particularly useful in the case of major incidents, such as road closures due to bad weather. Finally, digital road signs could be used to provide motorists with information about the best times to travel in order to avoid traffic congestion. This could be particularly useful in areas wherethere is a lot of traffic.

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="+"fbcb52a2a6c7b
bea1396de2b6b17ea8a"
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:

        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 & Project Demo Link:

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-42516-1660666497

PROJECT DEMO LINK:

https://drive.google.com/file/d/1AaN15KdOlvrP71JseanTkHg76L1BsAc0/view?usp=drivesdk