IBM NALAYATHIRAN 2022-2023

PROJECT NAME :

SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFDTY

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CONTENTS

1. Introduction:

Roads are the foremost source of linking between cities and villages. Due to the ease of traveling by road, vehicles have become the main way people travel. The chances of vehicular accidents (Vas) have increased with the growing number of vehicles on the roads. During a journey, one does not know what will happen on the next road, particularly during bad weather conditions (BWC). In such a situation, driving can be difficult due to bad visibility, which can lead to an accident. It was also noticed that in BWC, multiple vehicle collisions (MVCs) can occur owing to delays in receiving information about an incident. According to one study by the Islamabad police, there were 9582 accidents from 2016 to 2017 all over Pakistan, involving 11,317 vehicles, leading to 5047 fatalities and 12,696 persons injured

Digital technologies like the Internet of Things (IoT) are reshaping road safety measures. Many technology initiatives are undertaken the world over to make smarter and safer roads, the ones that can interact with traffic and pedestrians. Assuming that by giving in vehicle technology information to the driver, accidents can be averted, several technology-based products have been developed. The latest technology researchers are working on is based on the Internet of Things (IoT). IoT is all about data. Data is becoming a valuable resource for our world.

Many sectors and industries have adopted IoT to reduce errors and improve performance in manufacturing, energy, health care, and communication. The WHO describes different measures that can be implemented with minimal economic impacts in its "Save LIVES: Road Safety Technical Package". A cornerstone of these steps is realizing economic systems for "monitoring road safety by strengthening data systems". Meanwhile, a key theme in the package is motivating the adoption of a Safe System approach, which is a holistic approach to road safety that parts from traditional management solutions by emphasizing safety by design.

Mobile-phone-based applications use built-in sensor data to detect the speed limit based on environmental situations.

The main contributions of this research are

1. Abriefsurveyonthestateoftheartrelatedtopre-accidentaswellaspost-accident models, frameworks, andtechniques;

2.Identificationandreportingoflimitationsinpreviousstudiesrelatedtoaccident detection;

3.The concept of a smart road with an event-sensing capability, plus implementation and testing through variousexperiments;

4. Demonstrationofanewandmodernwaytoquicklydetectaccidentsand communicate with nearby vehicles andEOCs.

The risks for loss of life, injuries, and other damage may increase if an incident is not reported to an EOC in a timely fashion. Lives can be saved by sending timely information about an accident through an automated mechanism. Moreover, quick automobile accident detection and an alert system are required to protect approaching vehicles against an MVC. Several methods have been implemented in advanced vehicles (Avs) for avoiding an accident. An accident threat is detected through sensors installed in vehicles or by using smartphone sensors. Previous researchers have used accelerometers, smoke detectors, infrared (IR) obstacle sensors, proximity sensors, and biosensors to detect an accident.

1.1. Project Overview:

The main aim of this project is to help people automate the roads by providing them with a Web App through which they can monitor the parameters of the road like temperature, speed limit, and visibility of the road. They also show guides for schools and provide services of displaying hospitals, and restaurant signs accordingly.

1.2 Purpose:

A large amount of research is being carried out in the domain of accident avoidance and accident alarms by a large number of researchers and practitioners. To avoid accidents, many approaches are utilized to enhance safety. For ease of reference, the literature on accident detection and avoidance is separated into three approaches: stand-alone, cooperative, and hybrid. Stand-alone approaches use sensors, such as radar and light detection and ranging (LiDAR), for accident avoidance and detection, whereas cooperative approaches rely on V2X technology and hybrid approaches.

2. LITERATURE SURVEY:

Abstract:

In present Systems the road signs and the speed limits are Static. But the road signs can be changed in some cases. We can consider some cases when there are road diversions due to heavy traffic or due to accidents then we can change the road signs accordingly if they are digitalized. This project proposes a system that has digital signboards on which the signs can be changed dynamically. If there is rainfall then the roads will be slippery and the speed limit would be decreased. There is a web app through which you can enter the data on road diversions, accident-prone areas, and information sign boards can be entered through the web app. This data is retrieved and displayed on the signboards accordingly

Introduction:

An automated deep learning (DL)-based system was developed for detecting accidents from video data. The system uses visual components in temporal order to represent traffic collisions. As a result, the model architecture is composed of a visual-features-extraction phase followed by transient pattern identification. Convolution and recurrent layers are used in the training phase to learn visual and temporal features. In public traffic accident datasets, an accuracy of 98% was attained in the detection of accidents, demonstrating a strong capacity for detection independent of the road structure. The solution is limited to automobile crashes, not motorbikes, bicycles, and pedestrians. Furthermore, the model makes mistakes when determining accident segments under poor illumination (e.g., at night), at low resolutions, and when there are occlusions.

An accident management system was proposed in that makes use of cellular technology in public transportation. This method enables communication across various components, including those in ambulances, RSUs, and servers. Furthermore, in this system, an optimal route-planning algorithm (ORPA) is proposed to optimize aggregate spatial utilization of road networks while lowering the travel cost to operate a vehicle. The ORPA was evaluated through simulations, and findings were compared with other current algorithms. In congested areas, the proposed method can also be used to offer fast routes for ambulances. All vehicles, including ambulances, are required to have a route indicator installed, as well as the ability to use remote correspondence. The ORPA outperformed in terms of average speed and travel duration, according to the evaluation data. The proposed system only works for predicted patterns and can fail due to the unpredicted behavior of traff

Existingproblem:

The Safe System Approach

The Safe System (SS) approach to transport networks originated with the "Safe Road Transport System" model developed by the Swedish Transport Agency. In its essence, the approach migrates from the view that accidents are largely and automatically the driver's fault to a view that identifies and evaluates the true causes of accidents. Through the categorization of safety into the safety of three elements (vehicle, road, and road user), SS minimizes fatalities and injuries by controlling speeds and facilitating prompt emergency response. The model has been widely adopted since its introduction and is currently motivated by the WHO as a basis for road safety planning, policy-making, and enforcement

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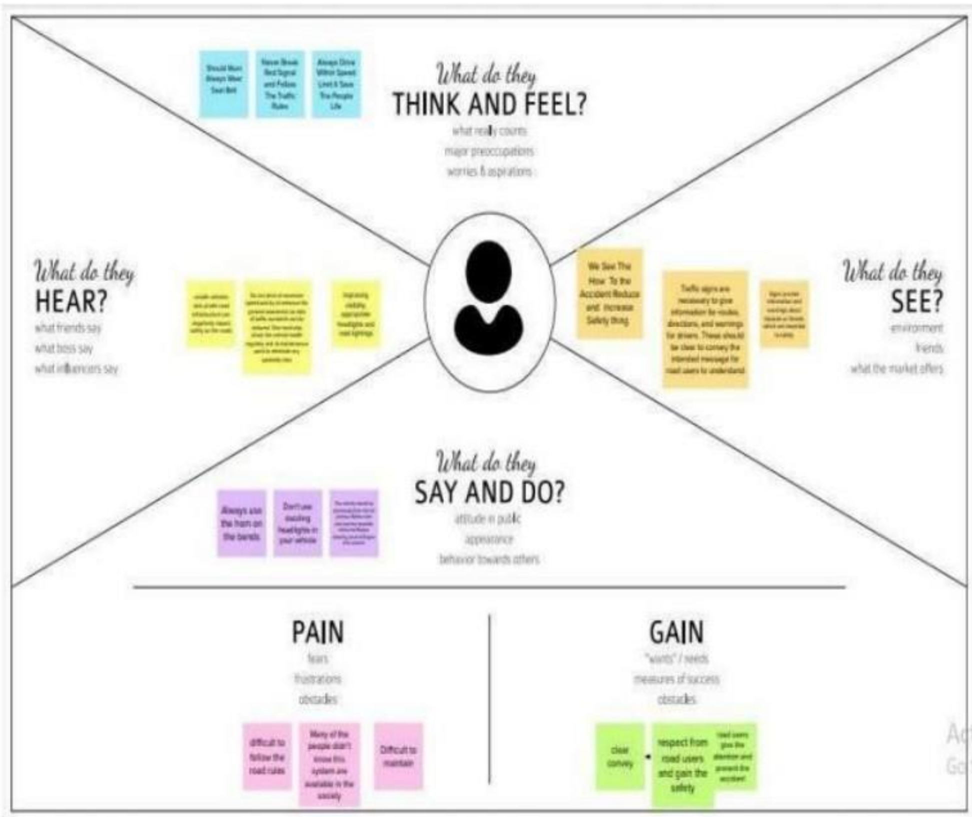
Problem StatementDefinition

A problem statement is a concise description of an issue to be addressed or a condition to be improved upon. It identifies the gap between the current (problem) state and desired (goal) state of a process or product. Focusing on the facts, the problem statement should be designed to address the Five Ws. The first condition of solving a problem is understanding the problem, which can be done by way of a problem statement.

In present Systems the road signs and the speed limits are Static. But the road signs can be changed in some cases. We can consider some cases when there are road diversions due to heavy traffic or due to accidents then we can change the road signs accordingly if they are digitalized. This project proposes a system that has digital signboards on which the signs can be changed dynamically. If there is rainfall then the roads will be slippery and the speed limit would be decreased. There is a web app through which you can enter the data on road diversions, accident-prone areas, and information sign boards can be entered through the web app. This data is retrieved and displayed on the signboardsaccordingly.

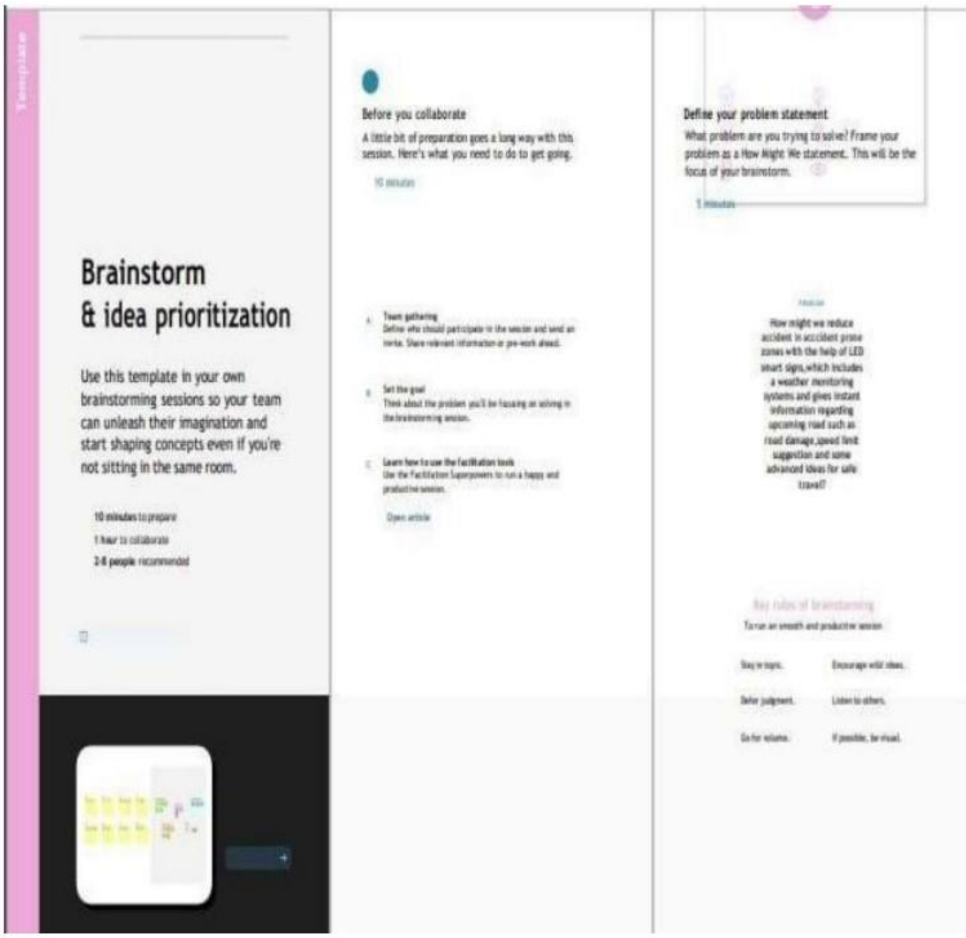
3.IDEATION AND PROPOSED SOLUTION:

3.1 Empathy Map Canvas:

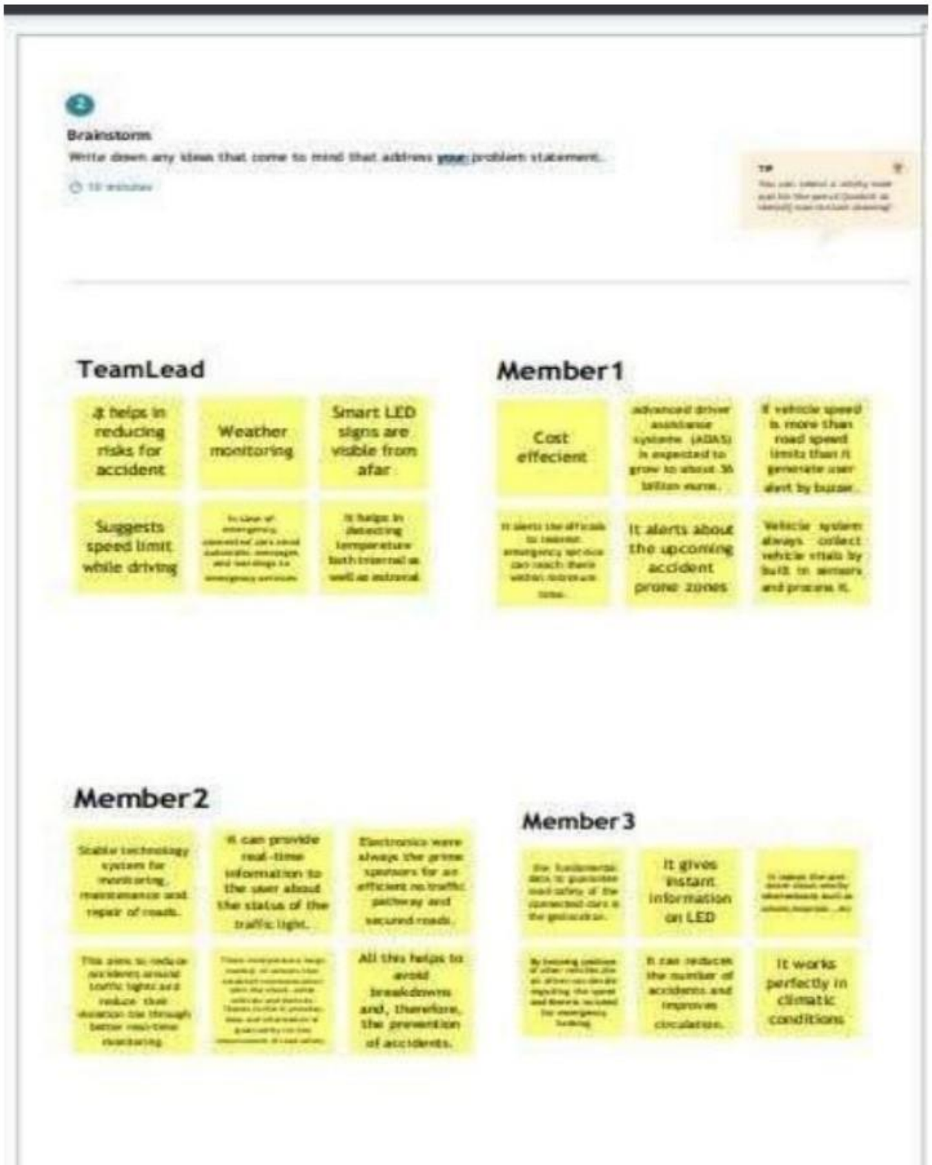


3.2 Ideation & Brainstorming:

Step- 1: Team Gathering, Collaboration and Select the Problem Statement.

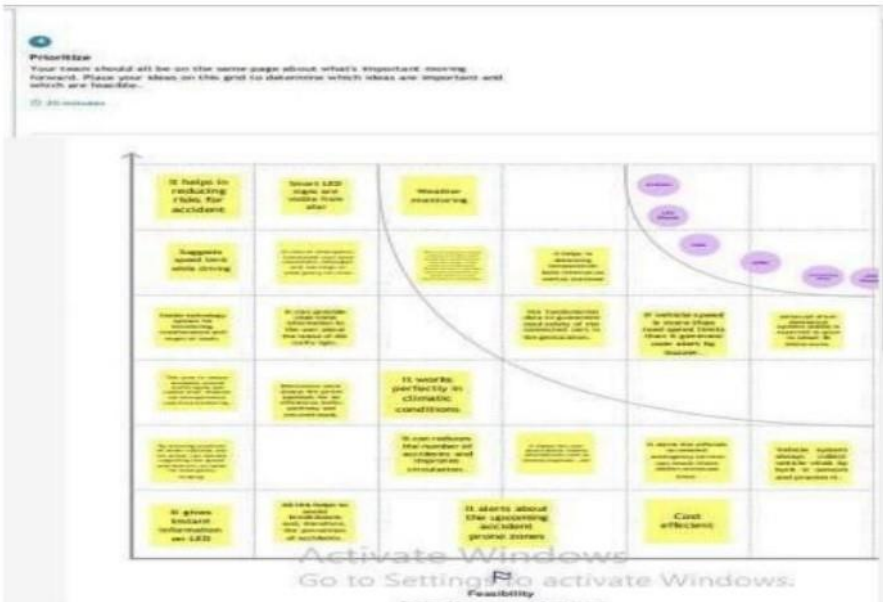


Step-2: Brainstorm, Idea Listing and Grouping



Step-3: Idea Prioritization

Prioritize:


Weather monitoring
It works perfectly in climatic conditions.
It can reduce the number of accidents and improves circulation.
It gives instant information on LED
It alerts about the upcoming accident prone zones
Cost effecient
Activate Windows
Go to Settings to activate Windows.
Feasibility

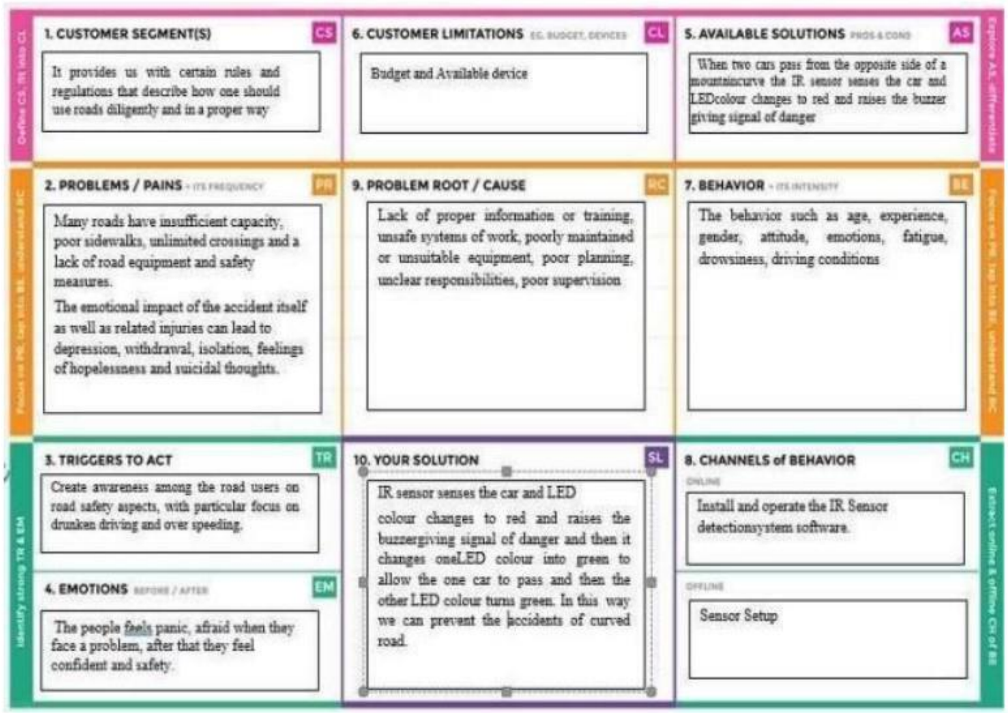
3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Road traffic accidents (RTA) are defined as accidents that occurred or originated on a way or street open to public traffic.This problem is due to some inconvenience in signs placed in Highways and Roads. This issue regularly causes death to human's .
2.	Idea / Solution description	There are some road diversions due to heavy traffic or due to accidents then we can change the road signs accordingly if they are digitalized. This project proposes a system which has digital sign boards 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. Using this we can enter the data of the road diversions, accident prone areas and the information sign boards can be entered through web app. This data is retrieved and displayed on the sign boards accordingly.
3.	Novelty / Uniqueness	This project is varies from others because here we are using our domain as Internet of Things (IOT).Then we use RAM-Minimum 4GB Processor-Min. Configuration OSWindows/Linux/MAC and etc.. The methods used now are high in cost and not an easy task to implement over the world .But our idea has an easy impact to spread all over the world. This

		project comes under budget friendly for implementation.
4.	Social Impact / Customer Satisfaction	Safety for all must be insured in today's world and it Is necessary for efficient and proactive safety Systems should be implemented in public places If we used this, there might be a less in accident detection and traffic problems. So, there will be an reduce in death rate and loss in morality problem. Surely, It will help the people which helps in the problems comes under Social Impact .
5.	Business Model (Revenue Model)	Route planning has become widely used in both personal and commercial use, resulting in an increasing dependence on its reliability. Various applications employ efficient algorithms for route planning . Trip time and cost, e.g., for tolls, have been the typical metrics for route planning applications, but other metrics, however, have been utilized, e.g., for fuel emission/consumption or energy requirements of electric vehicles. In this manner, drivers can be directed through routes that minimizes their overall risk in traversing the road network. It is furthermore possible to target auxiliary mechanisms for safety-control across the network by controlling and redirecting traffic based on user driving behaviour or irresponsive to incidental changes in the road network.

6.	Scalability of the Solution	The present framework is some what different from the others. *Road accidents* cannot be eliminated but can be reduced by enhancing the safety of the drivers.

3.4 Problem Solution Fit:



4.REQUIREMENT ANALYSIS:

4.1Functional Requirements:

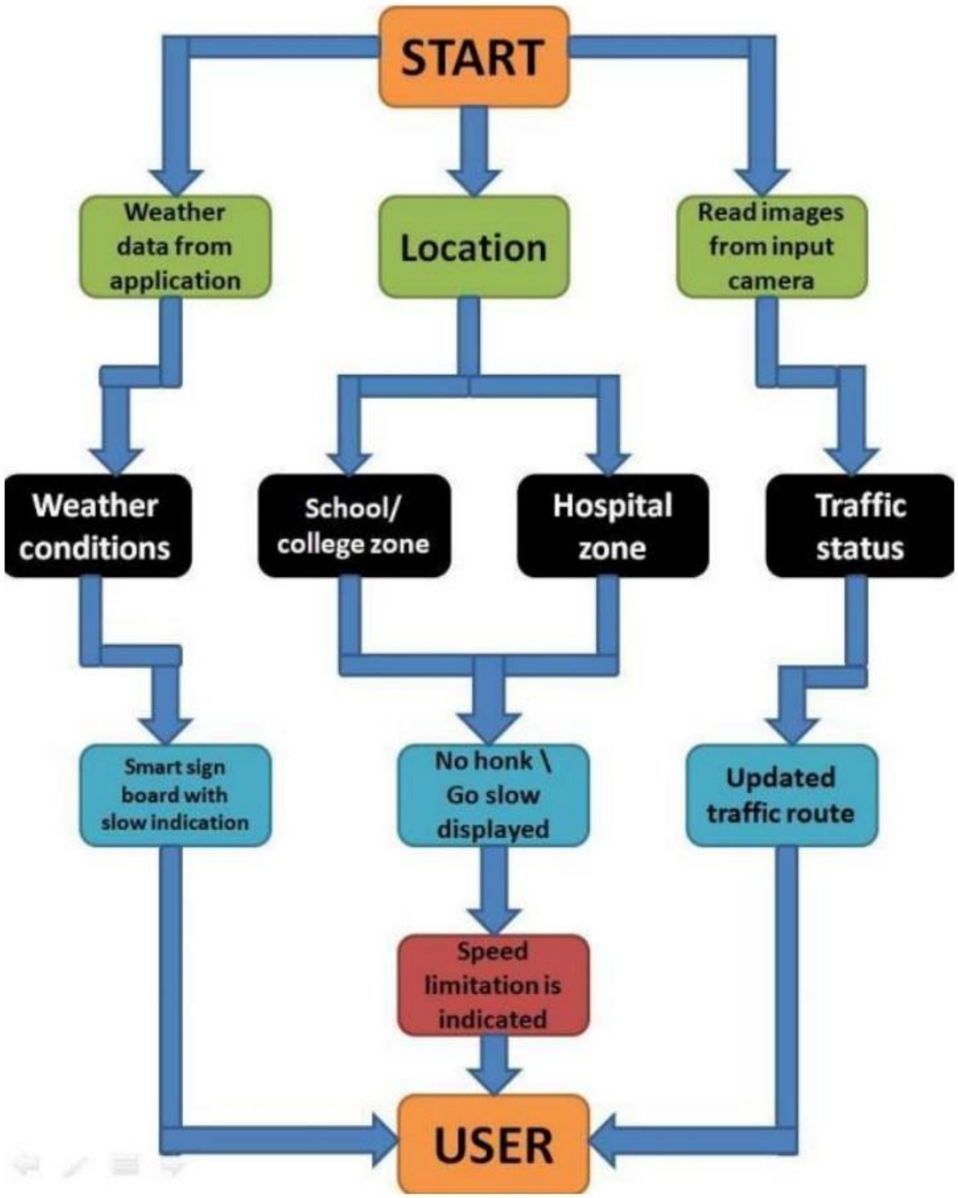
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-I	User Visibility	Sign Boards should be made of bright coloured LEDs capable of attracting driver's attention Not too distracting to cause accidents
FR-2	User Understanding	Should display information through means like images/illustrations with text so that the user can understand the signs correctly
FR-3	User Convenience	Display should be big enough to display all the signs correctly so that it is visible even to far away drivers

4.2 Non-Functional Requirements:

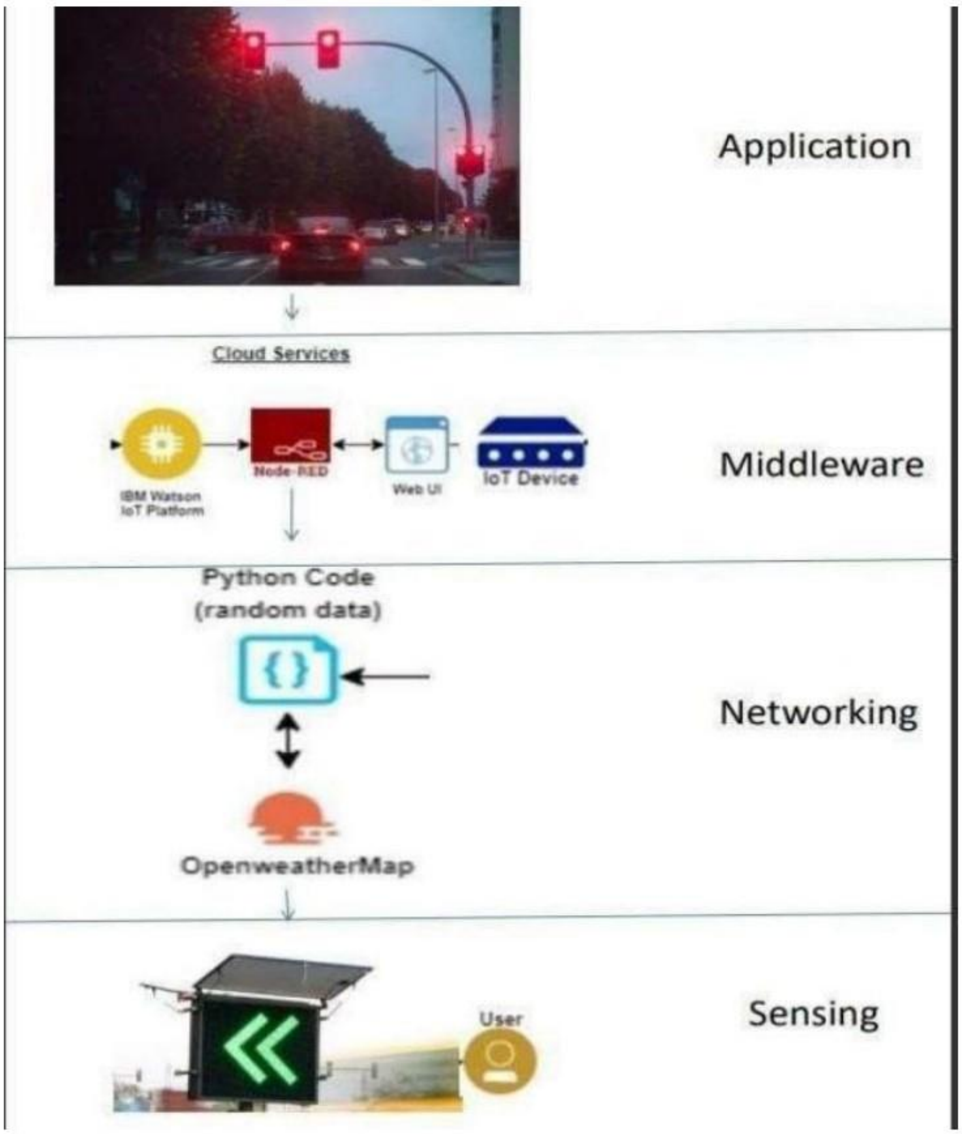
FR No.	Non-Functional Requirement	Description
NFR-I	Usability	Should be able to dynamically update with respect to time.
NFR-2	Security	Should be secure enough that only the intended messages are displayed in the display.
NFR-3	Reliability	Should convey the traffic information correctly.
NFR-4	Performance	Display should update dynamically whenever the weather or traffic values are updated
NFR-5	Availability	Should be on service 24/7
NFR-6	Scalability	Should be modular and hence able to scale on servers horizontally.

5. PROJECT DESIGN:

5.1 Data Flow Diagrams:



5.2 Solution & Technical Architecture:



5.3 User Stories:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Visibility	Sign Boards should be made with LED's which are bright coloured and are capable of attracting the drivers attention but it should also not be too distracting or blinding cause it may lead to accidents.
FR-2	User Need	The smart sign boards should be placed frequently in places it is needed and less in places where it is not needed much to avoid confusion for the user during travel.
FR-3	User Understanding	For better understanding of the driver, the signs should be big, clear and legible and it can also include illustrations which will make it easily understandable to the driver.
FR-4	User Convenience	The display should be big enough that it should even be visible from far distance clearly.

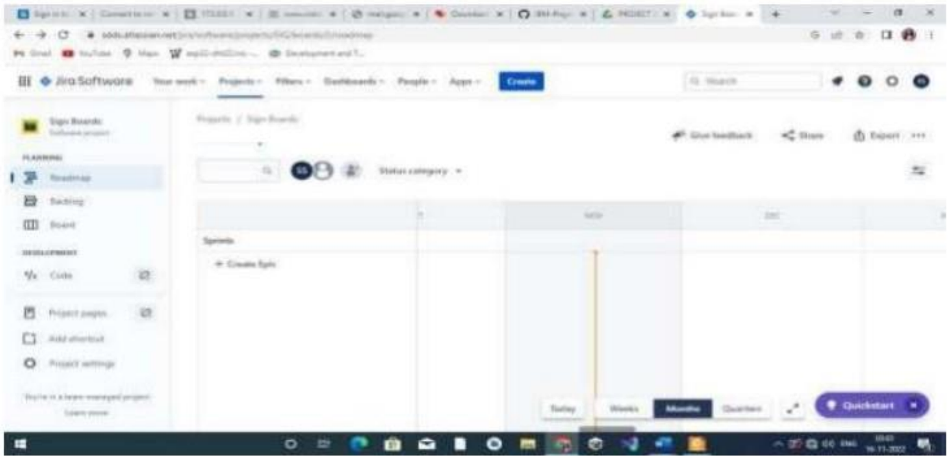
6.PROJECT PLANNING & SCHEDULING:
Sprint Planning & Estimation:

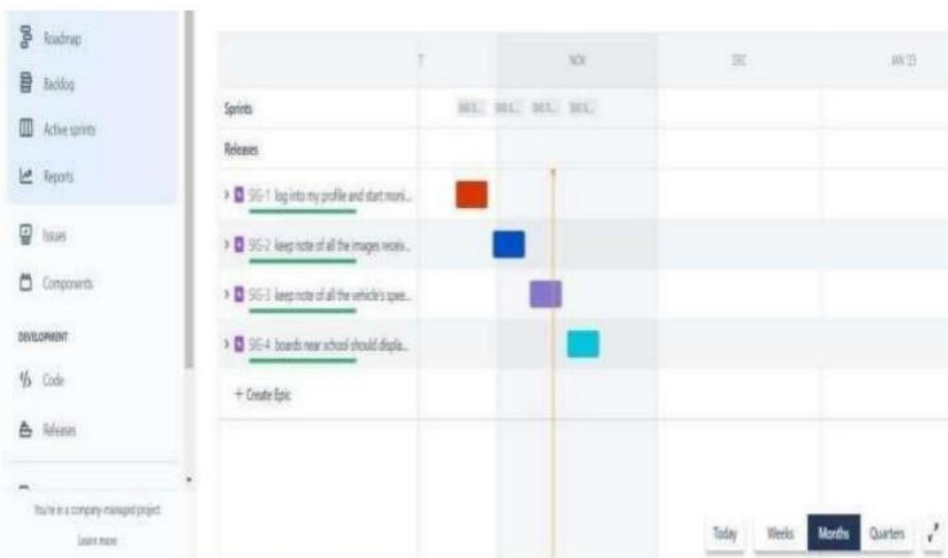
Sprint-1	Resources Initialization	Create and initialize accounts in various public APIs like OpenWeatherMap API.	1	Low	Vignesh R Vigneshwaren Yuvaraj N Ravi R
Sprint-1	Local Server/Software Run	Write a Python program that outputs results given the inputs like weather and location.	1	Medium	Vignesh R Vigneshwaren Yuvaraj N Ravi R
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	Vignesh R Vigneshwaren Yuvaraj N Ravi R
Sprint-3	Hardware initialization	Integrate the hardware to be able to access the cloud functions and provide inputs to the same.	2	High	Vignesh R Vigneshwaren Yuvaraj N Ravi R
Sprint-4	UI/UX optimisation and debugging	Optimize all the shortcomings and provide better user experience.	2	Low	Vignesh R Vigneshwaren Yuvaraj N Ravi R

6.2 Sprint Delivery Schedule:

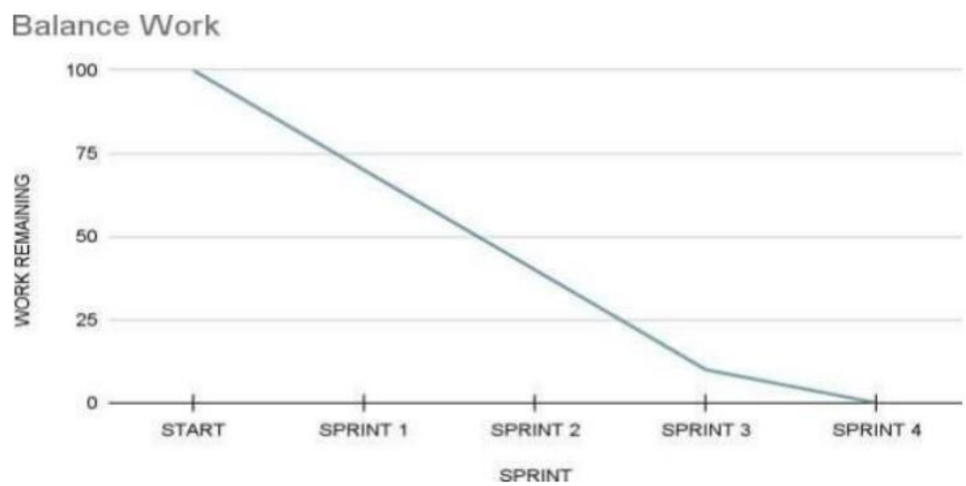
Sprint	Total Story Point	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022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

6.3Reports From JIRA:





Burndown Chart:



7.CODING & SOLUTIONING:

Code Explanation:

Libraries:

Including all libraries like json, random, time, sys, ibmiotf etc.

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
```

Credentials:

Entering all the credentials corresponding to IoT Watson device in order to publish data to it.

```
# watson device details

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

MIT Inventor Interruption:

Receiving commands as inputs when buttons are pressed in MIT inventor in order to perform separate functions.

```
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()
```

Exception Handling:

To handle exception if occurs while connecting with IBM IOT WATSON device

```
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:

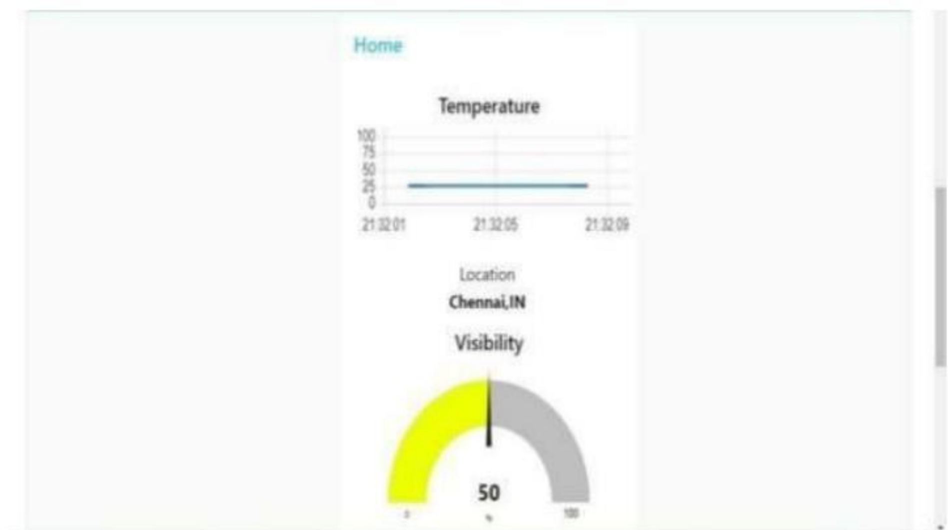
- Connecting to IBM IoT device.
- Getting temperature and humidity values in json format from open weather map as inputs.
- Accessing the values using their corresponding keys.
- Generating random values for distance since hardware sensors are not implemented.
- Passing a warning “stating please slow down” when humidity is less than 100 in order to promote safe driving experience.
- Passing instruction when distance is less than 20 in order to avoid accidents and clashes.

Publish Data To IBM IOT WATSON Platform:

- Passing all the data(temperature, humidity, warning, instruction) to ibm iot Watson.
- Disconnecting the connection established with IoT Watson device.

7.1 **Feature 1:** WEATHER UPDATE AND CORRESPONDING COMMAND:

Getting temperature and humidity from Open Weather Map for a particular city and displaying warning regarding the speed when humidity is below 100.



7.2 **Feature 2:** SPEED DETECTION

- By implementing a location sensor in MIT APP INVENTOR, with changes in the location with respect to time, speed can easily be detected and displayed in the app to the user.

- This requires location settings from user's phone to be active.

- An image of normal speed limit is also displayed which means that, travelling within that range would be safe.

7.3 **Feature 3:** MAP AND NAVIGATION

- By implementing same location sensor,current location can be detected. This also requires location settings in user's phone to be active.

- By dragging the green marker to start location and red marker to the destination location to be reached and clicking on the navigate button, displays the street path that connects the start and end point specified.

- In addition to this, it also displays the directions to be followed to reach the destination.

7.4 **Feature 4:** ZONAL CLASSIFICATION:

- Here, displays few sign boards indicating different zones like school zone, hospital zone, railway track etc. By clicking on the button below the sign displaysthe meaning and instruction to befollowed in the particular region.

- This provides the user with better understanding about the sign boards and to act accordingly.

7.4 **Feature 5:** DETERMINING TRAFFIC:

- Since hardware sensors are not implemented, we have used random function to generate values for the distance between the user and the vehicle ahead.
- If the distance is below 20, it instructs the driver or the user to stop immediately and try moving forward with different direction or to take diversion.

```
dist=random.randint(0,50)
dis={'dista':dist}
```

```
if(dist<20):
  insta={'inst':'stop'}
```

8. TESTING

8.1 Test Cases

A test case documents strategy that will be used to verify and ensure that a product or system meets its design specification and other requirements. A test case is usually prepared by or with significant input from the engineer. This document describes the plans for testing the architectural prototype of System. In my Project the system has to be tested to get the Desired Output. I use different speed for testing the system.

8.2 User Acceptance Testing

In engineering and its various sub disciplines, acceptance testing is black- box testing performed on a system (e.g. software, lots of manufactured mechanical parts, or batches of chemical products) prior to its delivery. It is also known as functional testing, black-box testing, release acceptance, QA testing, application testing, confidence testing, final testing, validation testing, or factory acceptance testing.

In software development, acceptance testing by the system provider is often distinguished from acceptance testing by the customer (the user or client) prior to accepting transfer of ownership. In such environments, acceptance testing performed by the customer is known as user acceptance testing (UAT). This is also known as end-user testing, site (acceptance) testing, or field (acceptance) testing.

A smoke test is used as an acceptance test prior to introducing a build to the main testing process. Acceptance test cards are ideally created during sprint planning or iteration planning meeting, before development begins so that the developers have a clear idea of what to develop. Sometimes (due to bad planning!) acceptance tests may span multiple stories (that are not implemented in the same sprint) and there are different ways to test them out during actual sprints.

One popular technique is to mock external interfaces or data to mimick other stories which might not be played out during an iteration (as those stories may have been relatively lower business priority). A user story is not considered complete until the acceptance tests have passed.

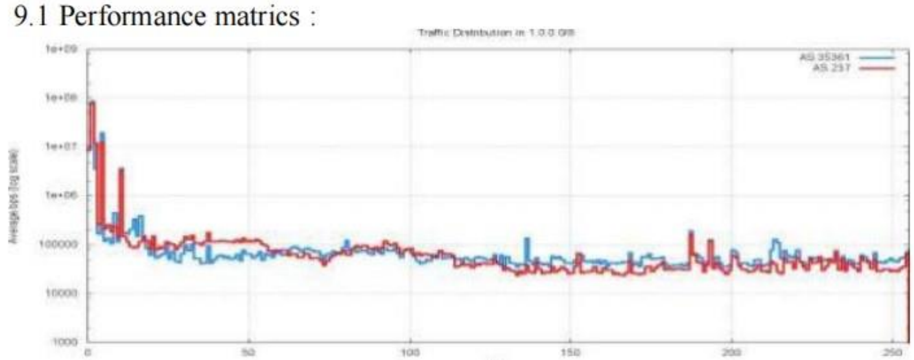
The acceptance test suite is run against the supplied input data or using an acceptance test script to direct the testers. Then the results obtained are compared with the expected results. If there is a correct match for every case, the test suite is said to pass. If not, the system may either be rejected or accepted on conditions previously agreed between the sponsor and the manufacturer.

The objective is to provide confidence that the delivered system meets the business requirements of both sponsors and users. The acceptance phase may also act as the final quality gateway, where any quality defects not previously detected may be uncovered.

In these testing procedures the project is given to the customer to test whether all requirements have been fulfilled and after the user is fully satisfied. The project is perfectly ready. If the user makes request for any change and if they found any errors those all errors has to be taken into consideration and to be correct it to make a project a perfect project.

9. Results:

9.1 Performance matrics :



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 helps 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 are user-friendly.

DISADVANTAGES:

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

11. CONCLUSION:

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:

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 where there is a lot of traffic.

13.APPENDIX:

Source Code:

```
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"
#generate random values for randomo variables (temperature&humidity)
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()
#connect and send a datapoint "temp" with value integer value into the cloudas
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=e
2bea247ed9ad643a04d9a8e55499d5f"
r=requests.get(url=a)
data=r.json()
Temp= data['main']['temp']
```

```
Humd=data['main']['humidity']

data= {'temp':Temp,'humid':Humd}

dist=random.randint(0,20)

dis={'dista':dist}

if(Humd<100):

warn={'alert':'PLEASE SLOW DOWN!!!!! !'}

if(dist<20):

insta={'inst':'stop'}

def myOnPublishCallback():

print("published Temperature = %s c" %Temp,"humidity:%s %%" %Humd)

print(warn)

 print(dis)

print(insta)

 success=deviceCli.publishEvent("IoTSensor","json",insta,qos=0,on_publish=
myOnPublishCallback)

success=deviceCli.publishEvent  ("IoTSensor","json",data,qos=0,on_publish=
myOnPublishCallback)

success=deviceCli.publishEvent
("IoTSensor","json",warn,qos=0,on_publish=myOnPublishCallback)

success=deviceCli.publishEvent    ("IoTSensor","json",dis,qos=0,on_publish=
myOnPublishCallback)
```

```
if not success:
print("not connected to ibmiot") time.sleep(5)
deviceCli.commandCallback=myCommandCallback
#disconnect the device

deviceCli.disconnect()
```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Github link:

https://github.com/IBM-EPBL/IBM-Project-54221-1661834454

Drive link: https://drive.google.com/file/d/1HpIBzqRERKOoBecfMWe57JSAuZgbA0bB/view?usp=drivesdk

youtube link:

https://youtu.be/4fslYEbeOC8

Thank you....