SIGN WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

PROJECT REPORT

Submitted by

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In partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

UNIVERSAL COLLEGE OF ENGINEERING AND TECHNOLOGY

VALLIOOR, TIRUNELVELI

1.Introduction:

Roads are the foremost source of linking between city and villages. Due to theease 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 alsonoticed 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 safetymeasures. 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 bygiving in vehicle technology information to the driver, accidents can be averted, severaltechnology-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.

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.

1.2Purpose:

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.

Existing problem:

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

REFERENCE:

1. World Health Organization, "Global status report on road safety 2015,"https://www.who.int/violence_injury_prevention/road_safety_status/2015/en/. View at: GoogleScholar
2. World Health Organization, "Decade ofAction for Road Safety 2011-2020 seeks to save millions of lives," http://www.who.int/roadsafety/decade_of_action/en/. View at: Publisher Site | Google Scholar
3. F. Wegman, "The future of road safety: A worldwide perspective," *IATSS Research*, vol. 40, no. 2, pp. 66–71,2017. View at: Publisher Site | Google Scholar
4. World HealthOrganization,"SaveLIVES-Aroadsafetytechnical package,"2017. View at: Google Scholar

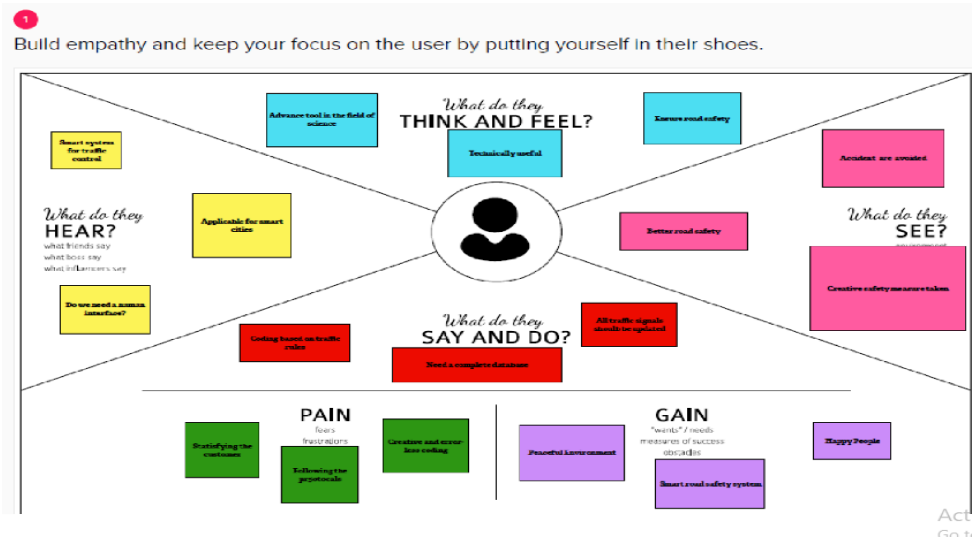
Problem Statement Definition

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.

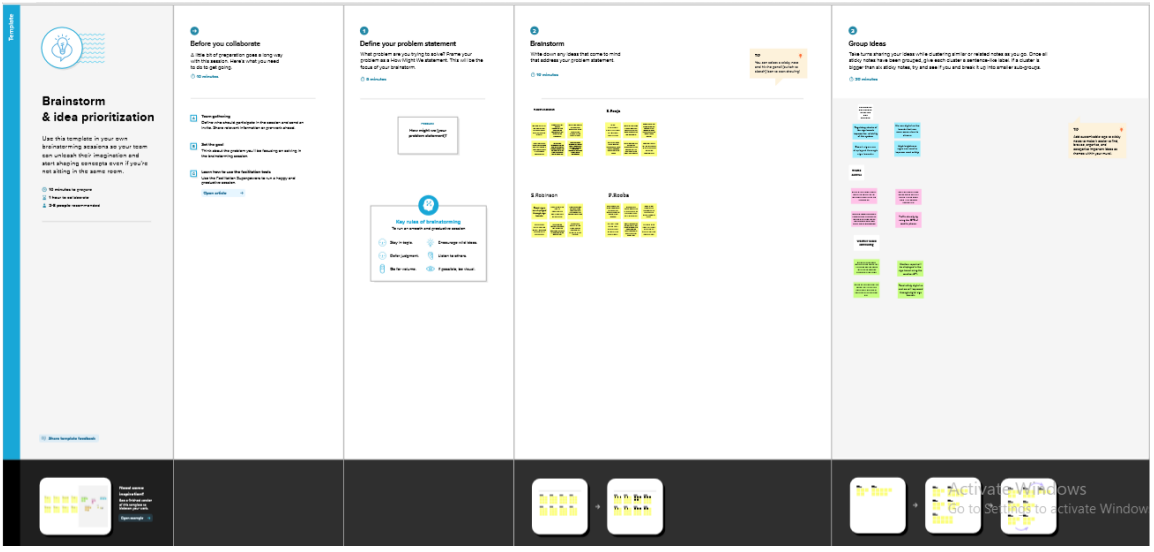
In present Systems the road signs and the speed limits are Static. But the road signs can be changed in some cases. We can consider some cases when there are road diversions due to heavy traffic or due to accidents then we can change the road signs accordingly if they are digitalized. This project proposes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

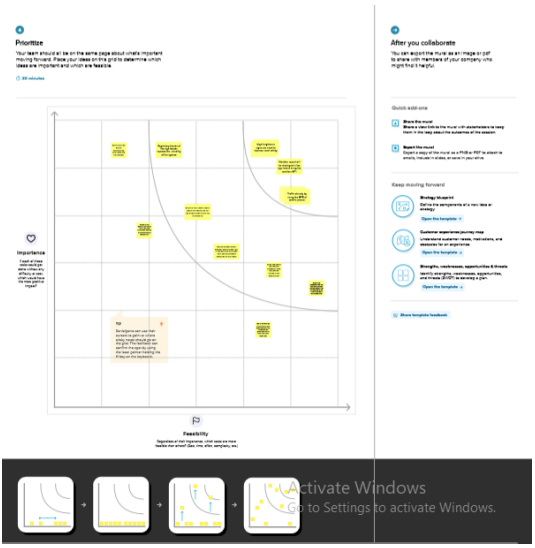
3. IDEATION & PROPOSED SOLUTION:

Empathy Map Canvas:



Ideation &Brainstorming:





Template

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- 10 minutes to prepare
- 1 hour to collaborate
- 2-8 people recommended

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

- **Team gathering** — Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.
- **Set the goal** — Think about the problem you'll be focusing on solving in the brainstorming session.
- **Learn how to use the facilitation tools** — Use the Facilitation Superpowers to run a happy and productive session.

Open article

1 Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM
How might we [your problem statement]?

Key rules of brainstorming

To run an smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.

2 Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP
You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

T.Ravi chandran

- Wireless sign notification and acknowledgement.
- Speed violation citation and notification.
- Wireless digital traffic sign post.
- Whom the transmitting vehicle is by latitude & longitude.
- Transceivers send out a basic safety message every tenth of a second.
- Improved air quality and environment.

E.Pooja

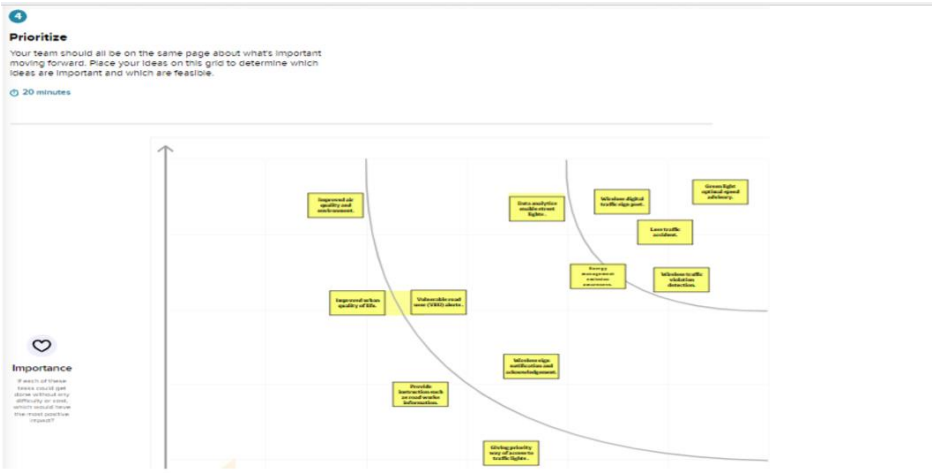
- Improved urban quality of life.
- Detection identification risk analysis reaction execution.
- ICT infrastructure road condition security.
- Vulnerable road user (VRU) alerts.
- Green light optimal speed advisory.
- Discover parking and charging.

S.Robinson

- Increased safety less traffic contestation ,less driving stress etc.
- Energy management emission awareness.
- Less traffic accident.
- Health aware smart city resident.
- Provide instruction such as road works information.
- Controls the flow of traffic and emission.

P.Rooba

- Reducing travel time by dynamic adjustment of traffic signal timing.
- Wireless traffic violation detection.
- Giving priority way of access to traffic lights .
- Automatic traffic violation citation.
- Data analytics enable street lights .
- Road will no longer be viewed as static infrastructure.



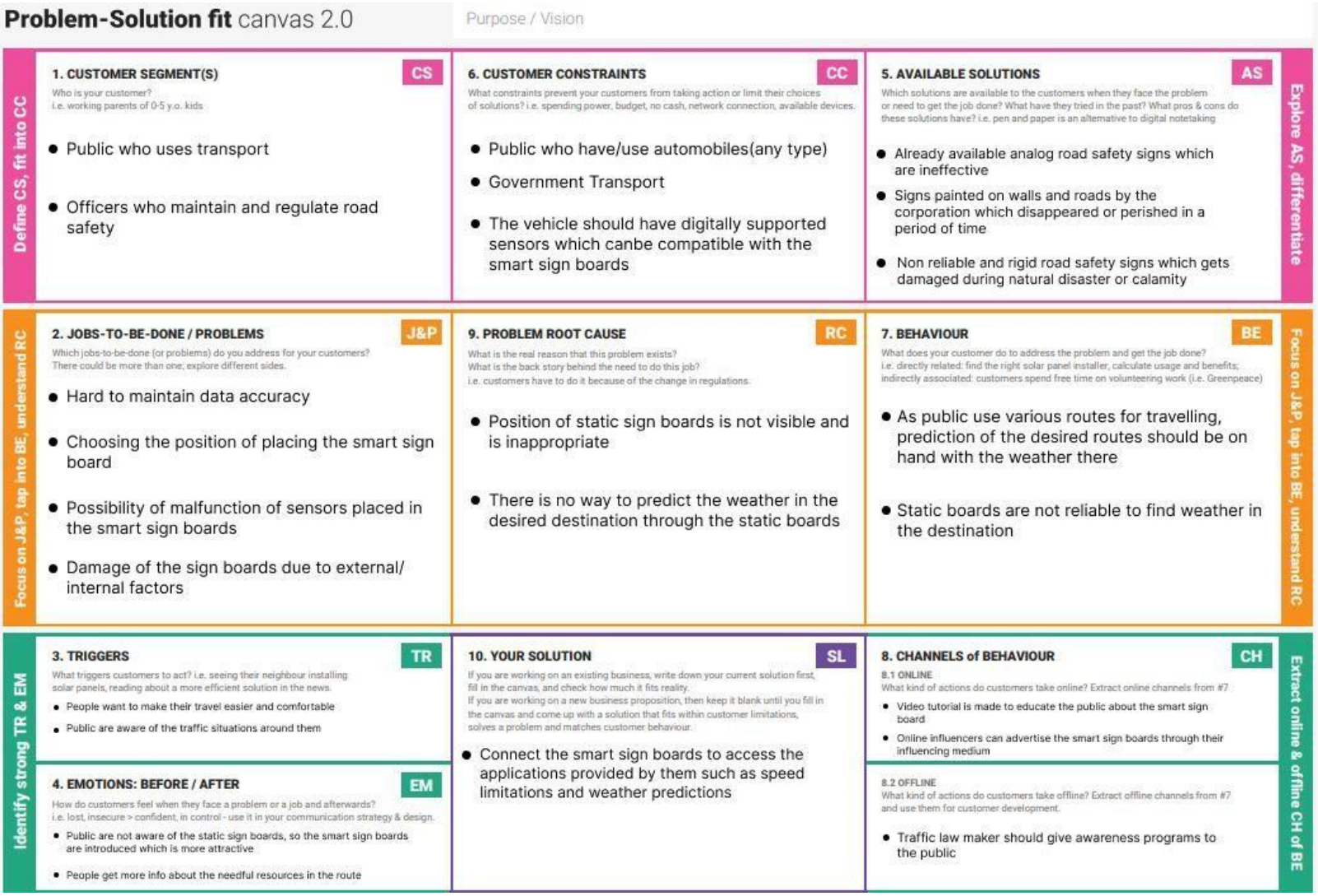
Proposed Solution:

The project team shall fill in the following information in the proposed solution template.

S .No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To replace the static signboards, smart connected sign boards are used which get the speed limitations from a web app using weather API and update automatically.
2.	Idea/Solution description	Predicting the speed limit from data acquired through weather map and pass through a web user interfacewhich in turn used by user
3.	Novelty/Uniqueness	Controlling the speed limit by weather map.

4.	Social Impact/Customer Satisfaction	Based on traffic diversion signs ,guide signs and warning signs are displayed to the public.
5.	Business Model (Revenue Model)	Smart connectivity and better road safety model.
6.	Scalability of the Solution	The process of understanding and operating this Model is easy and its highly scalable withproper efficiency.

Problem Solution fit:



4.REQUIREMENT ANALYSIS

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Visibility	Sign Boards should be made of bright coloured LEDs capable of attracting driver's attention not to 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 signs Correctly so that it is visible even to the far away drivers.

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

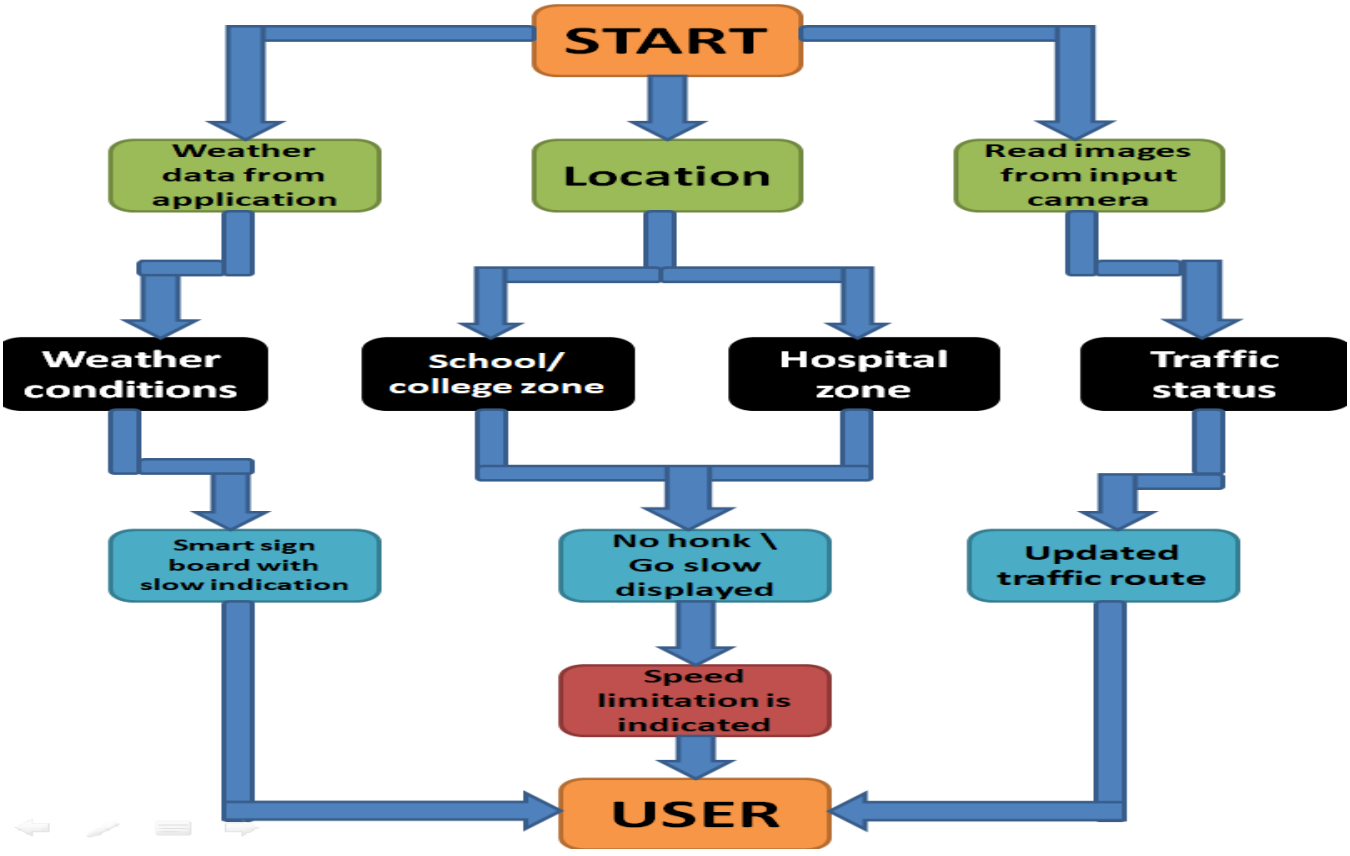
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Should be able to dynamically update with respect to time.
NFR-2	Security	Should be secure enough that only the intended messages are displayed in the display.
NFR-3	Reliability	Should convey the traffic information correctly.
NFR-4	Performance	Display should update dynamically whenever the weather or traffic values are updated.
NFR-5	Availability	Should be on service for 24/7
NFR-6	Scalability	Should be modular and hence able to scale on servers horizontally.

5.PROJECT DESIGN:

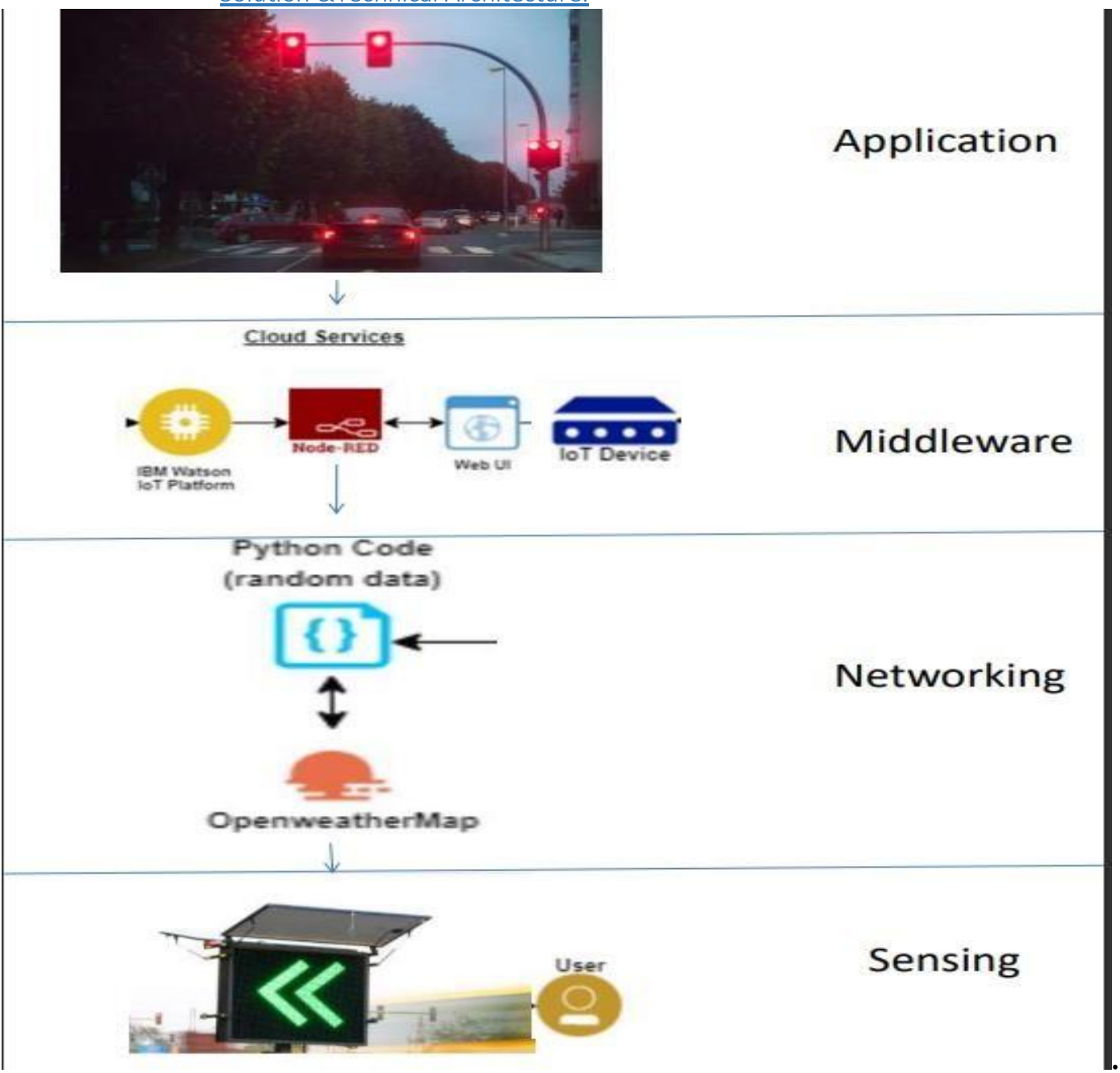
Project design is an early phase of the project lifecycle where ideas, processes, resources, and deliverables are planned out. A project design comes before a project plan as it's a broad overview whereas a project plan includes more detailed information.

Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



Solution &Technical Architecture:



User stories:

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	**User Story/Task**	**Acceptance criteria**	Priority	Release

Customer (Mobile user)	Registration	USN-1	**I can get my speed limitation using weather application .**	**I can receive speed limitations**	High	Sprint-1
		USN-2	**As a user, I can register for the application by entering my email, password, and confirming my password. As a user,**	**I can access my account / dashboard**	Medium	Sprint-2
		USN-3	**As a user, I can increase or decrease my speed according to the weather change**	**I can increase or decrease my speed**	High	Sprint-1
		USN-4	**As a user, I can I get my traffic diversion signs depending on the traffic and the fatal situations.**	**I can access my traffic status ahead in my travel**	Medium	Sprint-1
	Login	USN-5	**As a user, I can log into the open weather map by entering email & password**	**I can access the application through my Gmail login**	High	Sprint-2
	Interface	USN-6	**As a user the interface should be simple and easily accessible**	**I can access the interface easily**	High	Sprint-1
Customer (Web user)	Data generation	USN-7	**As a user I use open weather application to access the data regarding the**	**I can access the data regarding the weather through the**	High	Sprint-1

			weather changes.	**application**		
Administrator (Officials)	Problem solving/ Fault clearance	USN-8	**As an official who is in charge for the proper functioning of the sign boards have to maintain it through periodic monitoring.**	**Officials can monitor the sign boards for proper functioning.**	Medium	Sprint-2

6.PROJECT PLANNING &SCHEDULING

The definition of a sprint is a dedicated period in which a set amount of work will be completed on a project. It's part of the agile methodology, and an Agile project will be broken down into a number of sprints, each sprint taking the projectcloser to completion**.**

Sprint Planning &Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1		USN-4	I can receive traffic divert signs as a user based on traffic and potentially deadly scenarios.	2	Medium	RAVICHANDRAN.T POOJA.E, ROBINSON.S, ROOBA.P.
Sprint-2	Login	USN-5	I may access the open weather map as a user by logging in using my email address and password.	1	High	RAVICHANDRAN.T POOJA.E, ROBINSON.S, ROOBA.P.
Sprint-1	Interface	USN-6	The user interface needs to be straightforward and simple to use.	1	Medium	RAVICHANDRAN.T POOJA.E, ROBINSON.S, ROOBA.P.
Sprint-1	Data generation	USN-7	I utilise the open weather programme as a user to obtain information on weather changes.	2	High	RAVICHANDRAN.T POOJA.E, ROBINSON.S, ROOBA.P.
Sprint-2	Problem solving/ Fault clearance	USN-8	As the authority in charge of ensuring the sign boards work properly must do through routine inspection.	1	Medium	RAVICHANRAN.T POOJA.E, ROBINSON.S, ROOBA.P.

Project Tracker, 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	05 Nov 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	07 Nov 2022

Sprint Delivery Schedule:

Project Tracker, Velocity & Burndown Chart:

TITLE	DESCRIPTION	DATE
Literature Survey on the Selected project & Information Gathering	A literature Survey is a comprehensive summary of research done previously in the given topic. Literature surveys can be taken from books, research paper online or from any source..	19October2022
Prepare Empathy Map	Empathy map is a visualization tool which can be used to get a better insight of the customer.	30September2022

Ideation-Brainstorming	Brainstorming is a group problem-solving session were ideas are shard ,discussed and organized among the team members.	19September2022
Define Problem Statement	A problem statement is a concise description of the problem or issues a project seek to address. The problem statement identifies the current state, the desired future state and any gaps between the two.	19September2022
Problem Solution Fit	This helps us to understand The thoughts of the customer their likes behavior , emotions etc.	01 October 2022
Proposed solution	Proposed solution shows the current solution and it helps is going towards the desired result until it is achieved.	19 September2022

Solution Architecture	Solution architecture is a complex process – with many sub-processes –that bridges the gap between business problems andtechnology solutions. It helped us understand the features and components used to Complete them project.	19 September2022
Customer journey	It helped to analyse the various steps, inter actions ,goals and motivation ,positives , negatives and opportunities.	8 October2022
Functional Requirements	It briefs about functional andnon-functional requirements.It involves the various stepsin the entire process. Italso specifies features usability ,security, reliability, performance ,availability andscalability.	15October2022
Technology architectur e	A tech stack is the combination of technologies a company uses to build and run an application or project. It helps us analyse and understand various technologies that needs to be implemented in the project.	15October2022

Dataflow Diagram	A Data Flow Diagram(DFD)is a traditional visualre presentation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enter and leaves the system, what changes the information, and where data is stored.	14October2022
Sprint Delivery plan	Sprint Planning is an event in scrum that defines what can be delivered in the up coming sprint and how that work will be achieved. It helps us to organise and complete the work effectively and efficiently .	In progress
Prepare milestone and activity list	Helps us understand and evaluate our progressand accuracy so far.	31October2022

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)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Burndown Chart:

A burn-down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as scrum. However, burn-down charts can be applied to any project containing measurable progress over time.

7.CODING & SOLUTIONING:

(Explain the features added in the project along with code):

Feature 1 (coding andresult):

```
importwiotp.sdk.device
import time
import random
importibmiotf.application
import ibmiotf.device
import requests, json

myConfig = {
   #Configuration
   "identity": {
      "orgId": "3dpjnk",
      "typeId": "Sign_Board",
      "deviceId":"Board_1"},
   #API Key
   "auth": {
      "token": "1234567890"
   }
}

#Receiving callbacks from IBM IOT platform
defmyCommandCallback(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()

#OpenWeatherMap Credentials
BASE_URL    ="https://api.openweathermap.org/data/2.5/weather?"
```

```
CITY = "Nagercoil"
URL = BASE_URL + "q=" + CITY + "&units=metric"+"&appid=" +
"01df65417ab3968e3fc2a38c4aee27bb"

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']

        #messge part
        msg=random.randint(0,5)
        if msg==1:
            message="SLOW DOWN, SCHOOL IS NEAR"
        elifmsg==2:
            message="NEED HELP, POLICE STATION AHED"
        elifmsg==3:
            message="EMERGENCY, HOSPITAL NEARBY"
        elifmsg==4:
            message="DINE IN, RESTAURENT AVAILABLE"
        else:
            message=""

         #Speed Limit part

        speed=random.randint(0,150)
        if speed>=100:
            speedMsg=" Limit Exceeded"
        elif speed>=60 and speed<100:
            speedMsg="Moderate"
        else:
             speedMsg="Slow"

         #Diversion part
        sign=random.randint(0,5)
        if sign==1:
            signMsg="Right Diversion"
        elifsign==3:
            signMsg="Left Diversion"
        elifsign==5:
            signmsg="U Turn"
```

```
        else:
            signMsg=""

         #Visibility
        if temperature < 24:
            visibility="Fog Ahead, Drive Slow"
        elif temperature < 20:
            visibility="Bad Weather"
        else:
            visibility="Clear Weather"

    else:
        print("Error in the HTTP request")
    myData={'Temperature':temperature, 'Message':message, 'Sign':signMsg, 'Speed':speedMsg,
'Visibility':visibility}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
#PUBLISHING TO IOT WATSON
    print("Published data Successfully: %s", myData)
    client.commandCallback                                =
    myCommandCallbacktime.sleep(5)
client.disconnect()
```

Output:

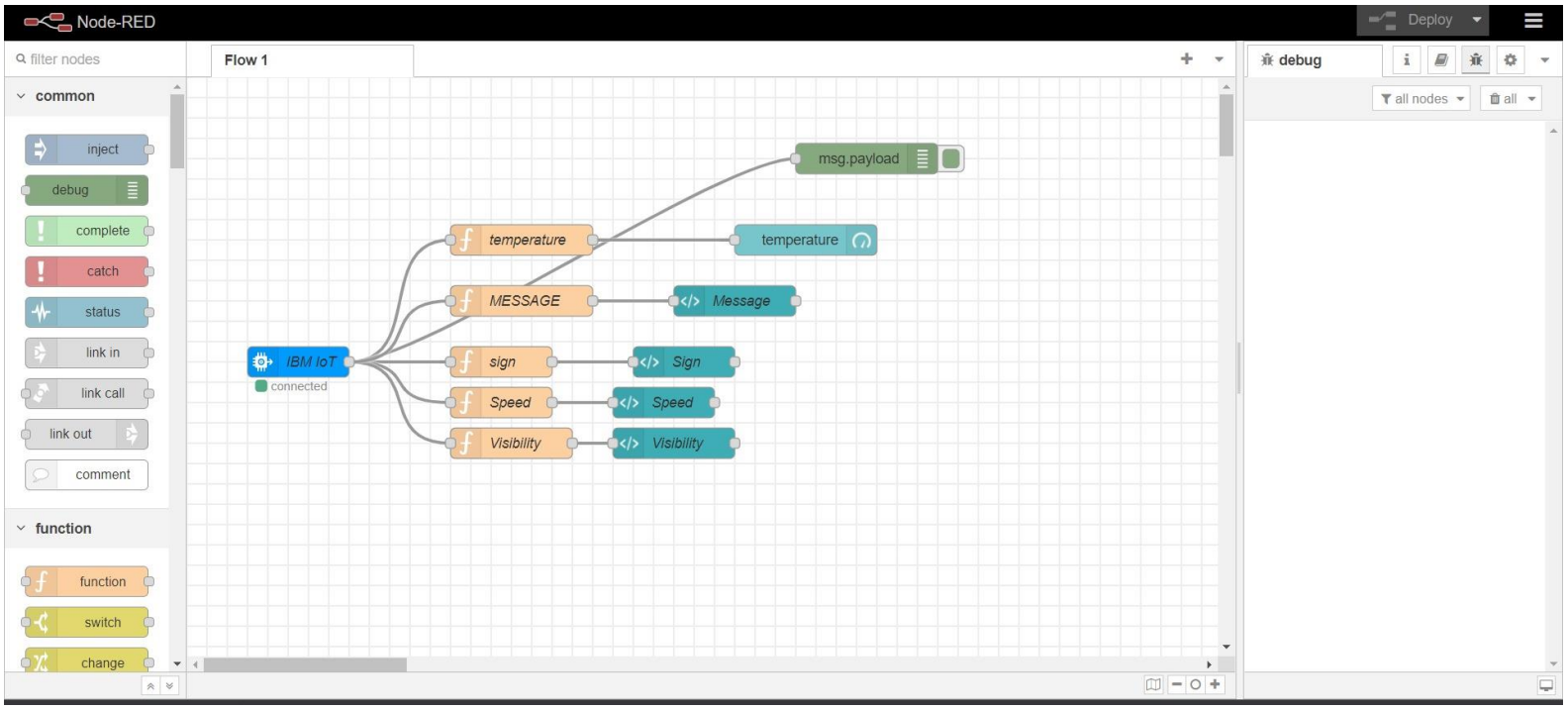
```
import wiotp.sdk.device
import time
import random
import ibmiotf.application
import ibmiotf.device
import requests, json

myConfig = { #Configuration
    "identity": {
"orgId": "3dpjnk",
"typeId": "Sign_Board",
"deviceId":"Board_1"
},
#API Key
"auth": {
"token": "1234567890"
}
}

#Receiving callbacks from IBM IOT platform
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()

#OpenWeatherMap Credentials
BASE_URL = "https://api.openweathermap.org/data/2.5/weather?"
CITY = "Chennai"
URL = BASE_URL + "q=" + CITY + "&units=metric"+"&appid=" + "01df65417ab3968e3fc2a38c4aee27bb"

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']

    #messge part
        temperature=random.randint(0,100)
        msg=random.randint(0,5)
        if msg==1:
            message="SLOW DOWN, SCHOOL IS NEAR"
        elif msg==2:
            message="NEED HELP, POLICE STATION AHED"
        elif msg==3:
            message="EMERGENCY, HOSPITAL NEARBY"
        else:
            message="DINE IN, RESTAURENT AVAILABLE"
```

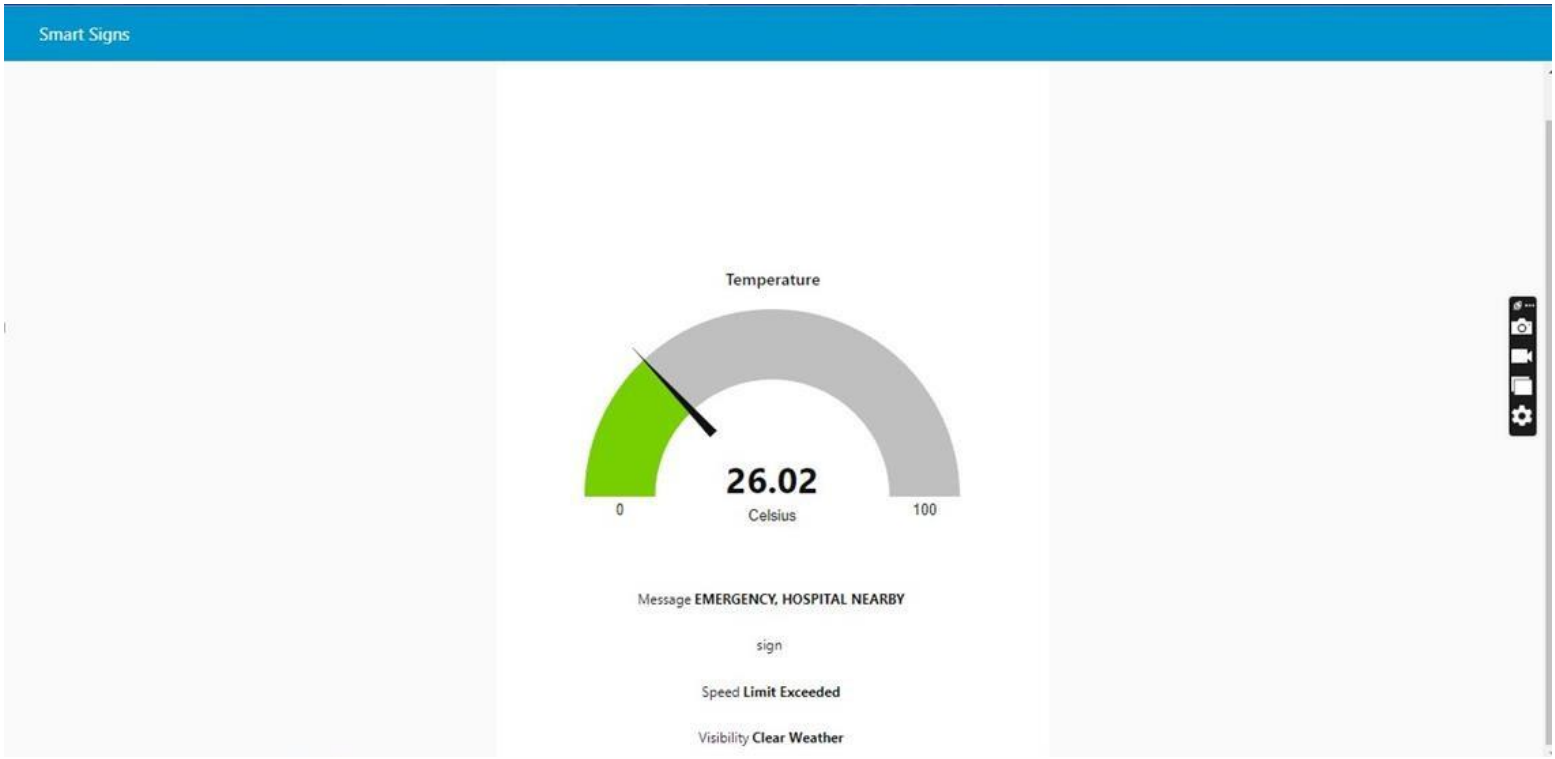
```
*Python 3.7.9 Shell*
File  Edit  Shell  Debug  Options  Window  Help
>>>
======= RESTART: C:\Users\Madhu Sundaran Nair\OneDrive\Desktop\project.py ======
2022-11-14 19:07:23,504   wiotp.sdk.device.client.DeviceClient  INFO    Connecte
d successfully: d:3dpjnk:Sign_Board:Board_1
Published data Successfully: %s {'Temperature': 77, 'Message': 'SLOW DOWN, SCHOO
L IS NEAR', 'Sign': 'U Turn', 'Speed': 'Slow', 'Visibility': 'Clear Weather'}
Published data Successfully: %s {'Temperature': 47, 'Message': 'DINE IN, RESTAUR
ENT AVAILABLE', 'Sign': 'Right Diversion', 'Speed': 'Slow', 'Visibility': 'Clear
 Weather'}
Published data Successfully: %s {'Temperature': 0, 'Message': 'NEED HELP, POLICE
 STATION AHED', 'Sign': 'Left Diversion', 'Speed': 'Moderate', 'Visibility': 'Fo
g Ahead, Drive Slow'}
Published data Successfully: %s {'Temperature': 84, 'Message': 'NEED HELP, POLIC
E STATION AHED', 'Sign': 'Right Diversion', 'Speed': ' Limit Exceeded', 'Visibil
ity': 'Clear Weather'}
Published data Successfully: %s {'Temperature': 14, 'Message': 'DINE IN, RESTAUR
ENT AVAILABLE', 'Sign': 'U Turn', 'Speed': ' Limit Exceeded', 'Visibility': 'Fog
 Ahead, Drive Slow'}
Published data Successfully: %s {'Temperature': 100, 'Message': 'EMERGENCY, HOSP
ITAL NEARBY', 'Sign': 'U Turn', 'Speed': 'Moderate', 'Visibility': 'Clear Weathe
r'}
Published data Successfully: %s {'Temperature': 55, 'Message': 'NEED HELP, POLIC
E STATION AHED', 'Sign': 'Right Diversion', 'Speed': 'Slow', 'Visibility': 'Clea
r Weather'}
Published data Successfully: %s {'Temperature': 66, 'Message': 'DINE IN, RESTAUR
ENT AVAILABLE', 'Sign': 'U Turn', 'Speed': 'Moderate', 'Visibility': 'Clear Weat
her'}
Published data Successfully: %s {'Temperature': 29, 'Message': 'DINE IN, RESTAUR
ENT AVAILABLE', 'Sign': 'Right Diversion', 'Speed': ' Limit Exceeded', 'Visibili
ty': 'Clear Weather'}
Published data Successfully: %s {'Temperature': 2, 'Message': 'DINE IN, RESTAURE
NT AVAILABLE', 'Sign': 'Left Diversion', 'Speed': 'Slow', 'Visibility': 'Fog Ahe
ad, Drive Slow'}
Published data Successfully: %s {'Temperature': 93, 'Message': 'EMERGENCY, HOSPI
TAL NEARBY', 'Sign': 'Left Diversion', 'Speed': 'Moderate', 'Visibility': 'Clear
 Weather'}
Published data Successfully: %s {'Temperature': 62, 'Message': 'EMERGENCY, HOSPI
TAL NEARBY', 'Sign': 'Left Diversion', 'Speed': 'Slow', 'Visibility': 'Clear Wea
ther'}
                                                                          Ln: 5  Col: 0
```

8.TESTING:

Test cases help guide the tester through a sequence of steps to validate whethera software application is free of bugs, and working as required by the end-user.

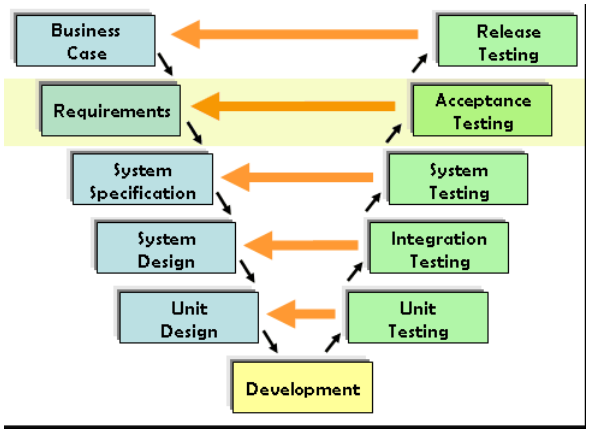
Learning how to write test cases for software requires basic writing skills, attention to detail, and a good understanding of the application under test (AUT).





User AcceptanceTesting:

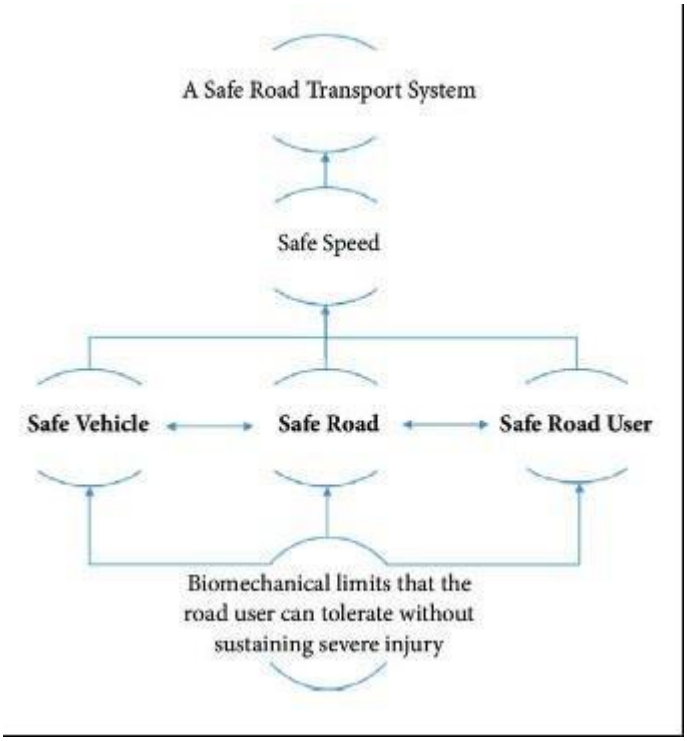
UAT consists, in practice, of people from the target audience using the application. The defects they find are then reported and fixed. This scenario is what most closely resembles "the real world." The process allows users to "get their hands dirty" with the application. They can see if things work as intended.



The main purpose of UAT is to validate end-to-end business flow. It does not focus on cosmetic errors, spelling mistakes, or system testing. User Acceptance Testing is carried out in a separate testing environment with a production-like data setup. It is a kind of black box testing where two or more end-users will be involved.

9.RESULTS:

Performance Metrics:



10.ADVANTAGES & DISADVANTAGES

Advantages:

Connected vehicles have various benefits such as

- Multimodalsensorsandedgecomputinghelpspeeduptheflowoftrafficwithreal-time processing, reducing congestion andemissions.
- Smart road technology can assist in optimizing trafficflow
- It will manage road conditions, creating a more sustainable environment withincities.
- Improved control and safety can be achieved through IoT-enabled cars. In case of over-speeding, the notification gets displayed.
- Ensuring a safe driving experience with real-time assistance, navigation, and even monitoring driving patterns and any emergency. Additionally, along with the state of the traffic, IOT drivers can receive updated information on the state of the roads, i.e., potholes, ice, grade changes, black spots ,etc.

DISADVANTAGES:

- Security and privacy. Keeping the data gathered and transmitted by IoT devices safe is challenging, as they evolve and expand in use....
- Technical complexity....
- Connectivity and power dependence....
- Integration....
- Higher costs (time andmoney)

11.CONCLUSION:

The world doesn’t change on its own but we humans can change the world to be safe, better, and harmless. Since the road isn’t said to be safe let’s make it safer with the technologies present and available to us. The Internet of Things is one of the technologiesthat can lead us to travel on enhanced safe roads. So let's come together to create a better world with no accidents and a smart road for the future generation.

12.FUTURE SCOPE

IOT obtains the majority of its data with the help of connected cars. These incorporatea large number of sensors that establish communication with the cloud, other vehicles, and devices. Thanks to this it provides data and information of great utility for the improvement of road safety. The safe system approach to road safety emphasizes safety by desigh ensuring safe vehicles, road networks, and road users. Evolving towards the future, the road needs to boil with advanced sensors and antenna systems to have peace with the new era.