***SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY***

***DONE BY***

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***in partial fulfillment for the award of the degree of***

**BACHELOR OF ENGINEERING**

***in***

## ELECTRONICS AND COMMUNICATION ENGINEERING PANIMALAR ENGINEERING COLLEGE – CHENNAI

## NOV 2022

**ANNA UNIVERSITY: CHENNAI**

# BONAFIDE CERTIFICATE

Certified that this project report **“SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY”** is the bonafide work of “**AVINASH.Y.A(211419106038), DHANUSH KUMAR(211419106063), BARATH KANNAH(211419106043), DANISH (211419106058)** who carried out the project work under my supervision.

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# 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. A brief survey on the state of the art related to pre-accident as well as post-accident models, frameworks, and techniques;
2. Identification and reporting of limitations in previous studies related to accident detection;
3. The concept of a smart road with an event-sensing capability, plus implementation and testing through various experiments;
4. Demonstration of a new and modern way to quickly detect accidents and communicate with nearby vehicles and EOCs.

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.

## 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

## 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:

|  |  |  |
| --- | --- | --- |
| LITERATURE PAPER TITLE | AUTHOR | OBJECTIVE |
| IOT based real time river water quality monitoring system(August 19,2019) | Elsevier B.V. | The main objective of this paper is to access data by the remote monitoring and IOT technology.If the acquired value is above the threshold value automated warning SMS alert will send to the agent |
| Design and Development of Real- Time Water Quality Monitoring System (October 18,2019) | Meghana M, Kiran Kumar B M Divya Kiran Ravikant Verma | This paper presents a system that is developed to measure the parameters of water such as turbidity dissolved solvents PH and temperature.The sensors are interfaced with Arduino UNO and raspberry Pi for data processing and  transmission.This data is  transmitted through Wi-Fi to the remote place |
| Ultrasonic as a green chemistry for bacterial and algal control in drinking water treatment source (20  September 2020) | Nourhan F.Ali Zenat M.kamel S.Z.Wahba | The treatment process is done using ultrasonic waves at a frequency of 20,40 and 60 KHz at different time intervals namely 15,30,45 and 60 minutes |
| Improved Cyanobacteria Removal from Harmful Algae Blooms by Two-Cycle, Low-Frequency, Low- Density, and Short- Duration Ultrasonic Radiation(29 August 2020) | Haocai Huang Gang Wu Chaowu Sheng Wu Jiannan Danhua Li Hangzhou Wang | This paper has a proposed cyanobacteria removal method based on two applications of low frequency, low density and short duration and ultra sonic radiation for calculating the effectiveness of ultrasonic radiation is done by algae removal rate/ultrasonic dosage |

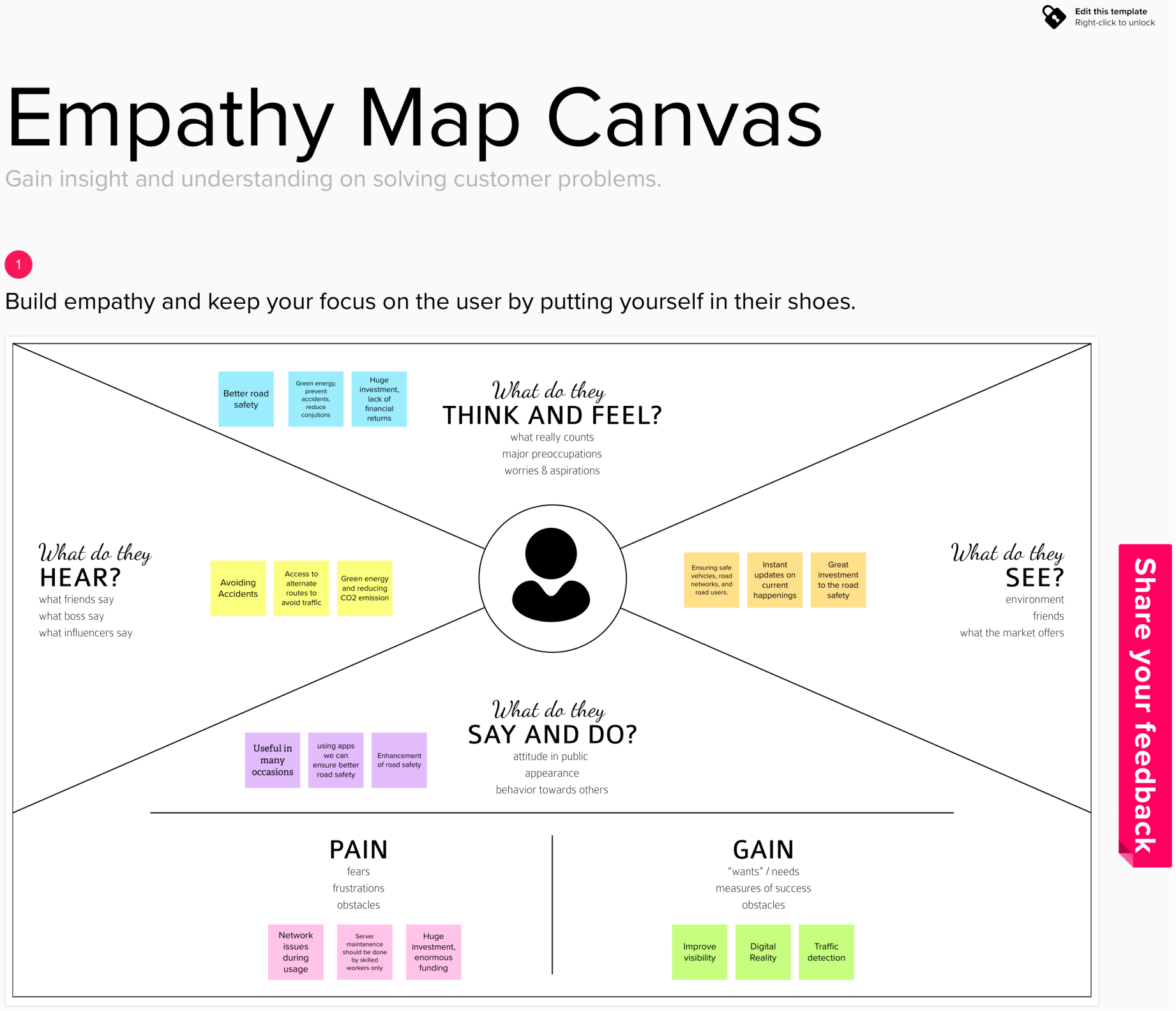
## Problem Statement Definition

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](https://en.wikipedia.org/wiki/Five_Ws). The first condition of solving a problem is understanding the problem, which can be done by way of a problem statement.

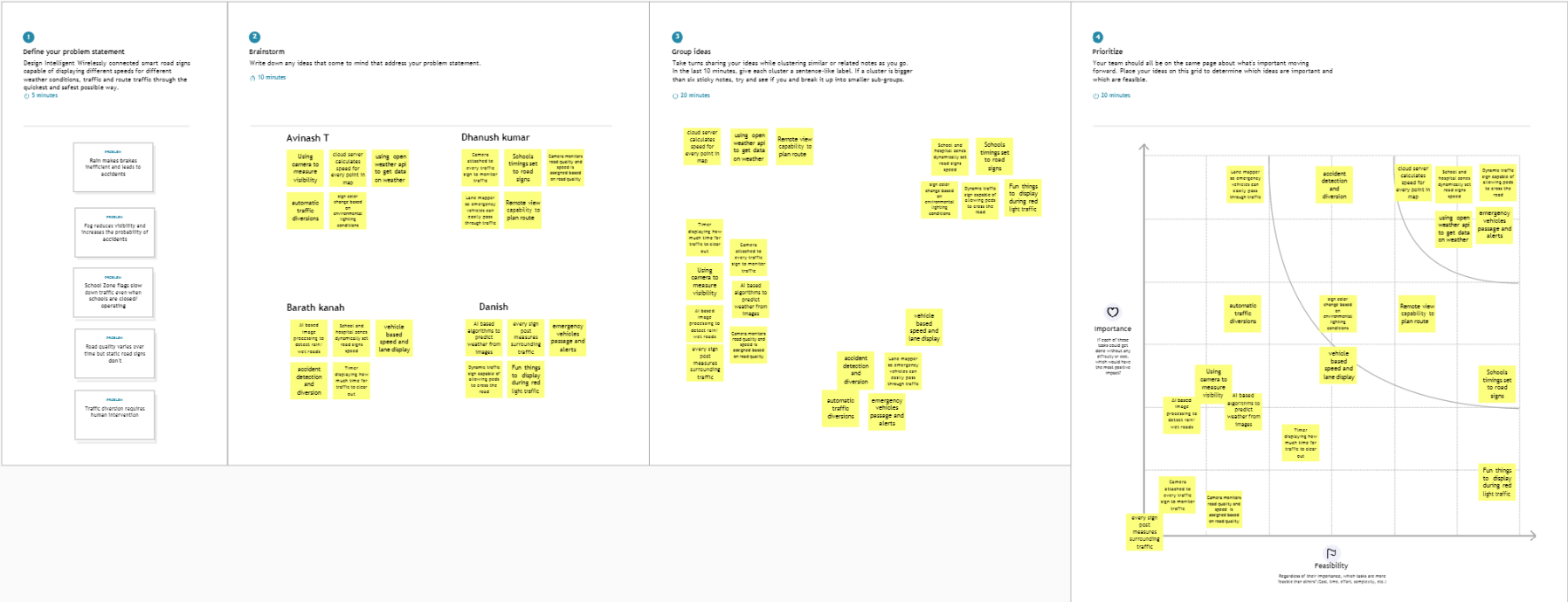
In present Systems the road signs and the speed limits are Static. But the road signs can be changed in some cases. We can consider some cases when there are road diversions due to heavy traffic or due to accidents then we can change the road signs accordingly if they are digitalized. This project proposes 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 signboards accordingly.

## IDEATION & PROPOSED SOLUTION:

* 1. **Empathy Map Canvas:**



* 1. **Ideation & Brainstorming:**

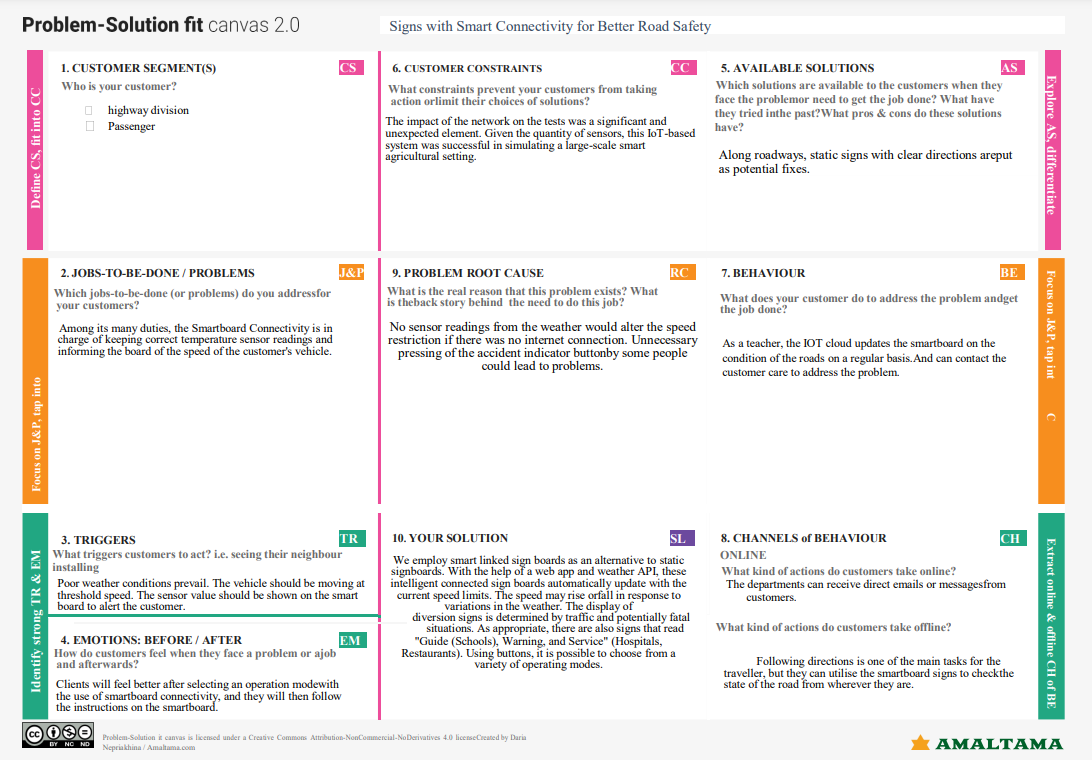
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* 1. **Proposed Solution:**

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) | Road safety(to avoid an accident, traffic conjunction, and to arrive at the destination on time). |
| 2. | Idea / Solution description | Road safety using iot. |
| 3. | Novelty / Uniqueness | Drivers can receive updated information on the road, traffic, weather conditions, and battery state. |
| 4. | Social Impact / Customer Satisfaction | Iot is working to ensure road safety in areas such as vehicle maintenance, weather conditions, and about the state of the road. |
| 5. | Business Model (Revenue Model) | It’s a b2c model where the consumer will make use of the product. They can generate revenue by installing this product in the city. |
| 6. | Scalability of the Solution | This product can be used all over the world since this device will have a great impact on the people’s time. |

## Problem Solution fit:

****

1. **REQUIREMENT ANALYSIS**
   1. **Functional requirement:**

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** |
| FR-1 | User Requirements | Static signboards will be replaced with smart linked sign boards that meet all criteria. |
| FR-2 | User Registration | Manual Registration Through a Website or Gmail |
| FR-3 | User Confirmation | Phone Confirmation  Email confirmation OTP authentication |
| FR-4 | Payments options | Bank Transfer |
| FR-5 | Product Delivery and installation | The installation fee will be determined by the length of the road. |
| FR-6 | Product Feedback | Through a website via Gmail |

* 1. **Non-Functional requirements:**

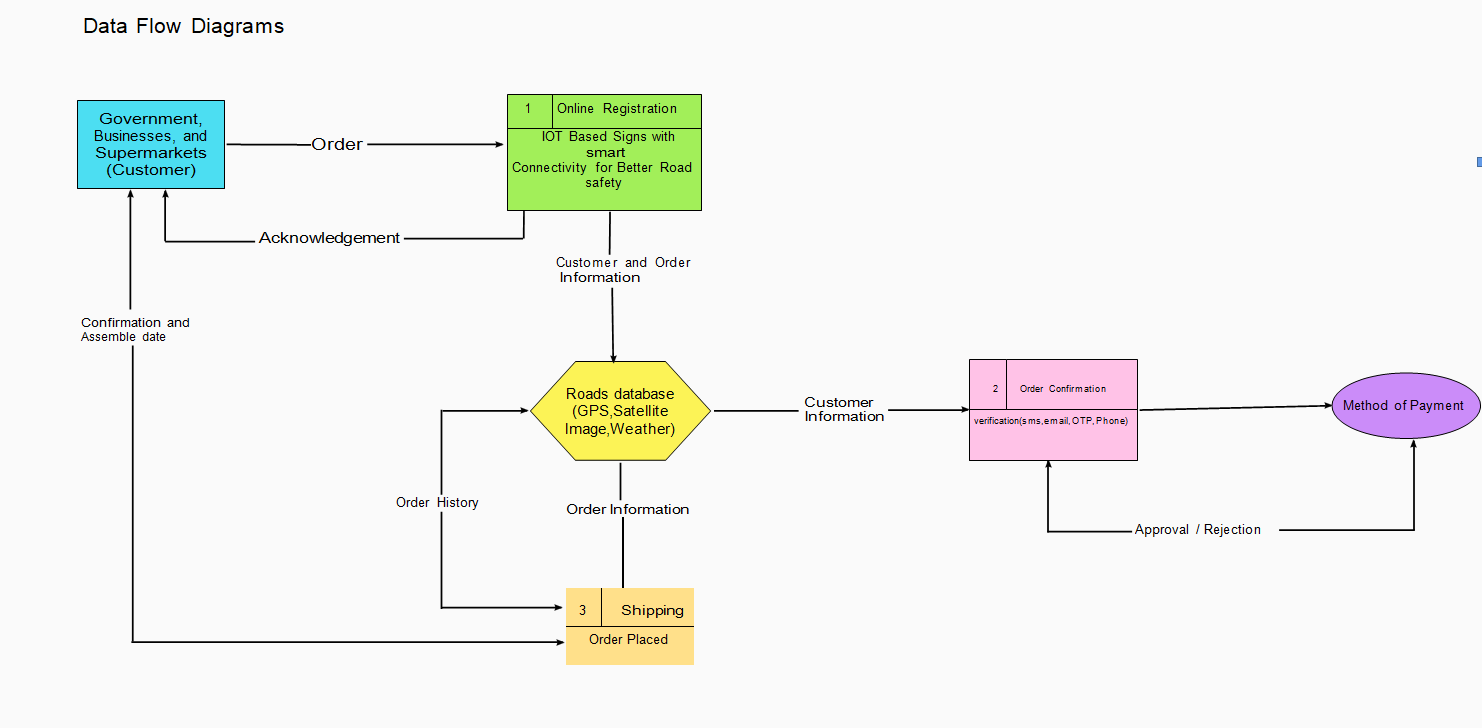
|  |  |  |
| --- | --- | --- |
| **FR No.** | **Non-Functional Requirement** | **Description** |
| NFR-1 | **Usability** | Have clear product instructions and a self- explanatory product that is simple to use. |
| NFR-2 | **Security** | Cloud data must be contained within the network, collapsing to be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

1. **PROJECT DESIGN:**

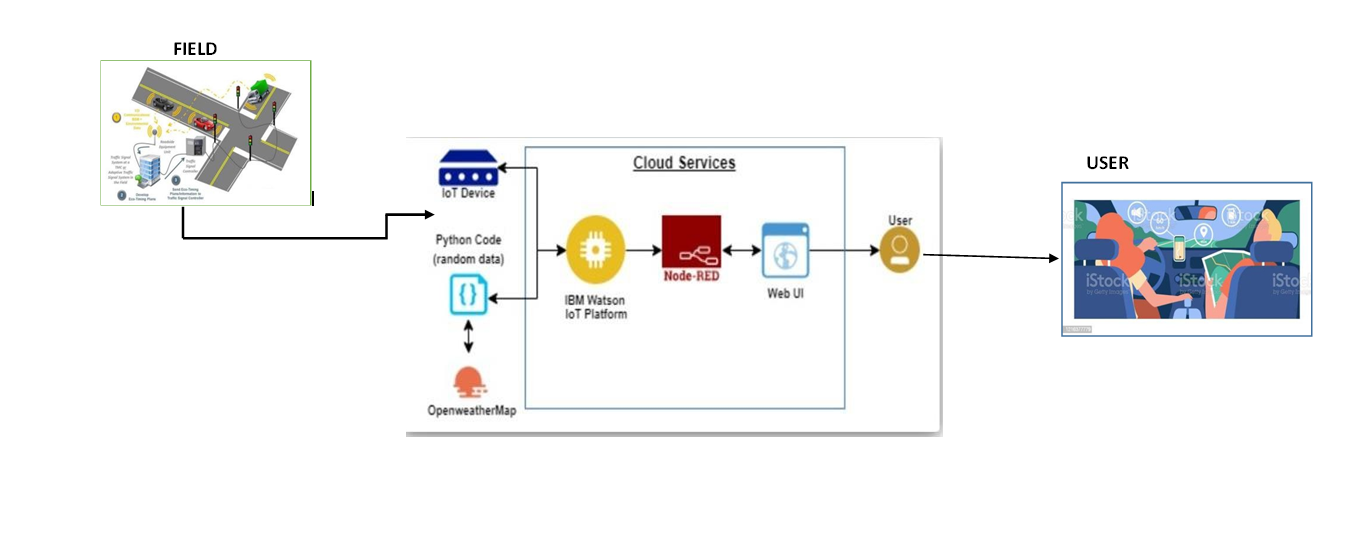
Project design is an early phase of the project lifecycle where ideas, processes, resources, and deliverables are planned out. A project design comes before a project plan as it's a broad overview whereas a project plan includes more detailed information.

## 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:



* 1. **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 weather changes.** | **I can access the data regarding the weather through the application** | High | Sprint-1 |
| 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 |

## 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 project closer to completion**.**

## Sprint Planning & Estimation:

Use the below template to create product backlog and sprint schedule

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sprint** | **Functional Requirement (Epic)** | **User Story / Task** | **Story Points** | **Priority** | **Team Members** |
| Sprint-1 | Resources Initialization | Create and initialize accounts in various public APIs like Open Weather API. | 1 | LOW | Avinash.Y.A,  DhanushKumar,  Danish,  Barath. |
| Sprint-1 | Local Server/Software Run | Write a Python program that outputs results given the inputs like weather and location. | 1 | MEDIUM | Avinash.Y.A,  DhanushKumar,  Danish,  Barath. |
| 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 | Avinash.Y.A,  DhanushKumar,  Danish,  Barath. |
| Sprint-3 | Hardware initialization | Integrate the hardware to be able to access the cloud functions and provide inputs to the same. | 2 | HIGH | Avinash.Y.A,  DhanushKumar,  Danish,  Barath. |
| Sprint-4 | UI/UX Optimization &  Debugging | Optimize all the shortcomings and provide better  user experience. | 2 | LOW | Avinash.Y.A,  DhanushKumar,  Danish,  Barath. |

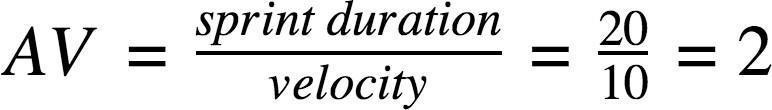
## Sprint Delivery Schedule:

**Project Tracker, Velocity & Burndown Chart:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **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 | 4 Days | 29 Oct 2022 | 01 Nov 2022 | 20 | 01 Nov 2022 |
| Sprint-2 | 20 | 3 Days | 01 Nov 2022 | 03 Nov 2022 | 20 | 03 Nov 2022 |
| Sprint-3 | 20 | 7 Days | 04 Nov 2022 | 10 Nov 2022 | 20 | 10 Nov 2022 |
| Sprint-4 | 20 | 7 Days | 11 Nov 2022 | 17 Nov 2022 | 20 | 17 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)



**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.

**8.CODING & SOLUTIONING:**

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

* 1. **Feature (coding and result):**

import wiotp.sdk.device

import time

import random

import ibmiotf.application

import ibmiotf.device

import requests, json

myConfig = { #Configuration

"identity": {

"orgId": "gmybrq",

"typeId": "Project",

"deviceId":"Project\_main"

},

#API Key

"auth": {

"token": "1234567890"

}

}

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 = "Nagercoil"

URL = BASE\_URL + "q=" + CITY + "&units=metric"+"&appid=" + "01df65417ab3968e3fc2a38c4aee27bb"

while True:

response = requests.get(URL)

data = response.json()

#messge part

msg=random.randint(0,5)

if msg==1:

message=" HOSPITAL near by "

elif msg==2:

message=" FUEL PUMP near by "

elif msg==3:

message=" Feeling hungry!RESTAURANT Ahead "

else :

message=" SCHOOL ZONE!Slow Down Ahead "

#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"

elif sign==3:

signMsg="Left Diversion"

else:

signMsg="U Turn"

#Visibility

temperature= random.randint(0,100)

if temperature < 24:

visibility="Fog Ahead, Drive Slow"

elif temperature < 20:

visibility="Bad Weather"

else:

visibility="Clear Weather"

myData={'Temperature':temperature, 'Message':message, 'Sign':signMsg, 'Speed':speedMsg, 'Visibility':visibility}

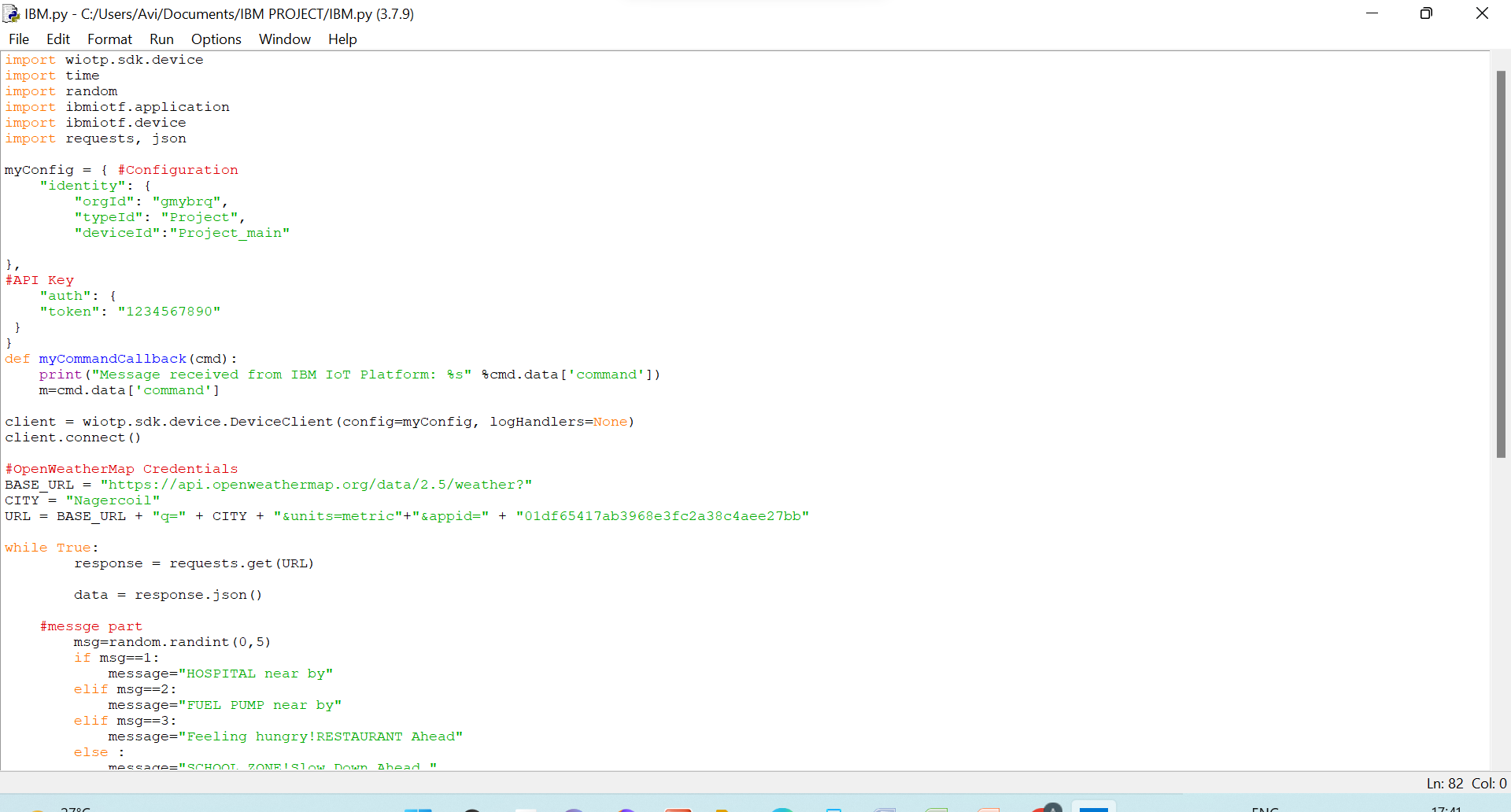
client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None) #PUBLISHING TO IOT WATSON

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

client.commandCallback = myCommandCallback

time.sleep(5)

client.disconnect()



**Output:**

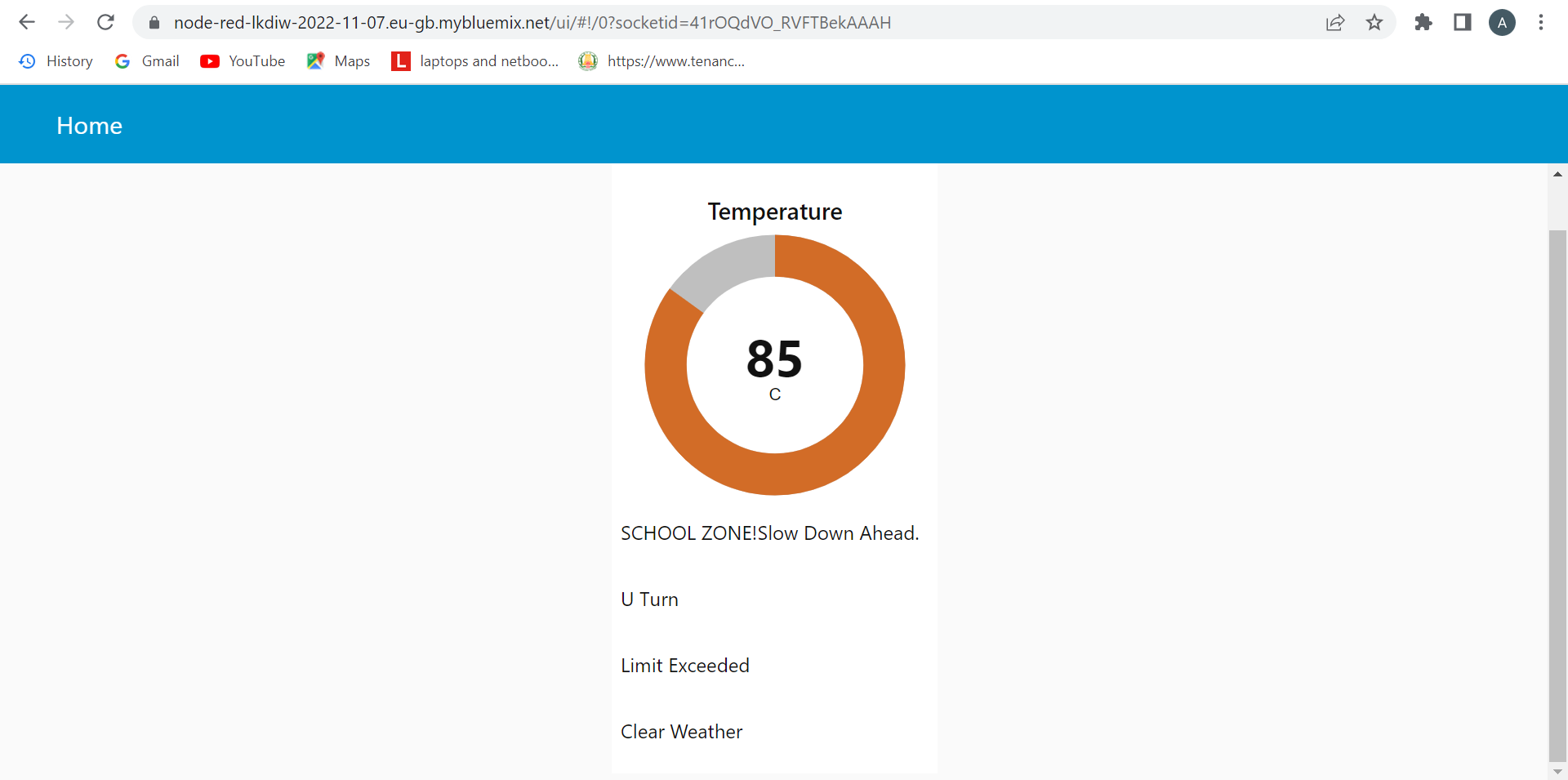
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## TESTING:

Test cases help guide the tester through a sequence of steps to validate whether a 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).

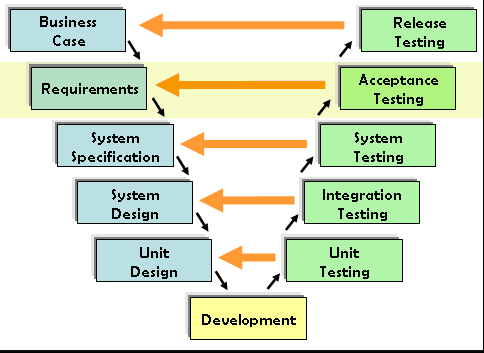
## Test Cases:

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* 1. **User Acceptance Testing:**

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**.**

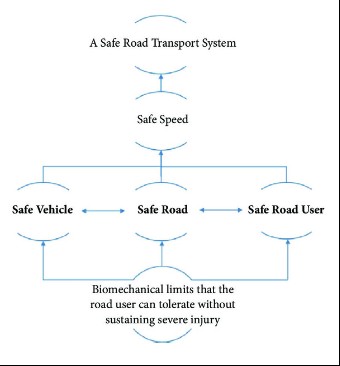


The main purpose of UAT is to validate end-to-end business flow. It does not focus on cosmetic errors, spelling mistakes, or system testing. User Acceptance Testing is carried out in a separate testing environment with a production-like data setup. It is a kind of black box testing where two or more

end-users will be involved.

## RESULTS:

* 1. **Performance Metrics:**



1. **ADVANTAGES & DISADVANTAGES**

**Advantages:**

Connected vehicles have various benefits such as

* Multimodal sensors and edge computing help speed up the flow of traffic with real-time processing, reducing congestion and emissions.
* Smart road technology can assist in optimizing traffic flow
* It will manage road conditions, creating a more sustainable environment within cities.
* 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 and money)

## 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 technologies that 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.

## FUTURE SCOPE:

IoT obtains the majority of its data with the help of connected cars. These incorporate a 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.

## APPENDIX:

**Source Code:**

import wiotp.sdk.device

import time

import random

import ibmiotf.application

import ibmiotf.device

import requests, json

myConfig = { #Configuration

"identity": {

"orgId": "gmybrq",

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"deviceId":"Project\_main"

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#API Key

"auth": {

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}

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elif sign==3:

signMsg="Left Diversion"

else:

signMsg="U Turn"

#Visibility

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if temperature < 24:

visibility="Fog Ahead, Drive Slow"

elif temperature < 20:

visibility="Bad Weather"

else:

visibility="Clear Weather"

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)

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client.disconnect()

## GitHub & Project Demo Link :

[**https://github.com/IBM-EPBL/IBM-Project-4085-1658684111**](https://github.com/IBM-EPBL/IBM-Project-4085-1658684111)

## Demo Link :

## https://drive.google.com/file/d/1KCTCBvPFXqM2RjjPHHEKfzc4p8sKu68V/view?usp=share\_link