SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

DONE BY

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ANNA UNIVERSITY: CHENNAI

BONAFIDE CERTIFICATE

Certified that this project report **“SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY”** is the bonafide work of “**ABIRAMI.V(6123201914001),ARULKUMAR.A(6123201914002),DHARANIDHARAN.S (6123201914004),PRIYA.N(6123201914010),RAMESHKUMAR.M(6123201914012)** who carried out the project work under my supervision.

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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. 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.

2. LITERATURE SURVEY:

2.1Existing 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

2.2.References:

PAPERS	AUTHOR	OBJECTIVE
IOT based realtime river water quality monitoring system(august,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 Removalfrom 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 oflow frequency, low density and short duration and ultra sonic radiation for calculating theeffectiveness of ultrasonicradiation is done by algae removal rate/ultrasonic dosage

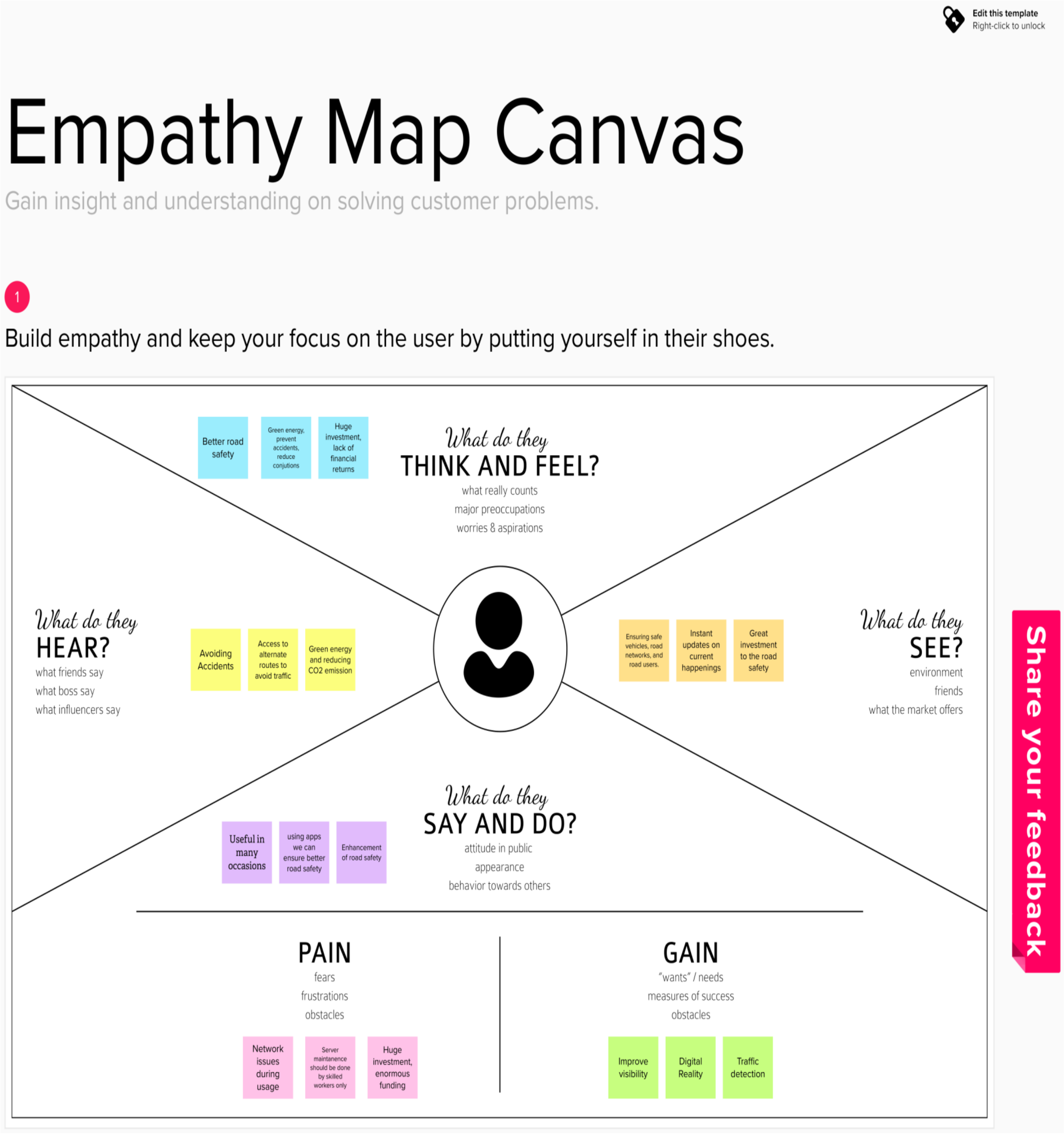
2.3.Problem Statement Definition

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 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.

3. IDEATION & PROPOSED SOLUTION:

3.1.Empathy Map Canvas:



Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

Build empathy and keep your focus on the user by putting yourself in their shoes.

What do they
THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations

- Better road safety
- Green energy, prevent accidents, reduce conjutions
- Huge investment, lack of financial returns

What do they
HEAR?
what friends say
what boss say
what influencers say

- Avoiding Accidents
- Access to alternate routes to avoid traffic
- Green energy and reducing CO2 emission

What do they
SEE?
environment
friends
what the market offers

- Ensuring safe vehicles, road networks, and road users.
- Instant updates on current happenings
- Great investment to the road safety

What do they
SAY AND DO?
attitude in public
appearance
behavior towards others

- Useful in many occasions
- using apps we can ensure better road safety
- Enhancement of road safety

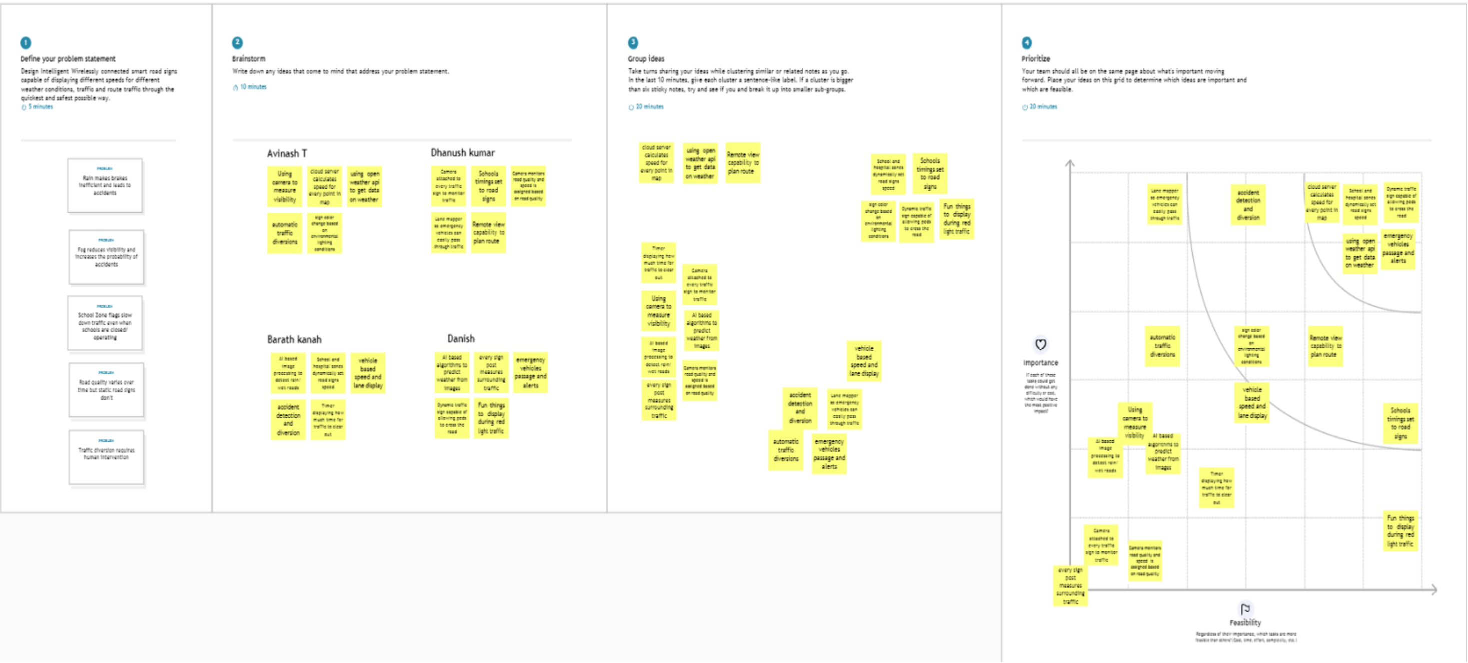
PAIN
fears
frustrations
obstacles

- Network issues during usage
- Server maintanenence should be done by skilled workers only
- Huge investment, enormous funding

GAIN
"wants" / needs
measures of success
obstacles

- Improve visibility
- Digital Reality
- Traffic detection

3.2. Ideation & Brainstorming:



1 Define your problem statement

Design Intelligent Wirelessly connected smart road signs capable of displaying different speeds for different weather conditions, traffic and route traffic through the quickest and safest possible way.

5 minutes

2 Brainstorm

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

10 minutes

3 Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

4 Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

PROBLEM
Rain makes brakes inefficient and leads to accidents
PROBLEM
Fog reduces visibility and increases the probability of accidents
PROBLEM
School Zone flags slow down traffic even when schools are closed/ operating
PROBLEM
Road quality varies over time but static road signs don't
PROBLEM
Traffic diversion requires human intervention
Avinash T
Using camera to measure visibility
cloud server calculates speed for every point in map
using open weather api to get data on weather
automatic traffic diversions
sign color change based on environmental lighting conditions
Dhanush kumar
Camera attached to every traffic sign to monitor traffic
Schools timings set to road signs
Camera monitors road quality and speed is assigned based on road quality
Lane mapper so emergency vehicles can easily pass through traffic
Remote view capability to plan route
Barath kanah
AI based image processing to detect rain/ wet roads
School and hospital zones dynamically set road signs speed
vehicle based speed and lane display
accident detection and diversion
Timer displaying how much time for traffic to clear out
Danish
AI based algorithms to predict weather from images
every sign post measures surrounding traffic
emergency vehicles passage and alerts
Dynamic traffic sign capable of allowing peds to cross the road
Fun things to display during red light traffic
Importance
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?
Feasibility
Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

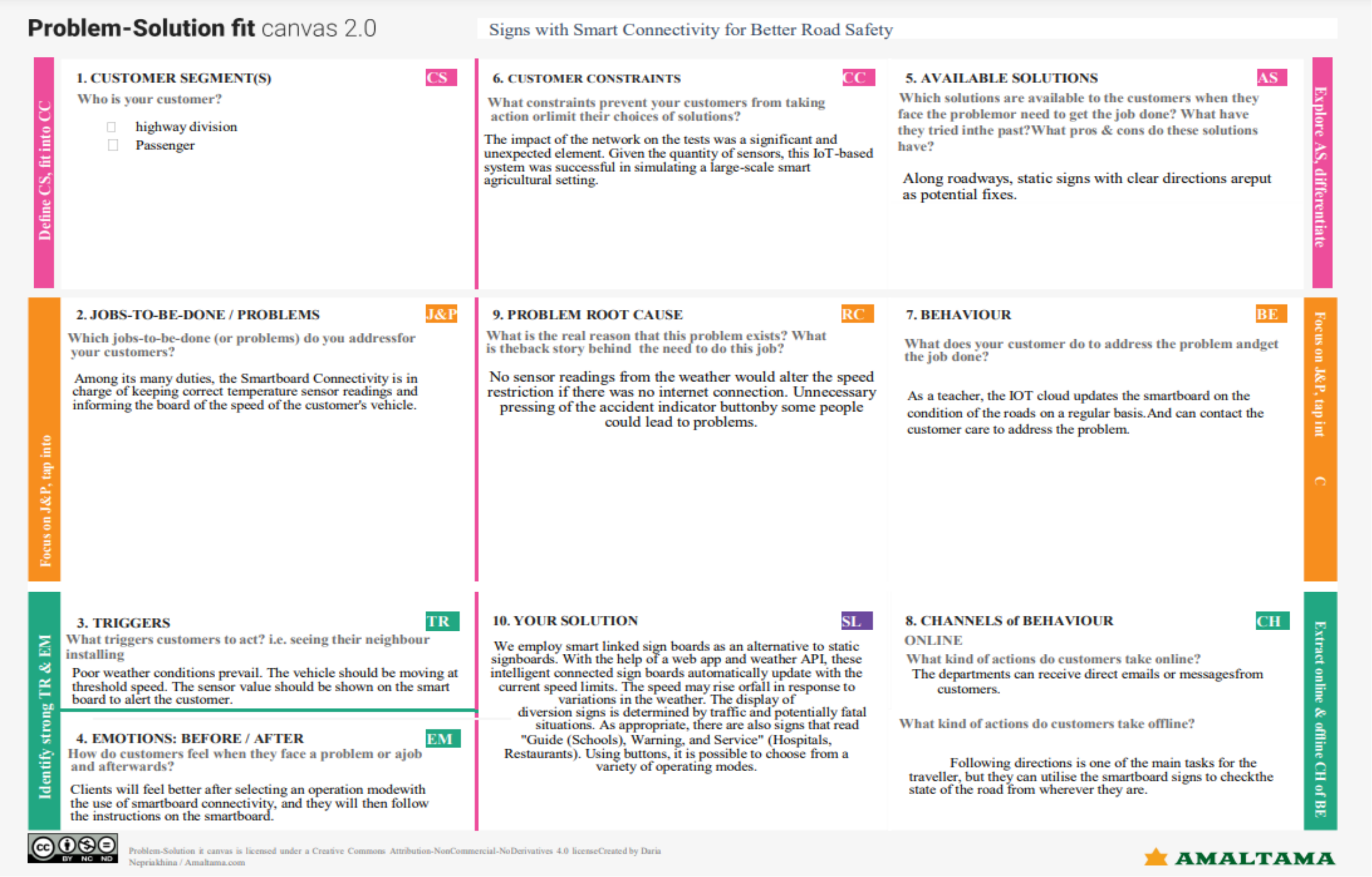
3.3.Proposed Solution:

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

S.No.	Parameter	Description
1.	Problem Statement (Problem to besolved)	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.

3.4. Problem Solution fit:



Problem-Solution fit canvas 2.0

Signs with Smart Connectivity for Better Road Safety

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Who is your customer?

- □ highway division
- □ Passenger

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action orlimit their choices of solutions?

The impact of the network on the tests was a significant and unexpected element. Given the quantity of sensors, this IoT-based system was successful in simulating a large-scale smart agricultural setting.

5. AVAILABLE SOLUTIONS AS

Which solutions are available to the customers when they face the problemor need to get the job done? What have they tried inthe past?What pros & cons do these solutions have?

Along roadways, static signs with clear directions areput as potential fixes.

Explore AS, differentiate

Focus on J&P, tap into

2. JOBS-TO-BE-DONE / PROBLEMS J&P

Which jobs-to-be-done (or problems) do you addressfor your customers?

Among its many duties, the Smartboard Connectivity is in charge of keeping correct temperature sensor readings and informing the board of the speed of the customer's vehicle.

9. PROBLEM ROOT CAUSE RC

What is the real reason that this problem exists? What is theback story behind the need to do this job?

No sensor readings from the weather would alter the speed restriction if there was no internet connection. Unnecessary pressing of the accident indicator buttonby some people could lead to problems.

7. BEHAVIOUR BE

What does your customer do to address the problem andget the job done?

As a teacher, the IOT cloud updates the smartboard on the condition of the roads on a regular basis.And can contact the customer care to address the problem.

Focus on J&P, tap int C

Identify strong TR & EM

3. TRIGGERS TR

What triggers customers to act? i.e. seeing their neighbour installing

Poor weather conditions prevail. The vehicle should be moving at threshold speed. The sensor value should be shown on the smart board to alert the customer.

4. EMOTIONS: BEFORE / AFTER EM

How do customers feel when they face a problem or ajob and afterwards?

Clients will feel better after selecting an operation modewith the use of smartboard connectivity, and they will then follow the instructions on the smartboard.

10. YOUR SOLUTION SL

We employ smart linked sign boards as an alternative to static signboards. With the help of a web app and weather API, these intelligent connected sign boards automatically update with the current speed limits. The speed may rise orfall in response to variations in the weather. The display of diversion signs is determined by traffic and potentially fatal situations. As appropriate, there are also signs that read "Guide (Schools), Warning, and Service" (Hospitals, Restaurants). Using buttons, it is possible to choose from a variety of operating modes.

8. CHANNELS of BEHAVIOUR CH

ONLINE

What kind of actions do customers take online?

The departments can receive direct emails or messagesfrom customers.

What kind of actions do customers take offline?

Following directions is one of the main tasks for the traveller, but they can utilise the smartboard signs to checkthe state of the road from wherever they are.

Extract online & offline CH of BE

AMALTAMA

4. REQUIREMENT ANALYSIS

4.1. Functional requirement:

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

4.2. Non-Functional requirements:

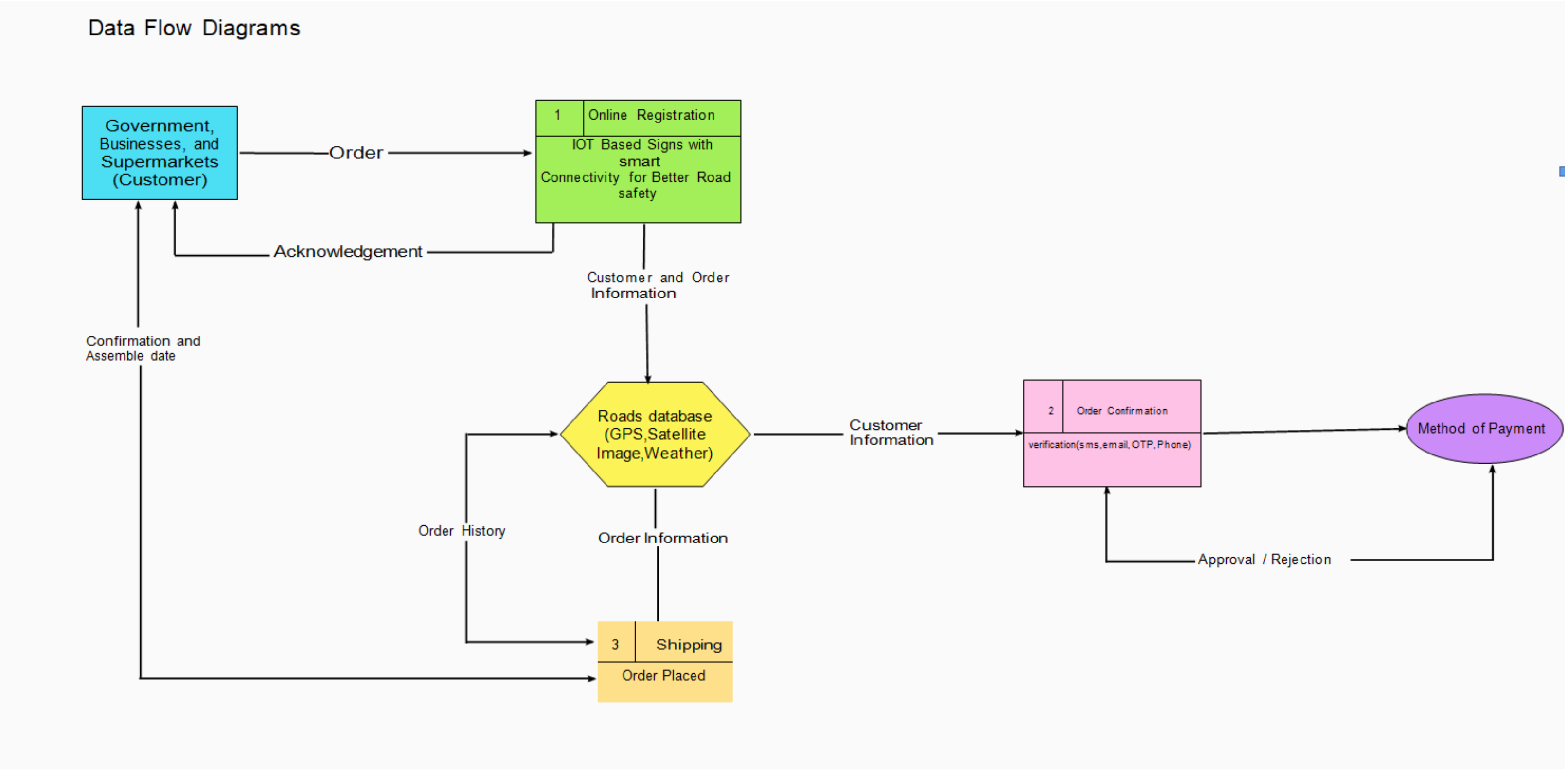
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Have clear product instructions and a self-explanatory product that is simple to use.
NFR-2	**Security**	Cloud data must be contained within the network,collapsing to be Real-time avoidance should be avoided, and theboard should be constantly monitored.
NFR-3	**Reliability**	Hardware is frequently tested.
NFR-4	**Performance**	The smart board must provide a better user experienceand 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 coverthe entire highway system.

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.

5.1. Data Flow Diagrams:

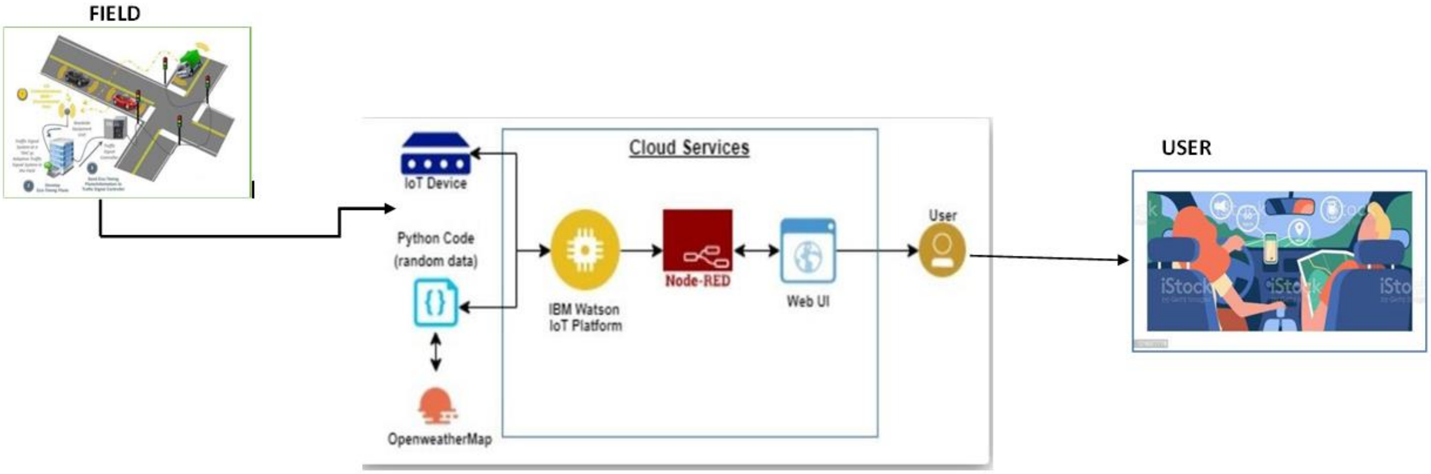
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



Data Flow Diagrams
Government, Businesses, and Supermarkets (Customer)
Order
1
Online Registration
IOT Based Signs with smart Connectivity for Better Road safety
Acknowledgement
Customer and Order Information
Confirmation and Assemble date
Roads database (GPS,Satellite Image,Weather)
Customer Information
2
Order Confirmation
verification(sms,email,OTP,Phone)
Method of Payment
Order History
Order Information
Approval / Rejection
3
Shipping
Order Placed

5.2.Solution & Technical Architecture:

6.



5.3.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

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 project closer to completion**.**

6.1.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 publicAPIs like Open Weather API.	1	LOW	Abirami.V,Arul kumar.A,Dharani dharan.S,Priya.N, Rameshkumar.M
Sprint-1	Local Server/Software Run	Write a Python program that outputs resultsgiven the inputs like weather and location.	1	MEDIUM	Abirami.V,Arul kumar.A,Dharanidharan.S,Priya.N,Rameshkumar.M
Sprint-2	Push the server/software to cloud	Push the code from Sprint 1 to cloud so it can beaccessed from anywhere	2	MEDIUM	Abirami.V,Arul kumar.A,Dharanidharan.S,Priya.N,Rameshkumar.M
Sprint-3	Hardware initialization	Integrate the hardware to be able to access thecloud functions and provide inputs to the same.	2	HIGH	Abirami.V,Arul kumar.A,Dharanidharan.S,Priya.N,Rameshkumar.M
Sprint-4	UI/UX Optimization & Debugging	Optimize all the shortcomings and provide better user experience.	2	LOW	Abirami.V,Arul kumar.A,Dharanidharan.S,Priya.N,Rameshkumar.M

6.2.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	6 Days	29 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-2	20	6 Days	05 Nov 2022	12 Nov 2022	20	03 Nov 2022
Sprint-3	20	2 Days	12 Nov 2022	14 Nov 2022	20	10 Nov 2022
Sprint-4	20	3 Days	14 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)

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

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):

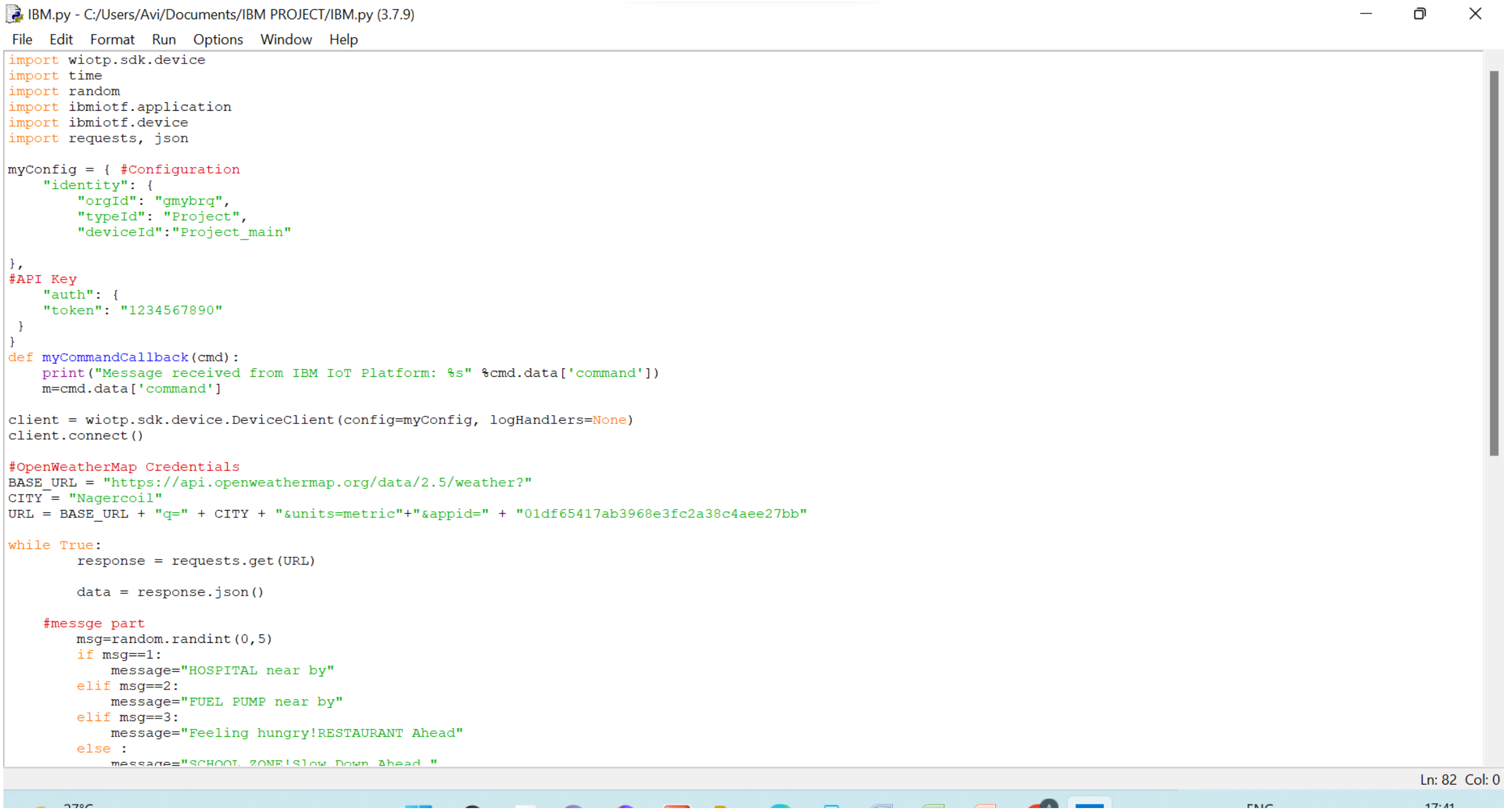
7.1.Feature (1)

```
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)
```

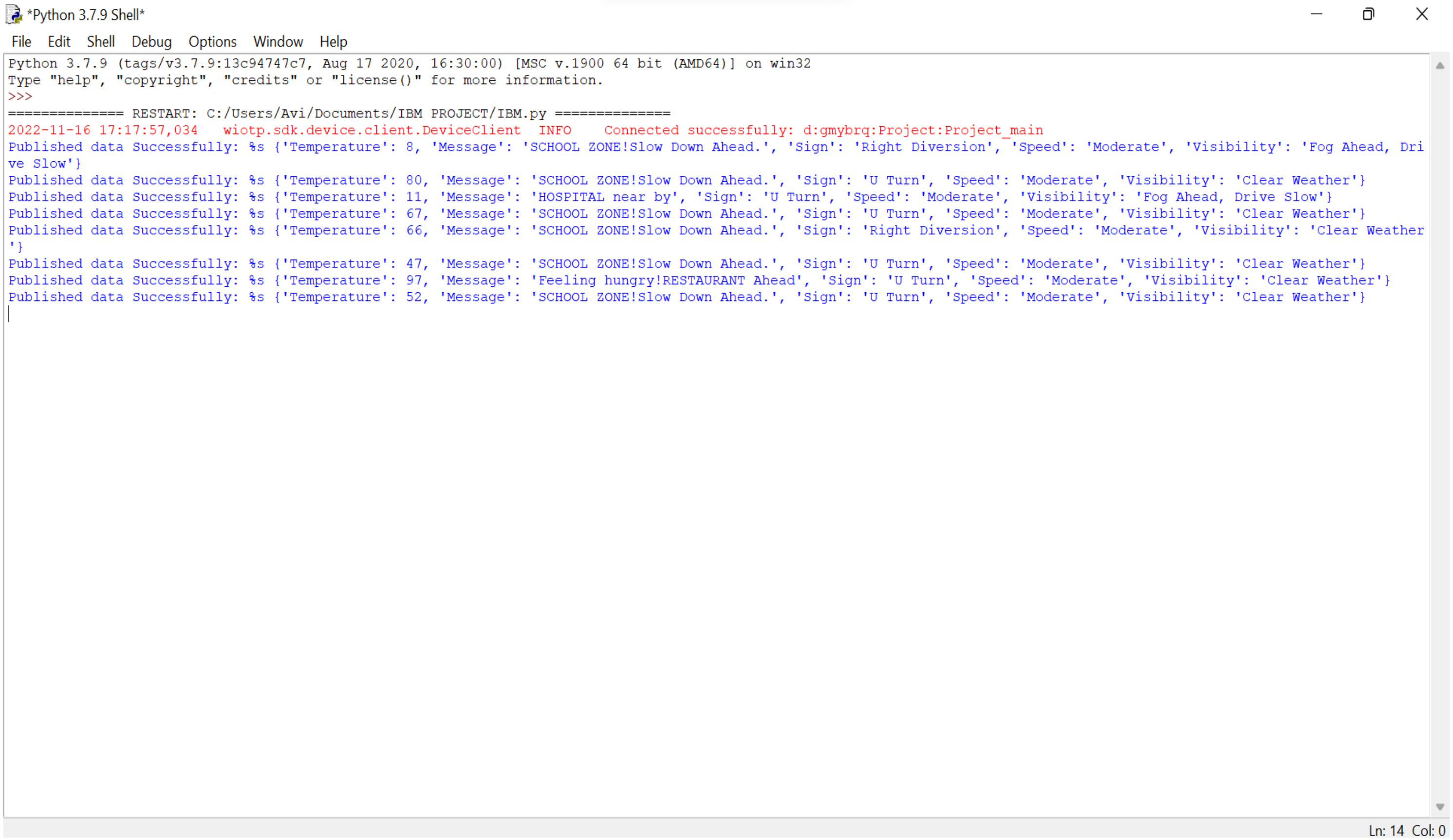
Client.disconnect()

7.2.Feature(2)



```
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 "
```

Output:

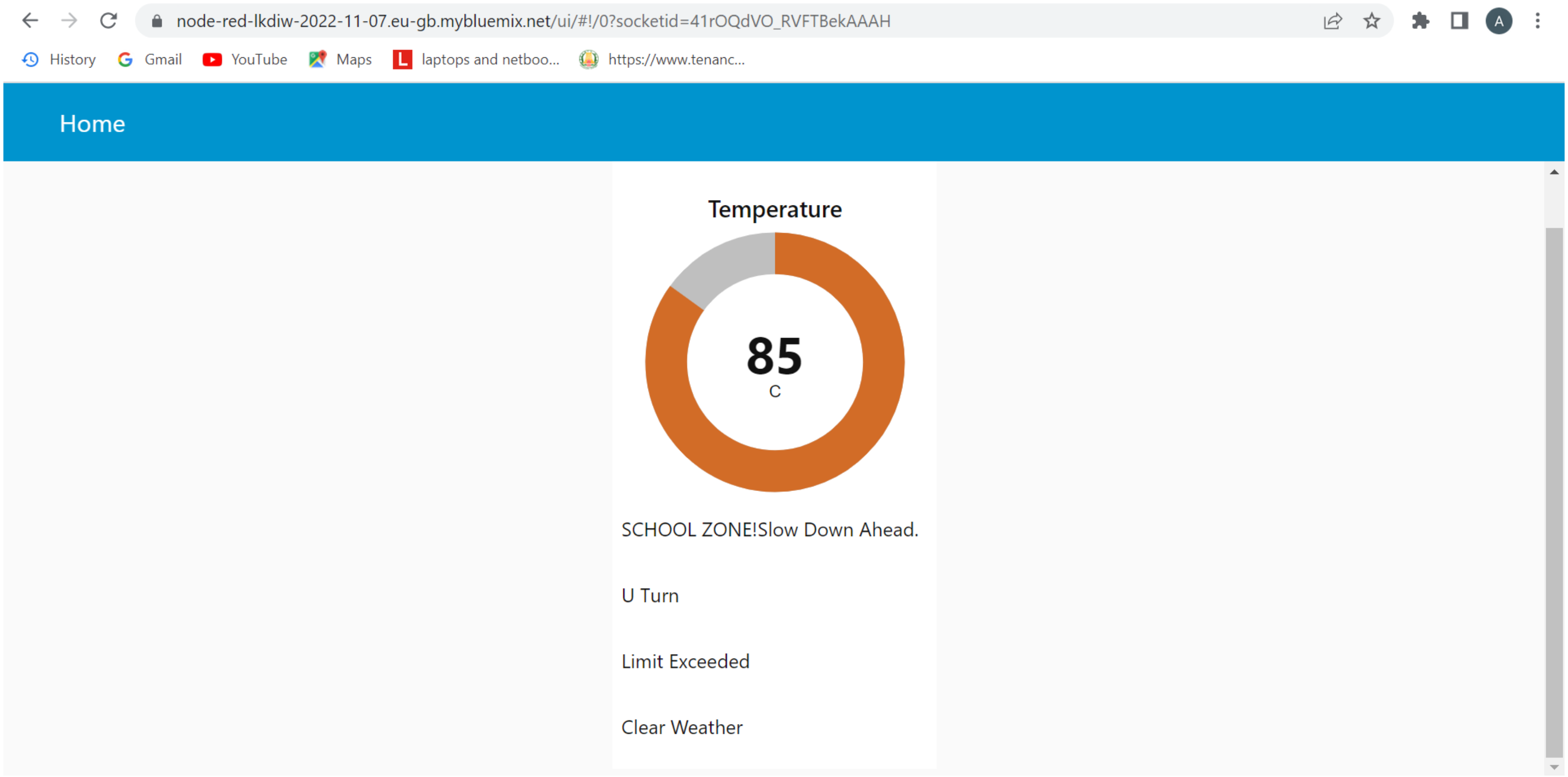


```
Python 3.7.9 (tags/v3.7.9:13c94747c7, Aug 17 2020, 16:30:00) [MSC v.1900 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>> 
============== RESTART: C:/Users/Avi/Documents/IBM PROJECT/IBM.py ==============
2022-11-16 17:17:57,034   wiotp.sdk.device.client.DeviceClient  INFO    Connected successfully: d:gmybrq:Project:Project_main
Published data Successfully: %s {'Temperature': 8, 'Message': 'SCHOOL ZONE!Slow Down Ahead.', 'Sign': 'Right Diversion', 'Speed': 'Moderate', 'Visibility': 'Fog Ahead, Dri
ve Slow'}
Published data Successfully: %s {'Temperature': 80, 'Message': 'SCHOOL ZONE!Slow Down Ahead.', 'Sign': 'U Turn', 'Speed': 'Moderate', 'Visibility': 'Clear Weather'}
Published data Successfully: %s {'Temperature': 11, 'Message': 'HOSPITAL near by', 'Sign': 'U Turn', 'Speed': 'Moderate', 'Visibility': 'Fog Ahead, Drive Slow'}
Published data Successfully: %s {'Temperature': 67, 'Message': 'SCHOOL ZONE!Slow Down Ahead.', 'Sign': 'U Turn', 'Speed': 'Moderate', 'Visibility': 'Clear Weather'}
Published data Successfully: %s {'Temperature': 66, 'Message': 'SCHOOL ZONE!Slow Down Ahead.', 'Sign': 'Right Diversion', 'Speed': 'Moderate', 'Visibility': 'Clear Weather
'}
Published data Successfully: %s {'Temperature': 47, 'Message': 'SCHOOL ZONE!Slow Down Ahead.', 'Sign': 'U Turn', 'Speed': 'Moderate', 'Visibility': 'Clear Weather'}
Published data Successfully: %s {'Temperature': 97, 'Message': 'Feeling hungry!RESTAURANT Ahead', 'Sign': 'U Turn', 'Speed': 'Moderate', 'Visibility': 'Clear Weather'}
Published data Successfully: %s {'Temperature': 52, 'Message': 'SCHOOL ZONE!Slow Down Ahead.', 'Sign': 'U Turn', 'Speed': 'Moderate', 'Visibility': 'Clear Weather'}
```

8.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).

8.1. Test Cases:


node-red-lkdiw-2022-11-07.eu-gb.mybluemix.net/ui/#!/0?socketid=41rOQdVO_RVFTBekAAAH
History
Gmail
YouTube
Maps
laptops and netboo...
https://www.tenanc...
Home
Temperature
85
C

SCHOOL ZONE!Slow Down Ahead.

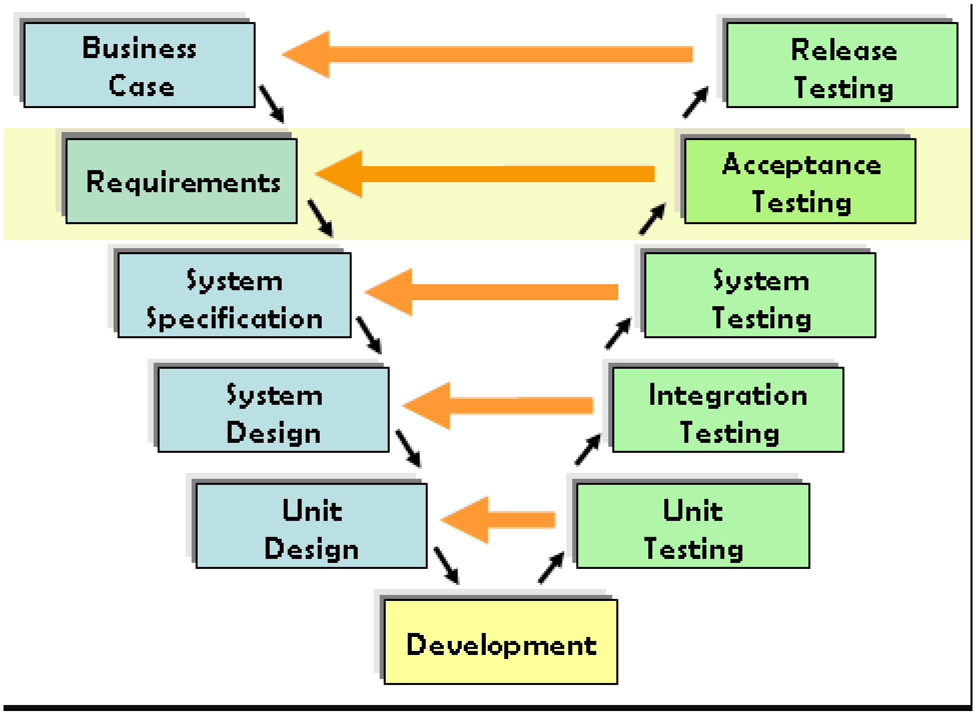
U Turn

Limit Exceeded

Clear Weather

8.2.User Acceptance Testing:

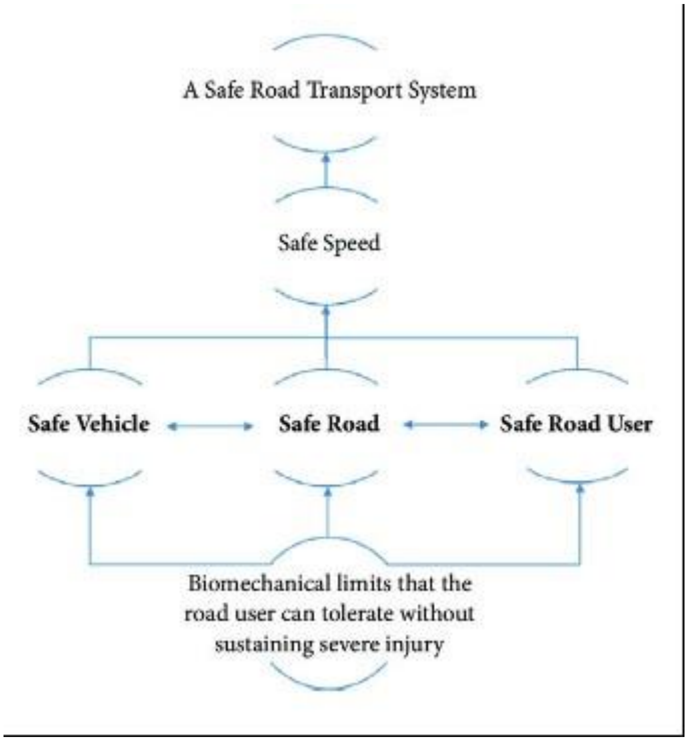
UAT consists, in practice, of people from the target audience using the application. The defects they find are then reported and fixed. This scenario is what most closely resembles "the real world." The process allows users to "get their hands dirty" with the application. They can see if things work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

9.RESULTS:

9.1.Performance Metrics:


A Safe Road Transport System
Safe Speed
Safe Vehicle
Safe Road
Safe Road User
Biomechanical limits that the road user can tolerate without sustaining severe injury

10.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)

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 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.

12.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.

13.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",
      "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()
```

GitHub & Project Demo Link :

https://github.com/IBM-EPBL/IBM-Project-29724-1660128910

Demo Link :

https://youtu.be/vc8WzDsGjns