

PROJECT REPORT

SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

SUBMITTED BY PNT2022TMID47389

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CONTENTS

1.INTRODUCTION

1.1Project Overview

1.2Purpose

1. LITERATURESURVEY

Existing problem

References

Problem Statement Definition

2. IDEATION & PROPOSEDSOLUTION

Empathy Map Canvas

Ideation &Brainstorming

Proposed Solution

Problem Solution fit

3. REQUIREMENTANALYSIS

Functional requirement

Non-Functional requirements

4. PROJECTDESIGN

Data Flow Diagrams

Solution & Technical Architecture

User Stories

5. PROJECT PLANNING &SCHEDULING

Sprint Planning & Estimation

Sprint Delivery Schedule

Reports from JIRA

6. CODING & SOLUTIONING (Explain the features added in the project along with code)

Feature 1

Feature 2

Database Schema (if Applicable)

7. TESTING

Test Cases

User Acceptance Testing

8. RESULTS

Performance Metrics

9. ADVANTAGES & DISADVANTAGES

10. CONCLUSION

11. FUTURE SCOPE

13. APPENDIX Source Code GitHub & Project Demo Link

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

A brief survey on the state of the art related to pre-accident as well as post-accident models, frameworks, and techniques;

1. Identification and reporting of limitation sin previous studies related to accident detection;
2. The concept of a smart road with an event-sensing capability, plus implementation and testing through variousexperiments;
3. Demonstration of an ewand 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.

1.2Purpose:

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. 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:

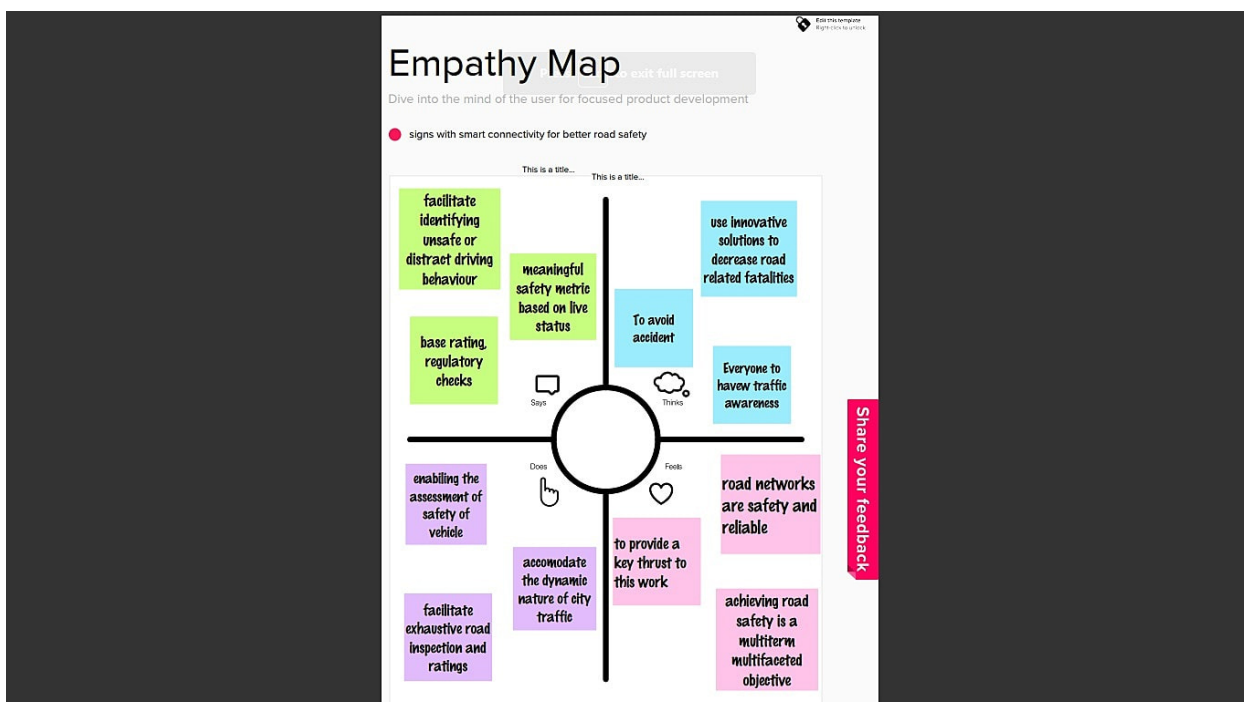
1. World Health Organization, "Global status report on road safety 2015,"https://www.who.int/violence_injury_prevention/road_safety_status/2015/en/. View at: [Google Scholar](#)
2. World Health Organization, "Decade of Action for Road Safety 2011-2020 seeks to save millions of lives,"
http://www.who.int/roadsafety/decade_of_action/en/. 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 Health Organization, "SaveLIVES-A road safety technical package," 2017. View at: [Google Scholar](#)
5. W. E. Marshall, "Understanding international road safety disparities: Why is Australia so much safer than the United States?" *Accident Analysis & Prevention*, vol. 111, pp. 251–265, 2018. View at: [Publisher Site](#) | [Google Scholar](#)
6. "Open Street Maps, with New York County highlighted,"
<https://www.openstreetmap.org/relation/2552485>. 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 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:

Empathy Map Canvas:



Ideation & Brainstorming:

Problem-Solution Fit canvas

Purpose / Vision

Version:

<div>1. CUSTOMER SEGMENT(S)</div> <div>CS</div> <div>Senior citizens, Working Professionals</div>	<div>6. CUSTOMER LIMITATIONS</div> <div>EG. BUDGET, DEVICES</div> <div>CL</div> <div>Security, Network Connection</div>	<div>5. AVAILABLE SOLUTIONS</div> <div>PROS & CONS</div> <div>AS</div> <div>App for ticket booking</div>
<div>2. PROBLEMS / PAINS</div> <div>+ ITS FREQUENCY</div> <div>PR</div> <div>Ticket Booking becomes easy</div>	<div>9. PROBLEM ROOT / CAUSE</div> <div>RC</div> <div>People can't wait to book ticket for so long time.</div>	<div>7. BEHAVIOR</div> <div>+ ITS INTENSITY</div> <div>BE</div> <div>Know how to use the app or scan using QR.</div>
<div>3. TRIGGERS TO ACT</div> <div>TR</div> <div>Advertisements, Promotions</div>	<div>10. YOUR SOLUTION</div> <div>SL</div> <div>QR scanner for ticket booking, checking makes it easy</div>	<div>8. CHANNELS of BEHAVIOR</div> <div>CH</div> <div>ONLINE Website activities</div> <div>OFFLINE Usage of ticket after download</div>
<div>4. EMOTIONS</div> <div>BEFORE / AFTER</div> <div>EM</div> <div>After this solution, saving time and easy booking of ticket</div>		

Proposed Solution:

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

S.No.	Parameter	Description
1.	Problem Statement (Problem at 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 interface which 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 with proper efficiency.

4.REQUIREMENT ANALYSIS:

Functional requirement:

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

Non-Functional requirements:

FR No.	Non-Functional Requirement	<u>Description</u>
NFR-1	<u>Usability</u>	It should be able to Upgrade and Update when there is a need for it.
NFR-2	<u>Security</u>	It should have good security system so that no other person is able to hack and display their own directions.
NFR-3	<u>Reliability</u>	It should be able to display to information correctly and error-free.
NFR-4	<u>Performance</u>	It should be able to automatically update itself when certain weather or traffic problem occurs.
NFR-5	<u>Availability</u>	It should be available 24/7 so that it can be beneficial to the customer i.e the driver.
NFR-6	<u>Scalability</u>	It should be able to easily change and upgrade according to change and need in requirement.

3.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 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:

III. SYSTEM ARCHITECTURE

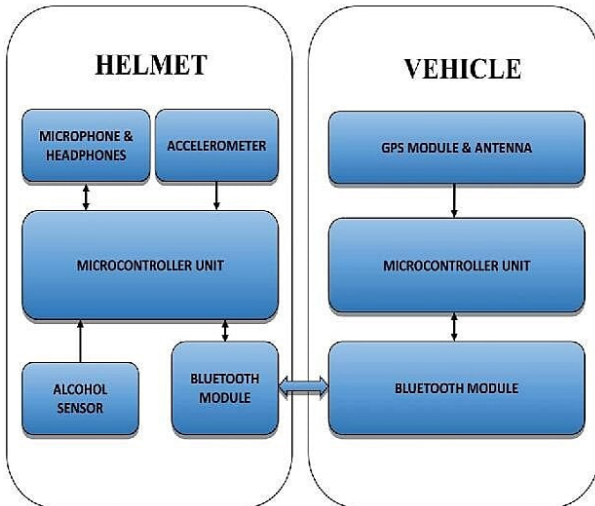


Fig. 1. Block Diagram of Proposed method

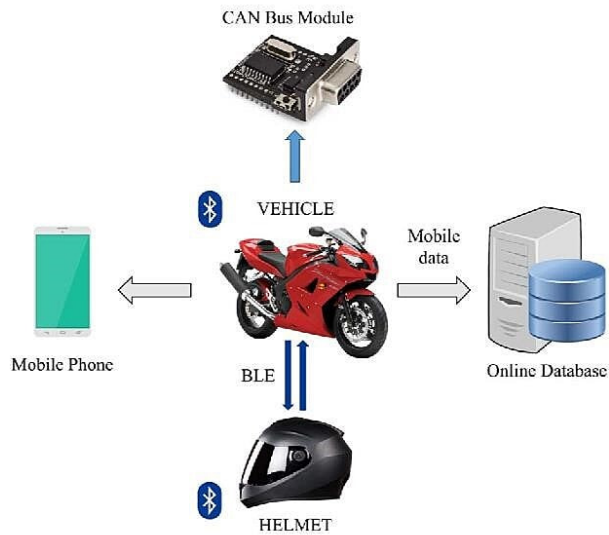


Fig. 2. System Architecture

Userstories:

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

User Type	Functional Requirement (Epic)	User Story Number	UserStory/Task	Acceptancecriteria	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

			entering my email, password, and confirming my password	dashboard		
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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 Number	User Story/Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	VIDHYA SHREE R
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	NACHAMMS
Sprint-1		USN-3	As a user, I can register for the application through Facebook	2	Low	JANANI T
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	VIDHYAS R

Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	VIDHYASR
Sprint-1	Dashboard	USN-6	As a user, I can log into the application by entering email & password and access all the resources and services available	2	High	VIDHYASR

Project Tracker, Velocity & Burndown Chart:

TITLE	DESCRIPTION	DATE
Literature Survey&InformationGathering	A literature review is a comprehensive summary of previous researches on the topic. The literature review surveys scholarly articles, books, and other sources relevant to a particular area of research.	3September2022
PrepareEmpathyMap	An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. It helps us to understand the customers' pain, gain and difficulties from their point of view.	10September2022

Solution Architecture	Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. It helped us understand the features and components used to complete the project.	1 October 2022
Customer journey map	It helped to analyse the various steps, interactions, goals and motivation, positives, negatives and opportunities.	7 October 2022
Solution requirements	It briefs about functional and non-functional requirements. It involves the various steps in the entire process. It also specifies features, usability, security, reliability, performance, availability and scalability.	12 October 2022
Technology stack	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 need to be implemented in the project.	15 October 2022

Solution Architecture	Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. It helped us understand the features and components used to complete the project.	1 October 2022
Dataflow	A Data Flow Diagram (DFD) is a traditional visual representation of	11 October 2022
	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.	
Sprint Delivery plan	Sprint Planning is an event in scrum that defines what can be delivered in the upcoming sprint and how that work will be achieved. It helps us to organise and complete the work effectively and efficiently.	22 October 2022
Prepare milestone and activity list	Helps us understand and evaluate our progress and accuracy so far.	23 October 2022

Solution Architecture	Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. It helped us understand the features and components used to complete the project.	1 October 2022
Project Development Delivery of Sprint-1	Develop and submit the developed code by testing it.	7 november 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 and Testing:

Feature 1 (coding and result):

Feature

2: 8. CODING AND SOLUTIONS

CODE

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

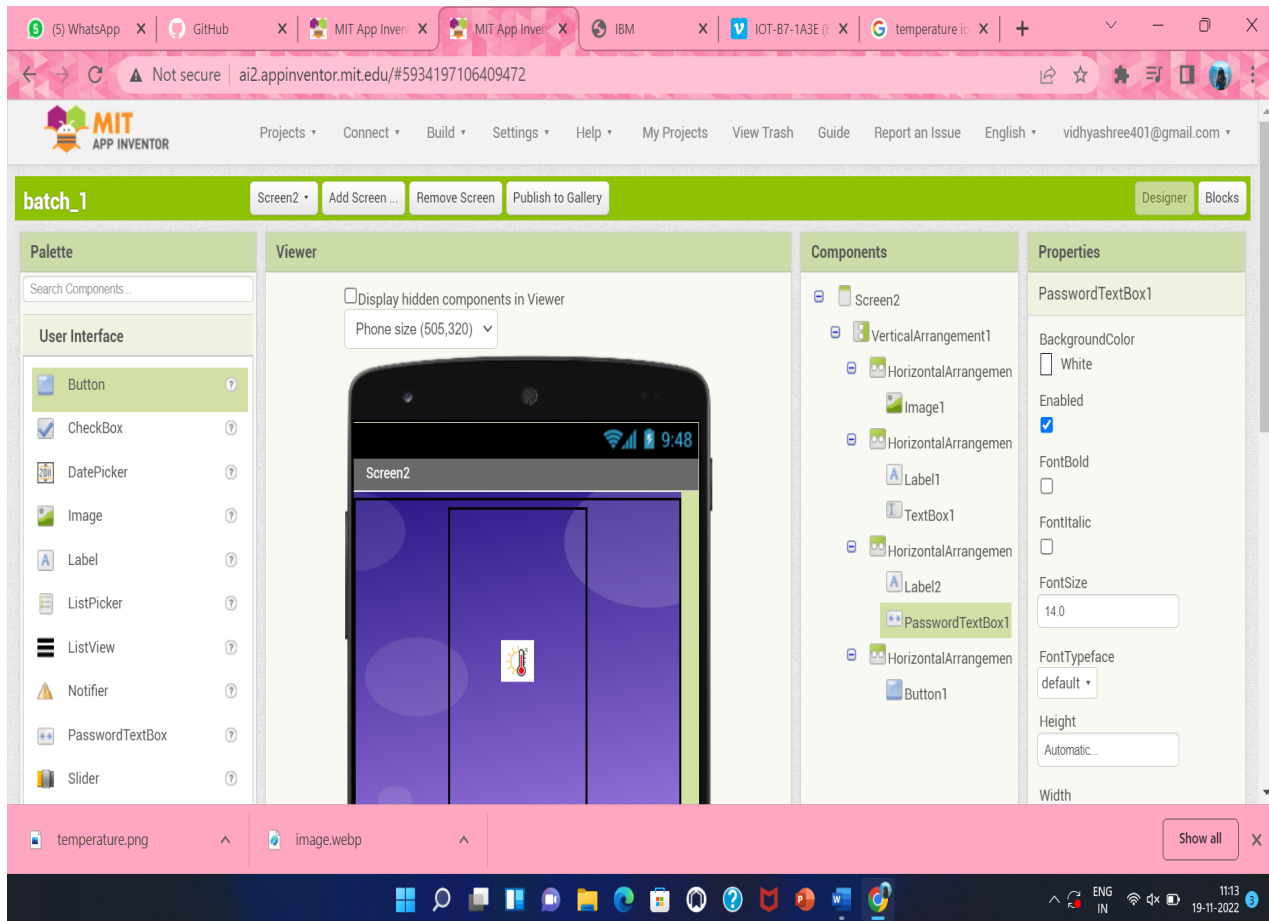
myConfig = {
    "identity": {
        "orgId": "h99ntm",
        "typeId": "Vss",
        "deviceId": "321"
    },
    "auth": {
        "token": "6369435045 "
    }
}

def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

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

MIT APP INVENTOR: ICON PAGE:



MIT APP INVENTOR

batch_1

Screen1 Add Screen ... Remove Screen Publish to Gallery Designer Blocks

Blocks

- Built-in
 - Control
 - Logic
 - Math
 - Text
 - Lists
 - Dictionaries
 - Colors
 - Variables
 - Procedures
- Screen1
 - VerticalArrangement1
 - Image1
 - button_get_weather
 - Label1
 - Label4
 - Label3

Viewer

when button_get_weather .Click

do call Web1 .Get

0 0

Show Warnings

15:49 19-11-2022

Blocks

Built-in

Control

Logic

Math

Text

Lists

Dictionaries

Colors

Variables

Procedures

Screen1

VerticalArrangement1

Image1

button_get_weather

Label_temp

Label_humidity

Label3

Rename

Delete

Viewer

when button_get_weather Click

do

set Web1 Uri to https://api.openweathermap.org/data/2.5/weather?...

call Web1 Get

when Web1 GotText

uri responseCode responseType responseContent

do

if get responseCode = 200

then

set Label_temp Text to look up in pairs key temp

look up in pairs key main

call Web1 JsonTextDecode jsonText get responseContent

notFound not found

set Label_humidity Text to look up in pairs key humidity

look up in pairs key main

call Web1 JsonTextDecode jsonText get responseContent

notFound not found

else

set Label_temp Text to could not access web server

0

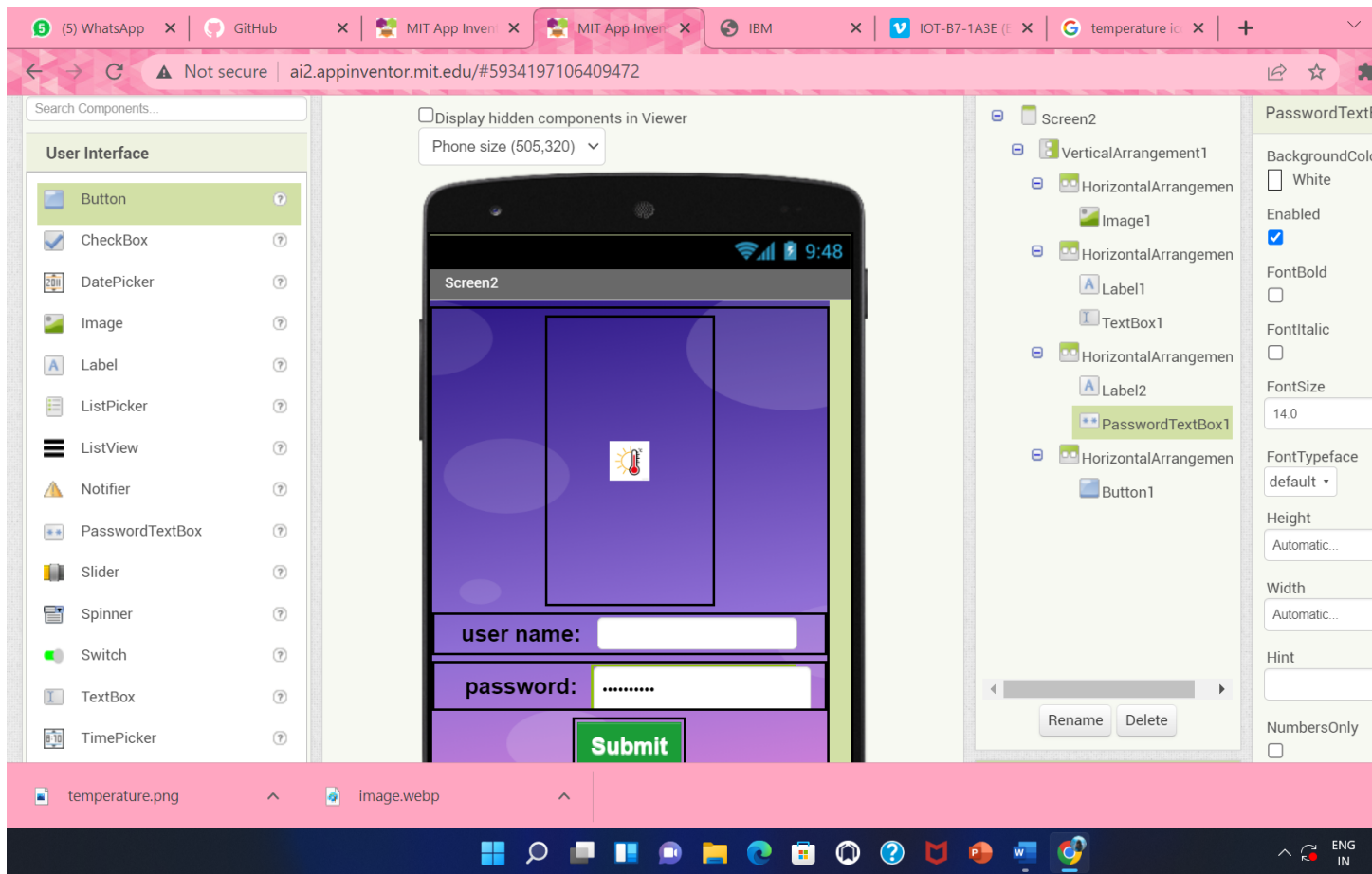
0

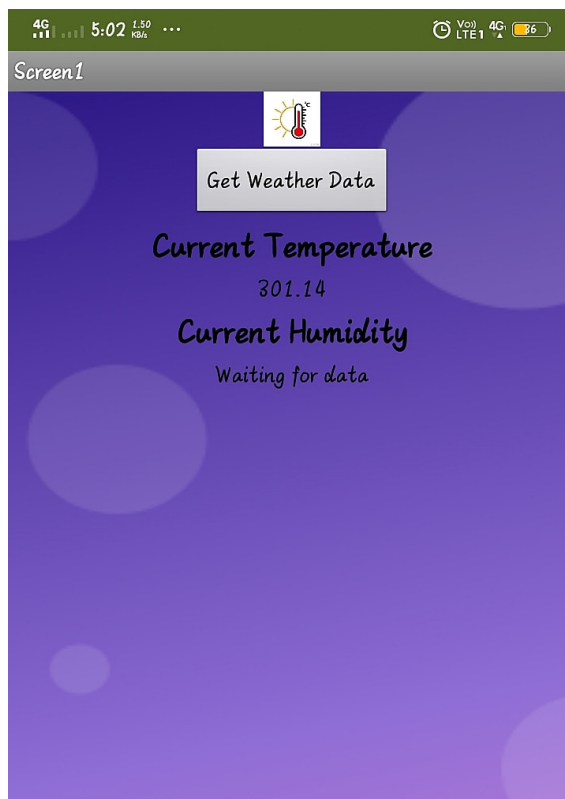
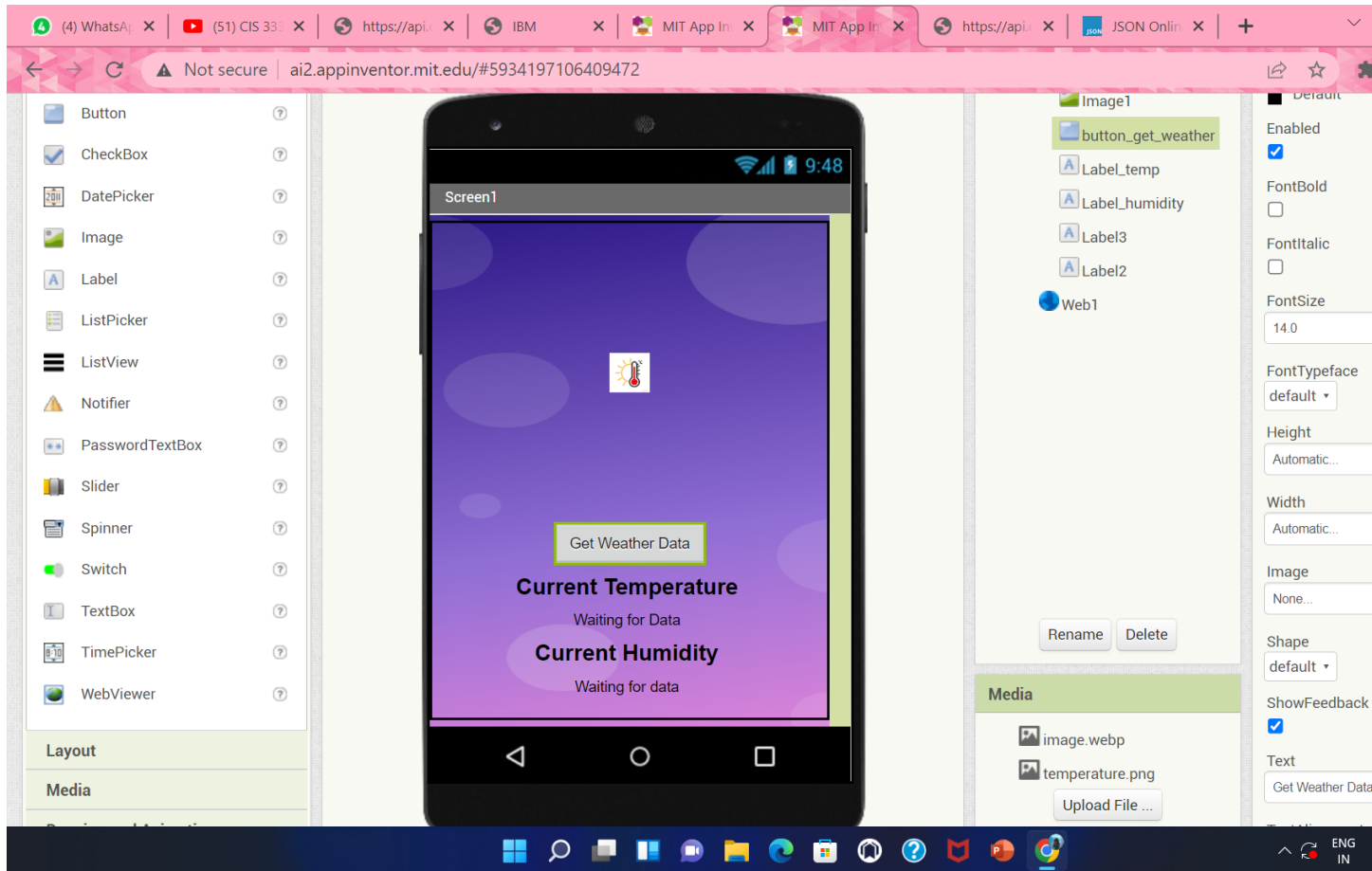
Show Warnings

Media

Windows Taskbar

ENG IN





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).

Testcases:

UI: <https://node-red-clyee-2022-11-10.eu-gb.mybluemix.net/red/#flow/795883c0b9b2336b>

IBM Cloud

Node-RED : node-red-clyee-2022-11-10.eu-gb.mybluemix.net

Node-RED Dashboard

IBM Watson IoT Platform

node-red-clyee-2022-11-10.eu-gb.mybluemix.net/red/#flow/795883c0b9b2336b

GmailYouTubeMapsNews

Node-RED

Successfully deployed
You have some unused configuration nodes. Click here to see them

filter nodes

switch

slider

numeric

text input

date picker

colour picker

form

text

gauge

chart

audio out

notification

ui control

template

Flow 1

IBM IoT

connected

Temp

speed

Message

visibility

sign

msg.payload

Temperature

speed

Message

Visibility

sign

dashboard

LayoutSite

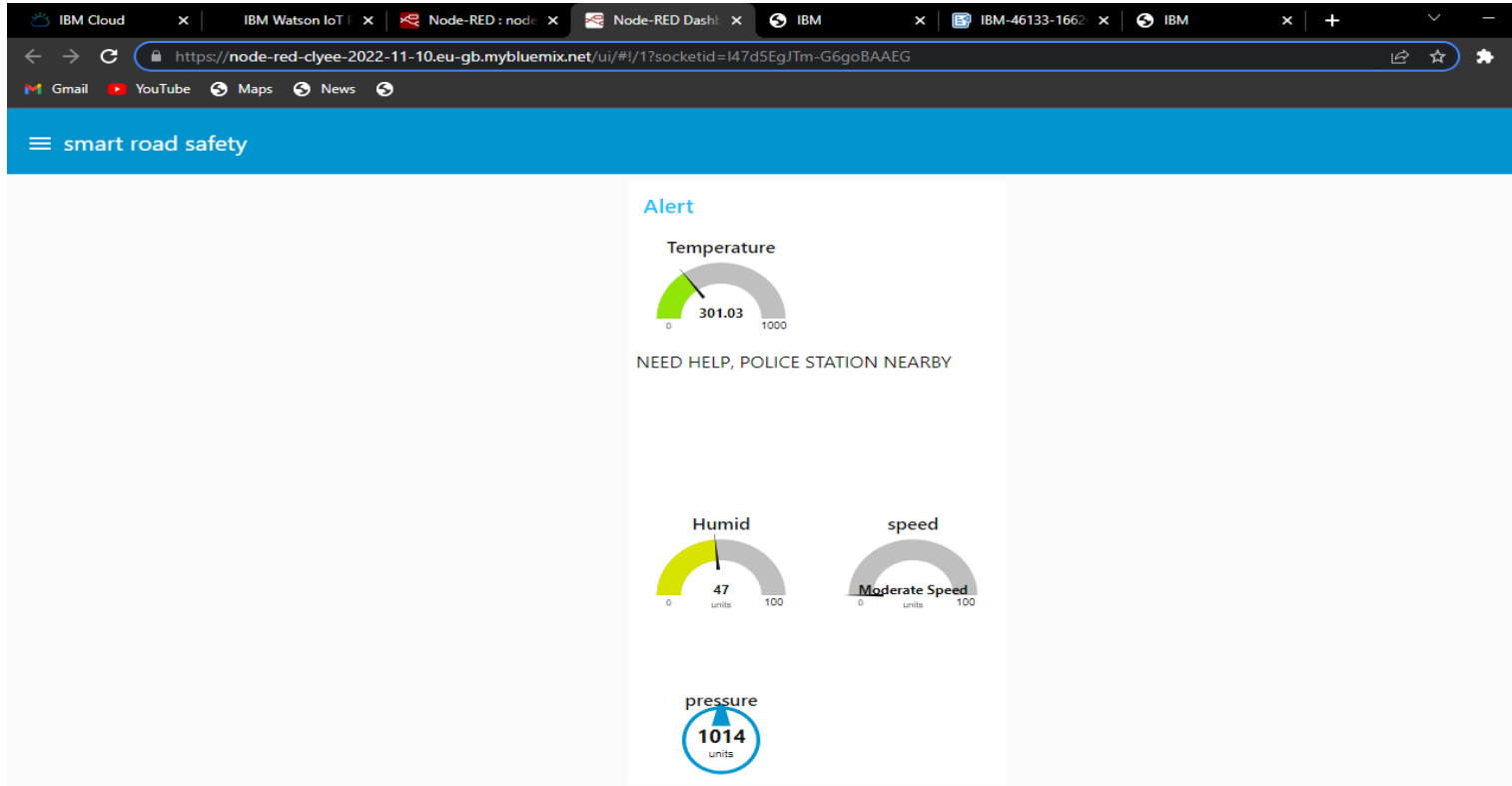
Tabs & Links

smart road

sign

smart road

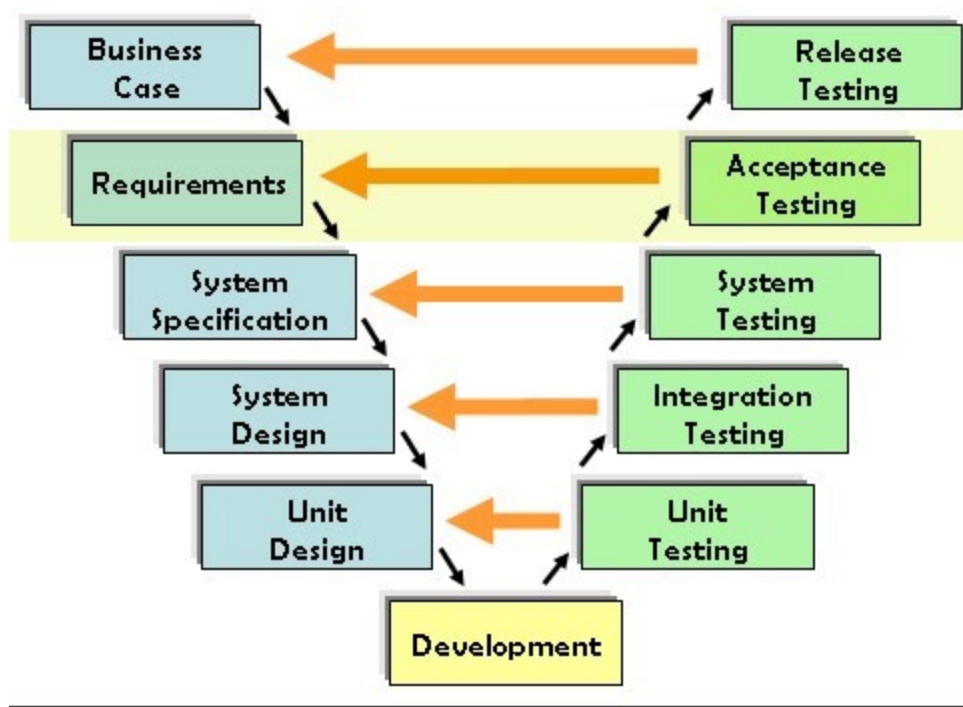
https://node-red-clyee-2022-11-10.eu-gb.mybluemix.net/red/#



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

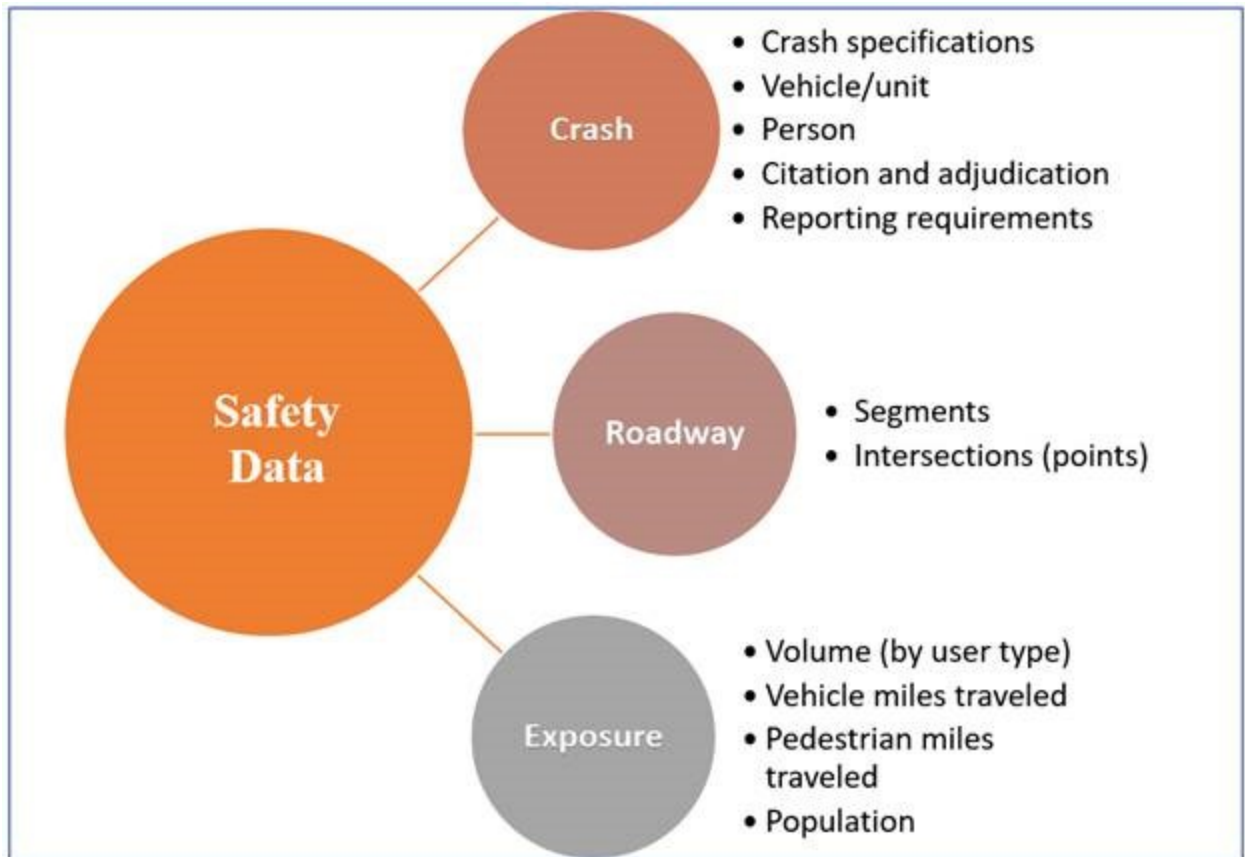
“get their hands dirty” with the application. They can see if things work as intended.



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:

Performance Metrics:



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.
- 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.
- 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.

Disadvantages:

Just like anything else, there are also disadvantages. You should note that these signals may not be a solution to various problems that occur in road intersections. For instance, an unwarranted signal can affect the efficiency and safety of the traffic. This means that it can cause these disadvantages:

- Some drivers disobey these signals
- Increasing traffic congestion, air pollution, and fuel consumption
- Increase in use of less-adequate roads to avoid traffic signs
- Excessive delay due to time allocated by the traffic signals

Nowadays, you will find the traffic signs nearly everywhere. They have been found to be effective in certain areas where the traffic flow is quite heavy. For instance, you can see them in loading bays and site entrances.

CONCLUSION:

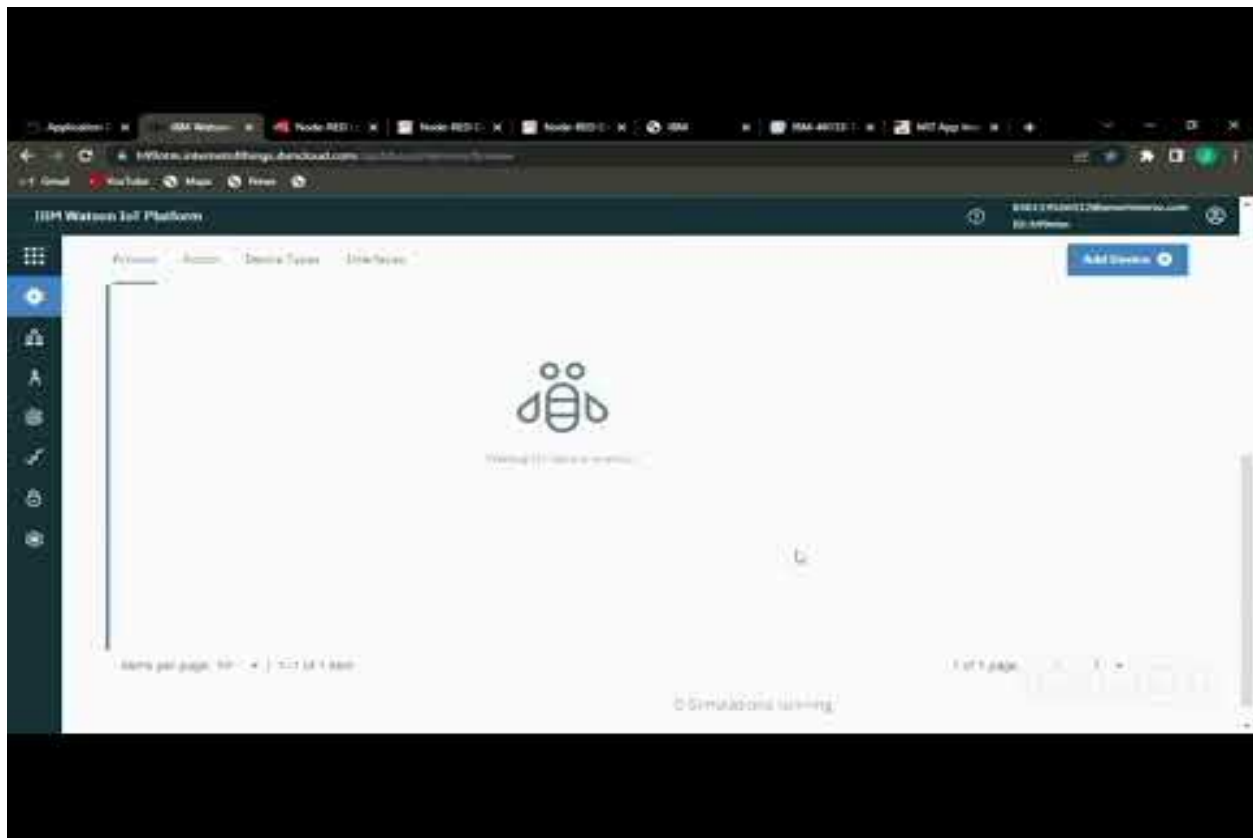
The world doesn't change on its own but we humans can make it safer, better, and harmless. Since the road isn't said to be safe let's make it safer with the technologies present and available to us. The Internet of Things is one of the technologies that can lead us to travel on enhanced safe roads. So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

FUTURESCOPE:

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 design 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.

1. APPENDIX:

DEMO LINK



GitHub Link :

<https://github.com/IBM-EPBL/IBM-Project-46133-1660739292>

