SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

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CHAPTER 1

INTRODUCTION

BACKGROUND

The main means of connecting cities and villages are roads. Due to how convenient driving is, vehicles are now the primary mode of transportation. The expanding number of automobiles on the roadways has raised the likelihood of vehicle accidents. One never knows what will happen on the road on a trip, especially in bad weather (BWC). Driving might be challenging in this circumstance because to poor sight, which could result in an accident. Additionally, it was discovered that in BWC, delays in getting information about an occurrence can lead to multiple vehicle collisions (MVCs). According to one analysis by the Islamabad police, there were 11,317 vehicles involved in 9582 accidents nationwide in Pakistan between 2016 and 2017.

Road safety regulations are changing as a result of digital technology like the Internet of Things (IoT). Around the world, numerous technological projects are being done to create smarter, safer roadways that can communicate with both vehicles and pedestrians. Several technology-based solutions have been developed upon the presumption that accidents can be avoided by providing the driver with information about vehicle technology. Researchers are developing the newest technology, which is based on the Internet of Things (IoT). Data is the central theme. The world is starting to value data as a resource.

IoT has been embraced by many sectors and companies to improve communication, manufacturing, energy, and health care performance while reducing errors. In its "Save LIVES: Road Safety Technical Package," the WHO lists various actions that can be taken with little financial impact. Realizing economic systems for "monitoring road safety by strengthening data systems" is a cornerstone of these measures. A major focus of the package is encouraging the adoption of the Safe System approach, a comprehensive strategy for improving road safety that differs from conventional management approaches by emphasising 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 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.

If an incident is not reported to an EOC in a timely manner, there may be an increased risk of fatalities, injuries, and other harm. By delivering timely accident information via an automated process, lives can be saved. Additionally, an alarm system and speedy car collision detection are needed to safeguard approaching automobiles from an MVC. In order to prevent accidents, a number of strategies have been implemented in advanced vehicles (Avs). A threat of an accident is identified using either smartphone sensors or sensors fitted in automobiles. Accelerometers, smoke detectors, IR obstacle sensors, proximity sensors, and biosensors have all been employed by earlier researchers to identify accidents.

1.1 PROJECT OVERVIEW

The main goal of this project is to assist people in automating the roads by giving them access to a Web App that allows them to track road conditions like temperature, speed limit, and visibility. Additionally, they provide services for displaying signage for restaurants, hospitals, and school guides.

1.2. PURPOSE

Many scholars and practitioners are engaged in extensive research in the areas of accident prevention and accident alarms. Numerous methods are used to improve safety in order to prevent accidents. The literature on accident detection and avoidance is divided into stand-alone, cooperative, and hybrid approaches for convenience of reference. For accident avoidance and detection, stand-alone systems use sensors like radar and light detection and ranging (LiDAR), whereas cooperative approaches rely on V2X technology and hybrid approaches.

CHAPTER 2

LITERATURE SURVEY

ABSTRACT

The speed limits and road signage in use today are static. However, under specific circumstances, the signs may be modified. If there are road diversions brought on by high traffic or accidents, we can take those into consideration and, if the signs are digital, modify them to reflect the situation. This idea suggests a system with dynamically changing signs on digital signboards. If it rains, the roads will become slick and the speed limit will be lowered. There is a web program that you may use to enter information on road diversions, accident-prone areas, and information sign boards. The signboards appropriately retrieve and show this data.

INTRODUCTION:

For the purpose of identifying accidents using video footage, an automated deep learning (DL)-based system was created. The method uses temporally ordered graphic elements to represent traffic crashes. As a result, the model architecture is made up of two phases: transitory pattern detection and visual characteristics extraction. During the training stage, visual and temporal features are learned using convolution and recurrent layers. An accuracy of 98% was achieved in the detection of accidents in public traffic accident datasets, revealing a great potential for detection independent of the road structure. Motorbike, bicycle, and pedestrian crashes are excluded from the solution. Additionally, the model is inaccurate when determining accident segments in low-light conditions (like at night) and when there are occlusions.

In, a proposal for an accident management system that uses cellular technology in public transportation was made. With the help of this technique, diverse parts, like those found in ambulances, RSUs, and servers, can communicate with one another. Additionally, an optimal route-planning algorithm (ORPA) is suggested for this system to improve aggregate spatial usage of road networks while reducing the cost of operating a vehicle. Simulations were used to assess the ORPA, and the results were contrasted with those of other recent algorithms. The suggested approach can also be utilized to provide quick routes for ambulances in busy regions. All vehicles, including ambulances, must be equipped with a route indication and have remote correspondence capability. According to the evaluation, the ORPA performed better in terms of average speed and journey time.

2.1. EXISTING PROBLEM

The Safe System Approach

The "Safe Road Transport System" model created by the Swedish Transport Agency is where the Safe System (SS) approach to transportation networks got its start. The method essentially shifts away from the perspective that accidents are mostly and automatically the

driver's fault in favor of a perspective that finds and assesses the real causes of accidents. By dividing safety into the three categories of vehicle, road, and road user safety, SS reduces fatalities and injuries by regulating speeds and permitting quick emergency response. The WHO is presently using the model as a foundation for planning, policy-making, and enforcement of road safety because it has been extensively embraced since its introduction.

2.2. REFERNECE:

1.World Health Organization, "Global status report on road safety 2015" https://www.who.int/publications/i/item/9789241565684. View at: Google Scholar

2.Global Alliance of NGOs for road safety, "Decade of Action For Road Safety 2011-2030 seeks to save millions of lives", https://www.roadsafetyngos.org/what-we-do/decade-of-action-for-road-safety-2011-2020/#:~:text=The%20second%20Decade%20of%20Action,injuries%20by%2050%25%20by%202030. View at: Publisher Site | Google Scholar.

3. Fred Wegman, https://www.sciencedirect.com/science/article/pii/S0386111216300103

"The Future of Road safety: A worldwide perspective," IATSS Research Volume 40, no.2, page no.66-71,2017

4.World Health Organization. "SAVE LIVES- A Road Safety Technical Package", https://www.who.int/publications/i/item/save-lives-a-road-safety-technical-package

View at: Google Scholar

5.Wesley.E. Marshall, "Understanding International road safety disparities: Why Austria is so much safer than United States?", Accident Analysis & Prevention, volume 111,page no:251-262,2018 https://www.sciencedirect.com/science/article/abs/pii/S000145751730427X

View at: Google Scholar

6.Efftronics, "Variable Message Sign" https://www.efftronics.com/variable-message-signage.

View at: Google Scholar

7. "International Road Assessment Programme (IRAP)", https://irap.org/.

8. Hany.M.Hassan, "Exploring the risk factor associated with the size and severity of roadway crash in Riyadh", Journal of Safety Research, Vol 47, pageno:67-74,2013

https://www.sciencedirect.com/science/article/abs/pii/S0022437513001503

Visit at: Google Scholar

9. Steve Admin "Digital Speed Signs: The key to a safe road transport system",

https://www.photonplay.com/blogs/Digital-Speed-Signs:-The-Key-to-a-Safe-Road-Transport-System

10.Eric M. Masatu “Development and Testing of Road Signs Alert System Using a Smart Mobile Phone”Volume 2022 Article ID:5289607 https://doi.org/10.1155/2022/5829607

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.

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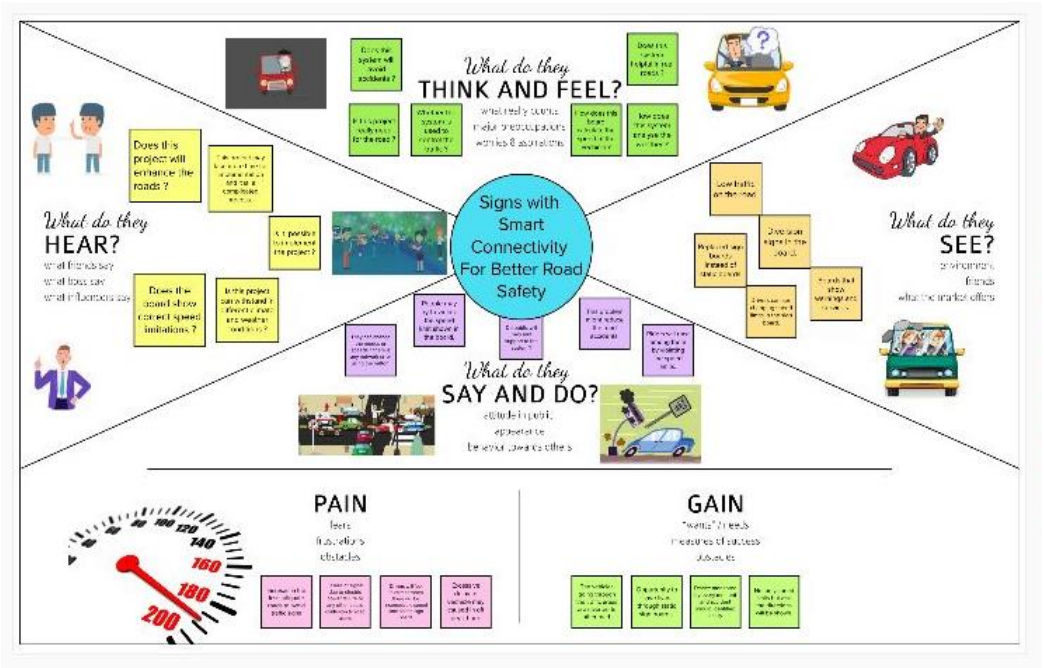
CHAPTER-3

IDEATION & PROPOSED SOLUTION

3.1. EMPATHY MAP CANVAS:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

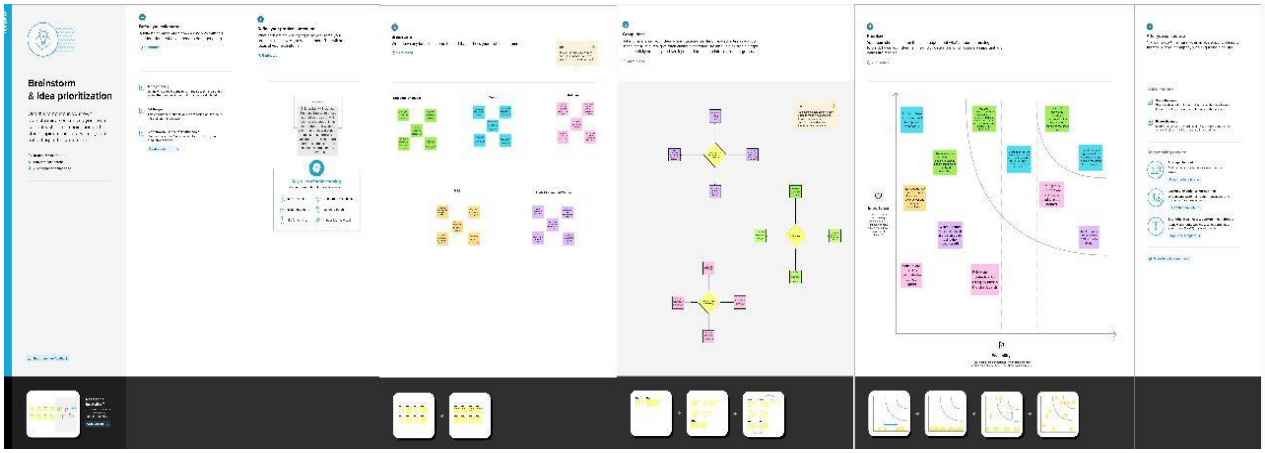
It is a useful tool to helps teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2. IDEATION & BRAINSTORMING

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

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



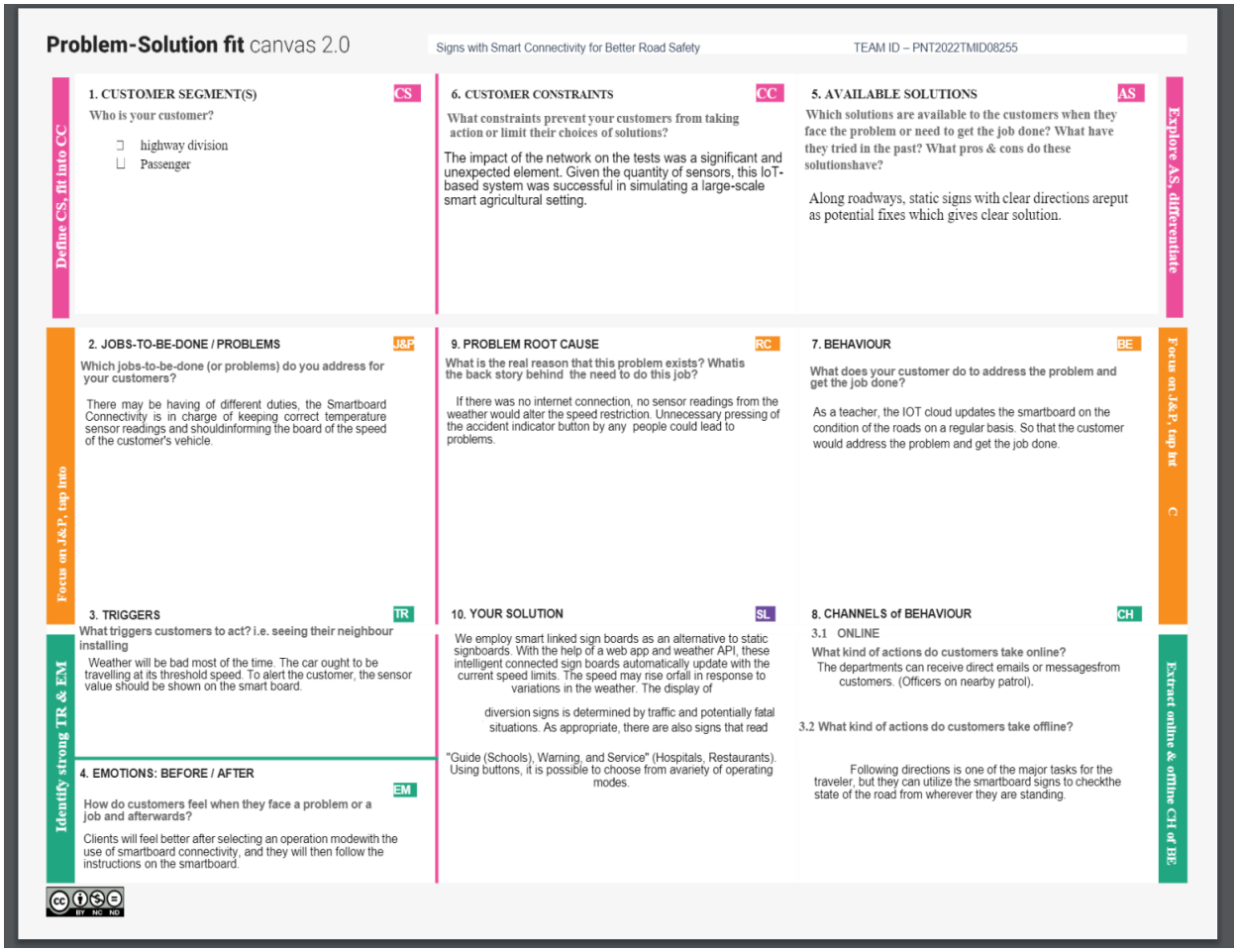
3.3. PROPOSED SOLUTION:

Project Team shall fill the following information in proposed solution template

S. No	Parameter	Description
1.	Problem Statement (Problem to be solved)	• The actual problem is thst drivers are unable to know whether the road conditions is safe to travel or not. • Hence there will be a need of guidance data for providing safety and to avoid travelling inconvenience to reach destination.
2.	Idea/Solution description	• This problem can be overcome by introducing the GPRS module, IR Sensor with Camera to sense the Traffic intensity even in dark areas. • Rain drop sensor to indicate the accumulation of rain has occurred. • And also collecting information from the local peoples and decision made by controller, who controls display manually (Manpower).
3.	Novelty/Uniqueness	• Voice indicators are placed in near, the display board location adjusted to that traffic signal area. It will indicate the road dangers to the public as it senses the nearby vehicles. • Speed limit changes according to the weather condition using rain drop sensor.

4.	Social Impact/Customer Satisfaction	• Large number of accidents may be minimized by replacing smart signs instead of static signs. • Obvious information only displayed. • Repots severity. • Sign changes dynamically depending upon the upcoming events.
5.	Business Model (Revenue Model)	• Systematic reduces manpower. • The systems can be used in public and private sectors which gives good revenue. • This type of system is helpful for education and medical institutions.
6.	Scalability of the Solution	• User friendly interface. • Accessibility of data is easy from source. • Precise information in sign boards can be easily captured.

3.4. PROBLEM SOLUTION FIT



CHAPTER 4

REQUIREMENTANALYSIS

4.1. FUNCTIONAL REQUIREMENT

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Visibility**	Sign Boards should be made with LED's which are bright 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	**User Need**	The smart sign boards should be placed frequently in places it is needed and less in places where it is not needed much to avoid confusion for the user during travel.
FR-3	**User Understanding**	For better understanding of the driver, the signs should be big, clear and legible and it can also include illustrations which will make it easily understandable to the driver.
FR- 4	**User Convenience**	The display should be big enough that it should even be visible from far distance clearly
FR- 5	**Product Feedback**	Will be shared through a website via Gmail.

4.2. NON-FUNCTIONAL REQUIREMENTS

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

CHAPTER 5

PROJECT DESIGN

5.0. Definition

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 required graphically. It shows how data enters and leaves the system, what changes the information and where data is stored.

Data Flow Diagram – Signs with smart connectivity for better road safety

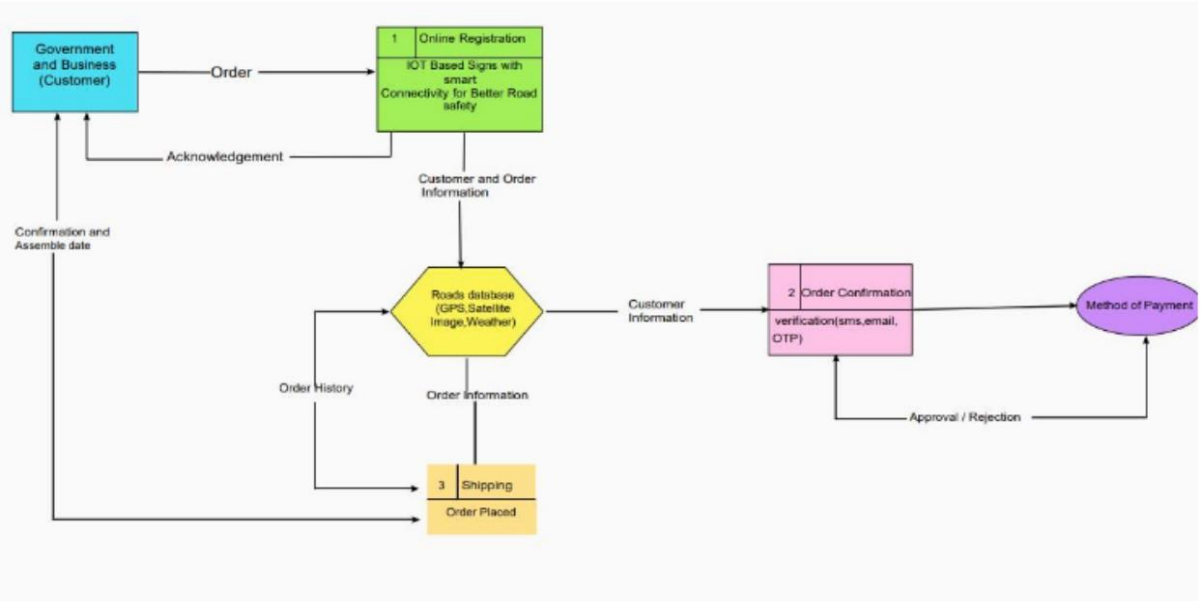


Fig 5.1. Data Flow Diagram

5.2. SOLUTION &TECHNICAL ARCHITECTURE

The deliverable shall include the architectural diagram as below and the information as per the table 1 & table 2.

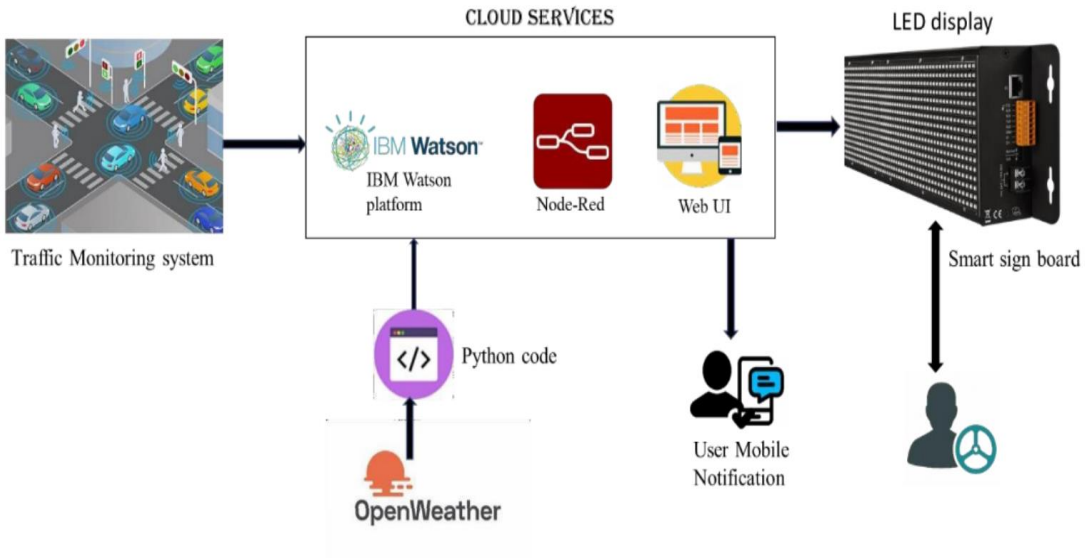


Fig 5.2. Solution & Technical Architecture

5.2.1. GUIDELINES

- To replace the static signboards, smart connected sign boards are used.
- These smart connected sign boards get the speed limitations from a web app using weather API and update automatically.
- Based on the weather changes the speed may increase or decrease.
- Based on the traffic and fatal situations the diversion signs are displayed.
- Guide(schools), warning and service (Hospitals, Restaurant) signs are also displayed accordingly.
- Different modes od operations can be selected with the help of buttons.

Table- 1: Components & Technologies

S. No	Component	Description	Technology
1.	User interface	How user interacts with application E g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript/ Angular Js/ React Js etc.
2.	Application Logic- 1	Logic for a process in the application	Java / Python
3.	Application Logic- 2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic- 3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configuration etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File Storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API- 1	Purpose of external API used in the application	IBM Weather AOI, etc.

Table- 2: Application Characteristics

S. No	Characteristics	Description	Technology
1.	Security Implementation	Strong security system that anyone without login credentials and hackers are not allowed to enter the network.	Firewall, Firebase, cyber resiliency strategy
2.	Scalable Architecture	Easy to expand the operating range by increasing the bandwidth of the network.	IoT, Internet
3.	Availability	Available anytime and everywhere 24/7 as long as the user is signed into the network.	IBM Cloud
4.	Performance	Supports a large number of users to access the technology simultaneously.	IBM Cloud

5.3. USER STORIES

Use the below template to list all 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	As a user, I can register for the application by entering my email, password and confirming my password	Access my account/ dashboard	High	Sprint- 1

Weather	Open Weather Map	USN- 2	As a user, I want to check the weather of that location	Get the weather of that location	High	Sprint- 1
IoT devices	Automation	USN- 3	As a user, I want to use IoT devices for automation purposes	Get the work done without manual effort	High	Sprint- 2
Python code	Random data	USN- 4	As a user, I want to give some input to the devices for performing some action to complete the tasks very easily	Get the data workflow	Medium	Sprint- 1
IBM Cloud	Cloud services	USN- 5	As a user, I want to deploy these application for public version	Useful for all domain users	High	Sprint- 1
Node-Red	Integration	USN- 6	As a user, I want to integrate the applications with hardware	To precise for linear workflow	Medium	Sprint- 3
Web UI	Interaction	USN- 7	As a user, I want to interact with the digital products	To interact with the users	Medium	Sprint- 2
Data validation	Checking accuracy	USN- 8	As a user, I can check the ability and accuracy of the model in obtaining the required information	Check the capability of the model	High	Sprint- 2
Data extraction	Obtaining the data	USN- 9	As a user, I can retrieve the result data from the application for data storage for further uses	Download the result in the form of data	High	Sprint- 3

CHAPTER 6

PROJECT PLANNING &SCHEDULING

6.1. 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	Dynamic implementation	USN- 1	As a traveller, it is essential for me to know the speed limit	7	High	Sangeeth Dhanapal V Saswin P Nikil R
Sprint-2	Sensor Implementation	USN- 2	As a traveller, I should concern in traffic density and road condition, pedestrian monitoring and controls traffic signals.	7	Low	Gokulnath N Sheik Mohammed Mishal Nikil R
Sprint-1	Weather speed limit	USN- 3	As a user, I should be aware of weather influence on speed limit of safer ride. Open weather API has to implement to monitor weather reports.	6	medium	Sangeeth Dhanapal V Saswin P Nikil R
Sprint-2	Safer Ride	USN- 4	As a user, I should have a hustle free journey.	12	Medium	Sangeeth Dhanapal V Gokulnath N Saswin P
Sprint-2	Transport Agency Registration	USN- 5	Register for getting approval to implement the smart sign boards for better road safety	8	Medium	Gokulnath N Nikil R Sheik Mohammed Mishal

Sprint-3	Login	USN- 6	As an administrator, I should have an account on the website.	7	Low	Sangeeth Dhanapal V Saswin P Gokulnath N
Sprint-3	dashboard	USN- 7	As an admin, I should be able to monitor and add sign nodes.	13	Medium	Nikil R Saswin P Sheik Mohammed Mishal
Sprint-4	Monitoring	USN- 8	As an admin, I must control and monitor the proper functioning of the sign through rarely required.	9	Low	Gokulnath N Sheik Mohammad Mishel Nikil R
Sprint-4	More accurate indications	USN- 9	As a user, as days pass by, more accurate guidance is needed.	4	Low	Nikil R Sangeeth Dhanapal V Sheik Mohammed Mishal
Sprint-4	Information sharing	USN- 10	Once the situation detected the user grt information via the original display who travels along the road.	7	High	Sangeeth Dhanapal V Saswin P Gokulnath N

6.2. SPRINT DELIVERY SCHEDULE

In project Management, planning is an important task to schedule the phrase of the project to the team member. In this activity represents the various activities allocated and are done by team members.

Sprint Planning Diagram

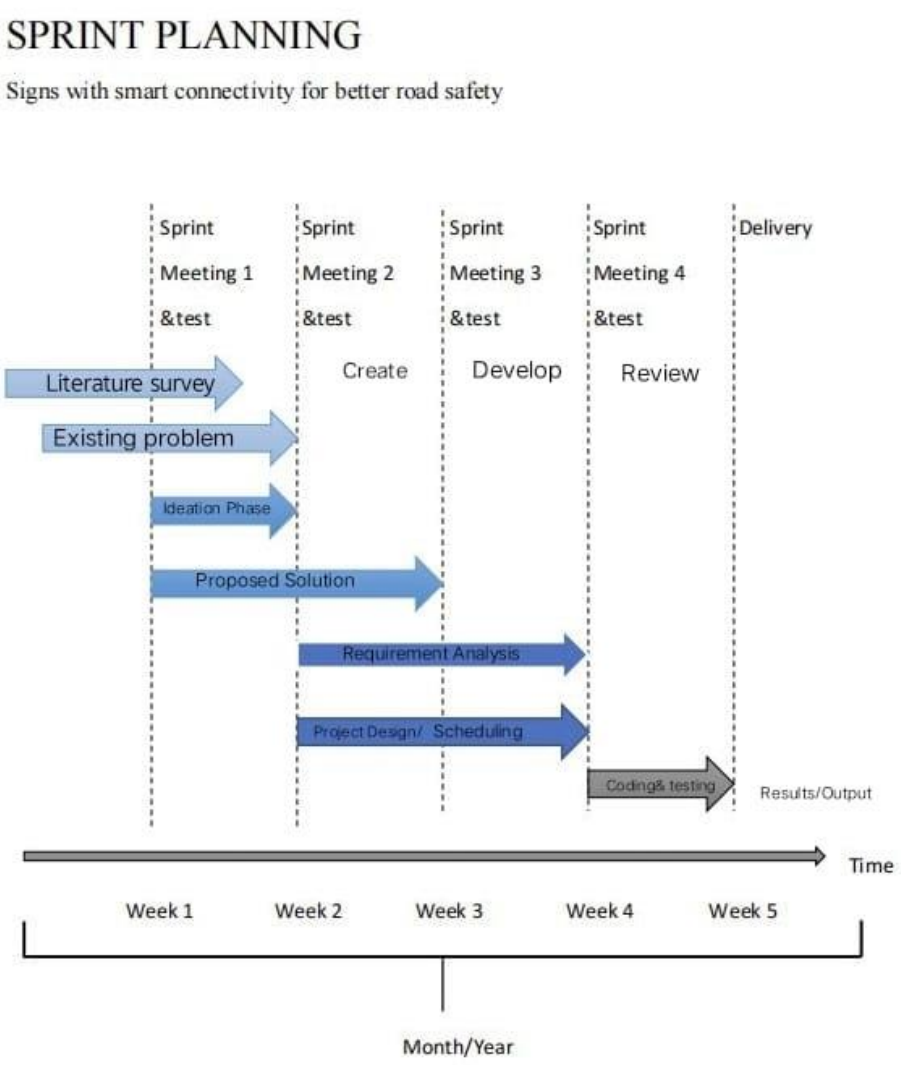


Fig 6.2.1. Schedule Chart

6.3. REPORTS FROM JIRA

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, burndown charts can be applied to any project containing measurable progress over time.

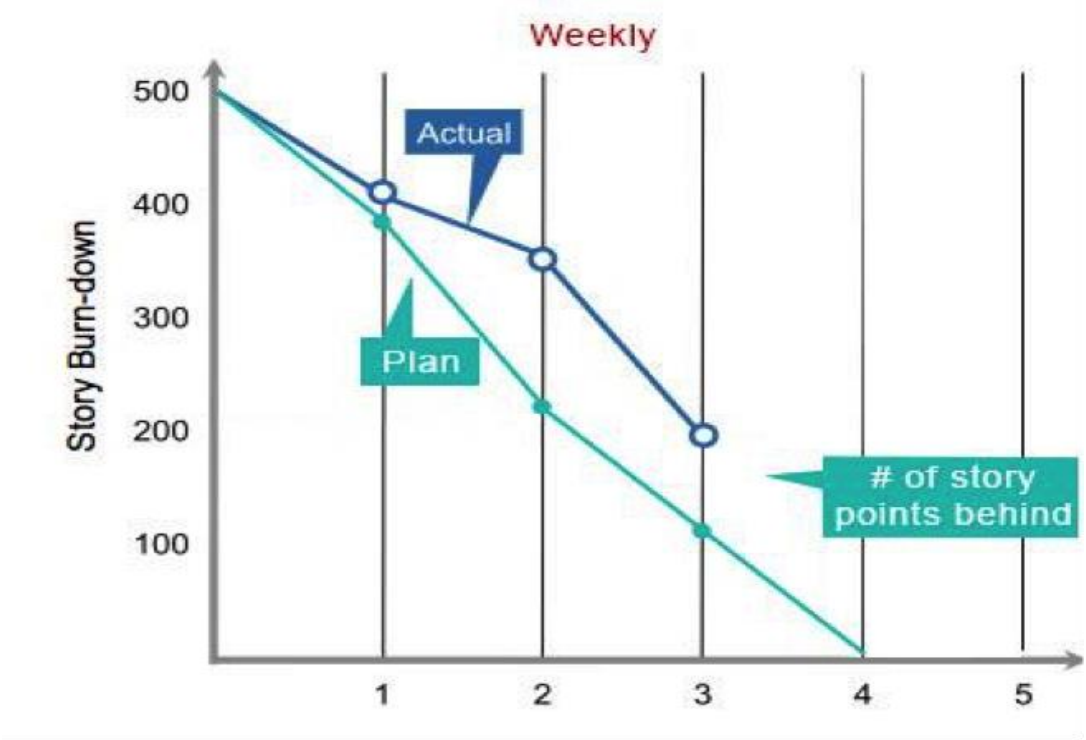


Fig 6.2.2. Burndown Chart

CHAPTER 7

CODING & SOLUTIONING

7.1 FEATURE 1 (Coding and Result)

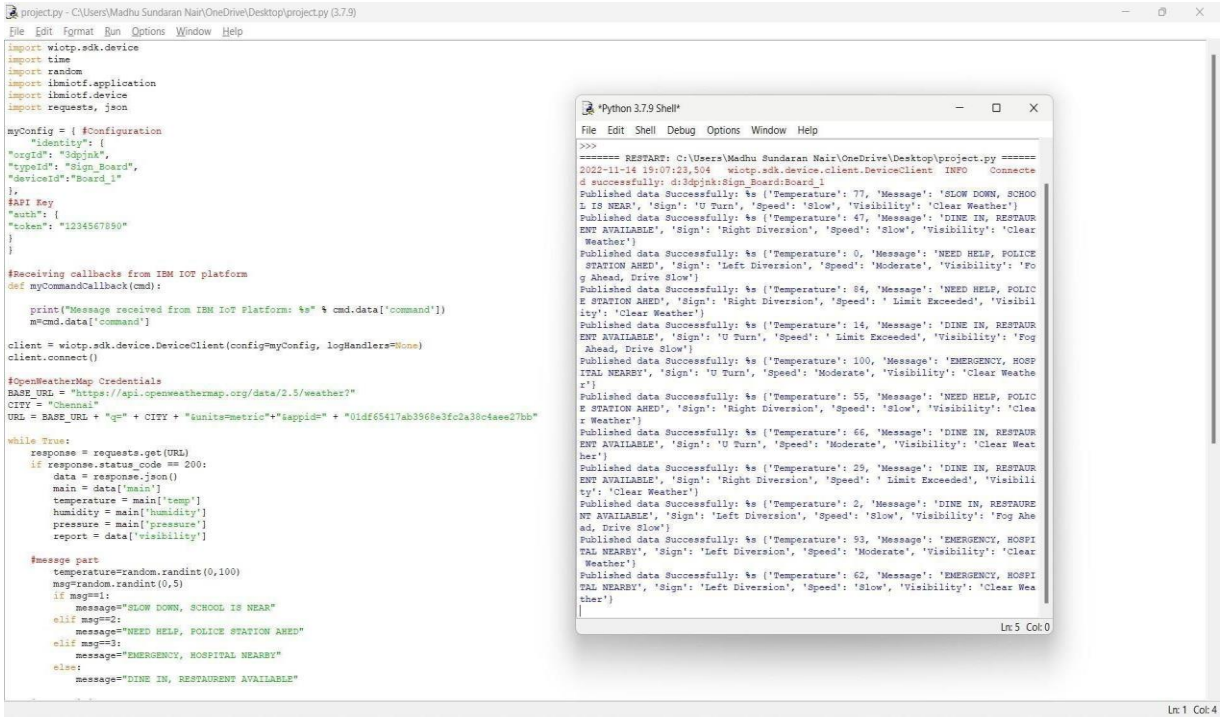
```
#IBM Watsin IOT Platform

#PIP install wiotp-sdk

import wiotp.sdk.device

import time
```

```
import random
myConfig={"identity":{"orgId":"nto8zt","typeId":"abcd","deviceId":"12345" },"auth":
{"token":"12345678"}
}
def myCommandCallback(cmd):
print("Message Received from IOT IBM Platform: %s" % cmd.data['command'])
m=cmd.data['command']
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()
while True:
temperature=random.randint(-10,120)
vechicles_on_the_road=random.randint(0,100)
roadwork_on_distance=random.randint(0,50)
accidentalzone_distance=random.randint(1,25)
p="Prefered Speed"
q="speed limit is 35kms"
r="Take another route"
s="Your wish"
t="Go slow"
u="Moderate Speed"
v="Accidental Zone !! Drive carefully"
w="Beyond the accidental zone ! Have a safe journey"
a={'Speed_cond1':p}
b={'Speed_cond1':q}
c={'Direction-cond':r}
d={'Direction_cond':s}
e={'Speed_cond2':t}
f={'Speed_cond2':u}
g={'Drive_cond':v}
```

```
h={'Drive_cond':w}
myData1={'Temperature':temperature}
myData2={'Vechichles_count':vechicles_on_the_road}
myData3={'Roadwork_in_distance':roadwork_on_distance}
myData4={'Accidental_area_distance':accidentalzone_distance}
client.publishEvent(eventId="status",msgFormat="json",data=myData1,qos=0,onPublish=None)
print("Published:%s:,myData1")
if temperature>=22:
client.publishEvent(eventId="status",msgFormat="json",data=a,qos=0,onPublish=None)
print(a)
print("\n")
else:
client.publishEvent(eventId="status",msgFormat="json",data=b,qos=0,onPublish=None)
print(b)
print("\n")
client.publishEvent(eventId="status",msgFormat="json",data=myData2,qos=0,onPublish=None)
print("Published:%s:,myData2")
if vechicles_on_the_road>=50:
client.publishEvent(eventId="status",msgFormat="json",data=c,qos=0,onPublish=None)
print(c)
print("\n")
else:
client.publishEvent(eventId="status",msgFormat="json",data=d,qos=0,onPublish=None)
print(d)
print("\n")
client.publishEvent(eventId="status",msgFormat="json",data=myData3,qos=0,onPublish=None)
print("Published:%s:,myData3")
```

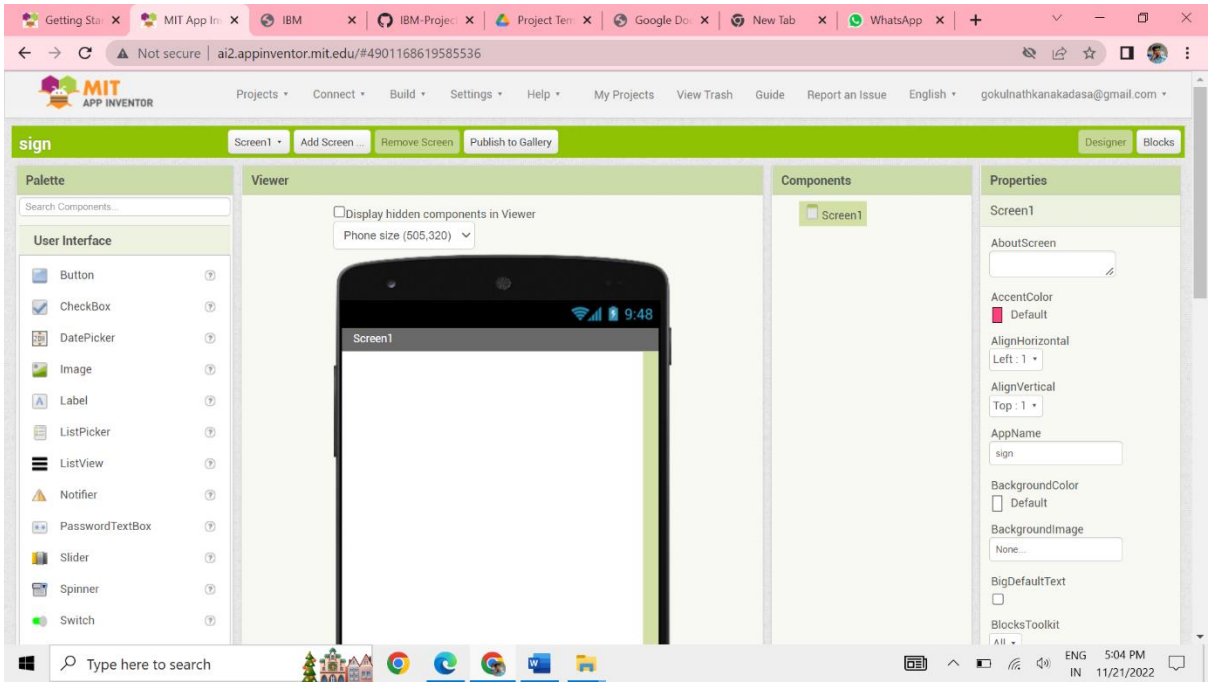
```
if  roadwork_on_distance>=5:
client.publishEvent(eventId="status",msgFormat="json",data=f,qos=0,onPublish=None)
print(f)
print("\n")
else:
client.publishEvent(eventId="status",msgFormat="json",data=e,qos=0,onPublish=None)
print(e)
print("\n")
client.publishEvent(eventId="status",msgFormat="json",data=myData4,qos=0,onPublish=No
ne)
print("Published:%s:,myData4")
if accidentalzone_distance>=4:
client.publishEvent(eventId="status",msgFormat="json",data=h,qos=0,onPublish=None)
print(h)
print("\n")
else:
client.publishEvent(eventId="status",msgFormat="json",data=g,qos=0,onPublish=None)
print(g)
print("\n")
client.commandCallback=myCommandCallback
time.sleep(10)
```

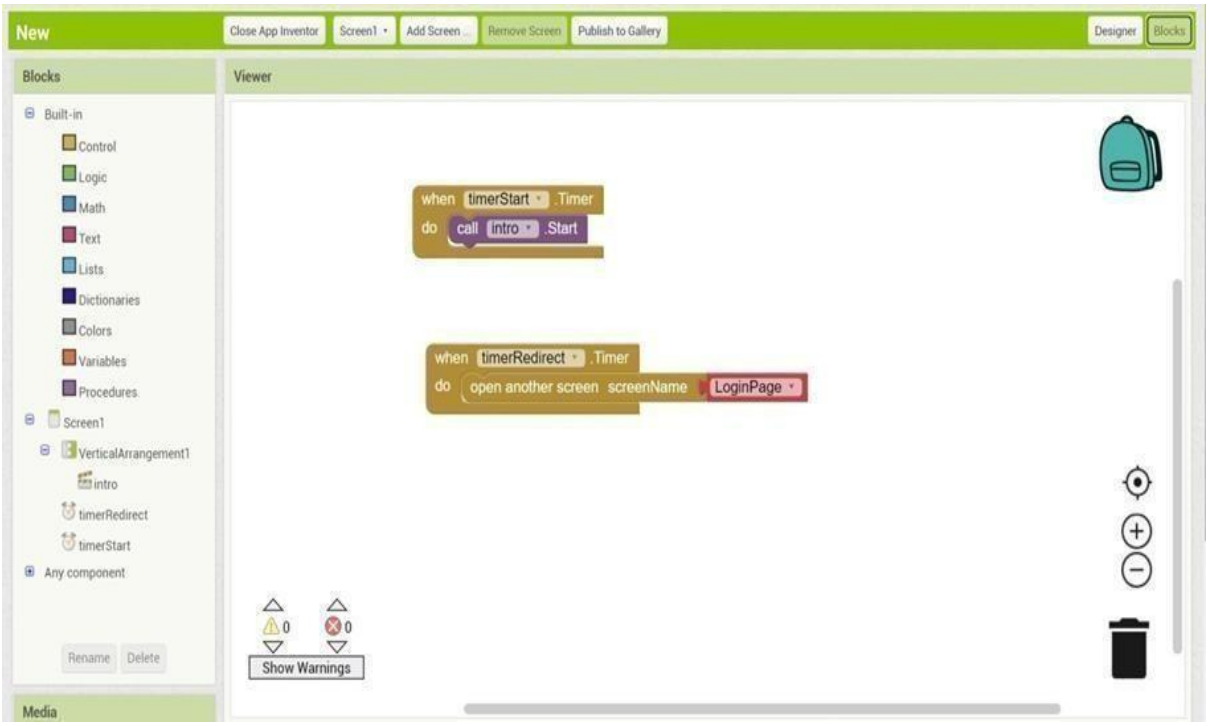
OUTPUT



7.2. FEATURE 2 : (MITAPPINVENTER)

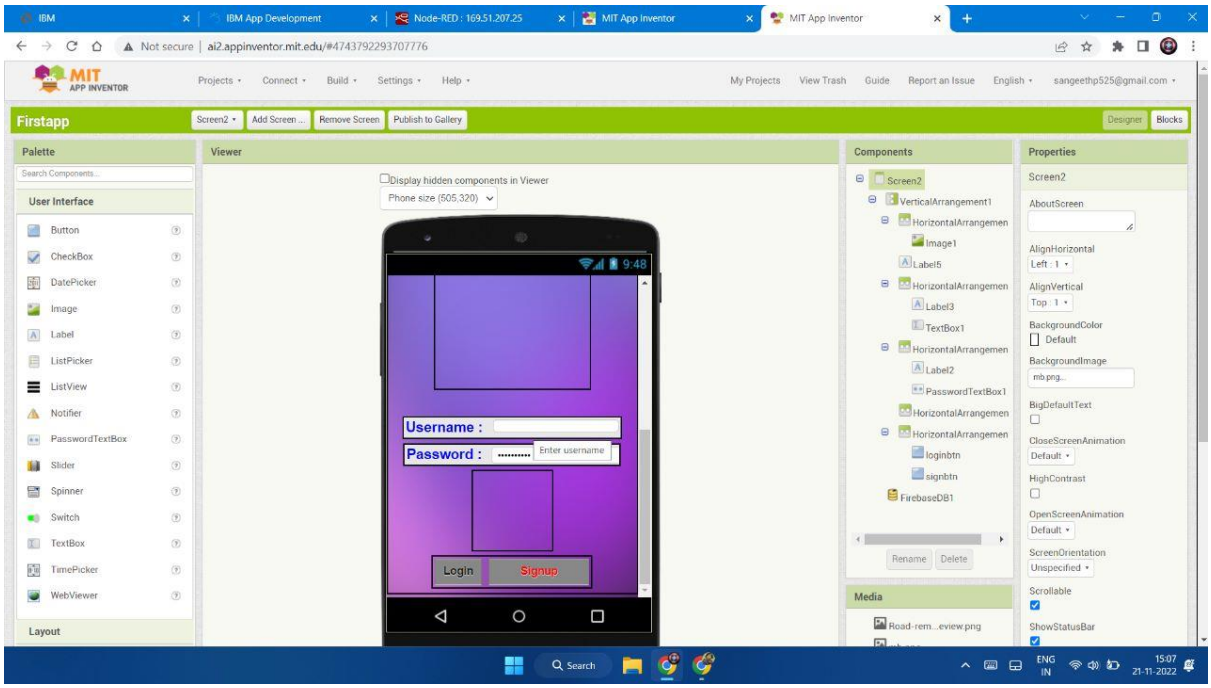
7.2.1. MIT APP INVENTOR ICON PAGE



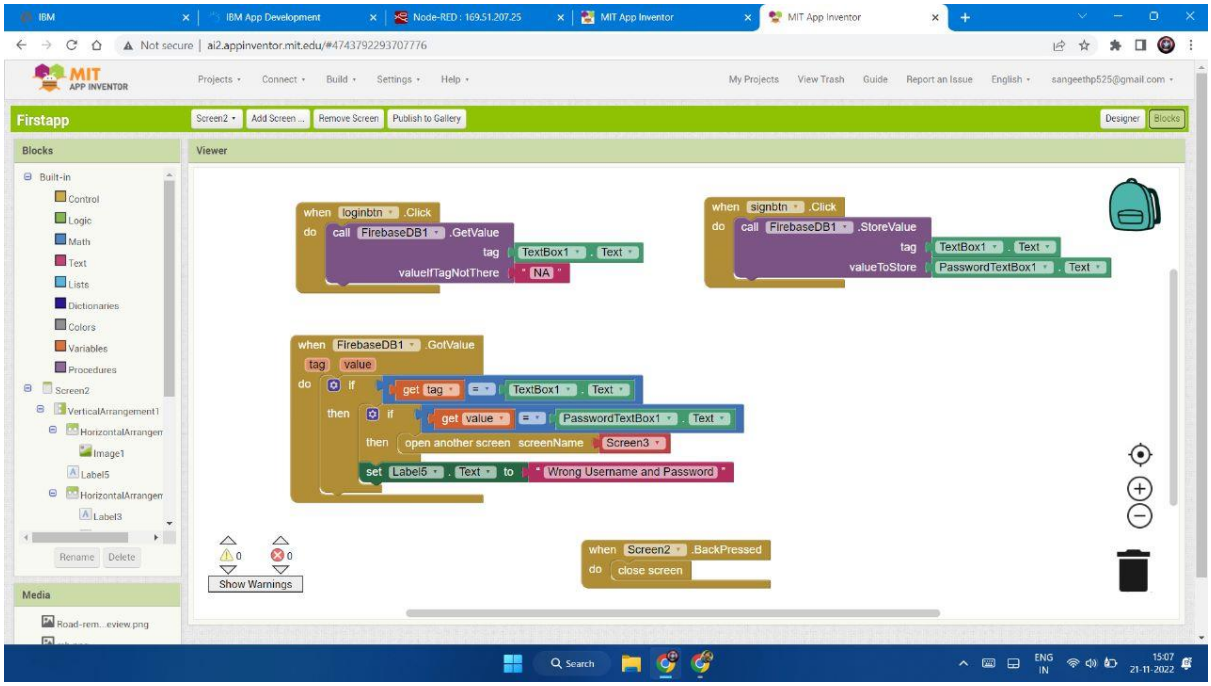

New
Close App Inventor
Screen1
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen1
VerticalArrangement1
intro
timerRedirect
timerStart
Any component
Rename
Delete
Media
when timerStart .Timer
do call intro .Start
when timerRedirect .Timer
do open another screen screenName LoginPage
0
0
Show Warnings


New
Close App Inventor
LoginPage
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
LoginPage
loginPageArrangemen
loginArrangement
imgLogo
fillerAfterLogo
usernameArranger
lblUsername
Rename
Delete
Media
when btnLogin .Click
do if txtUsername . Text = admin and txtPassword . Text = admin
then open another screen screenName contentScreen
else call checkCred .ShowAlert
notice Admin for both
0
0
Show Warnings

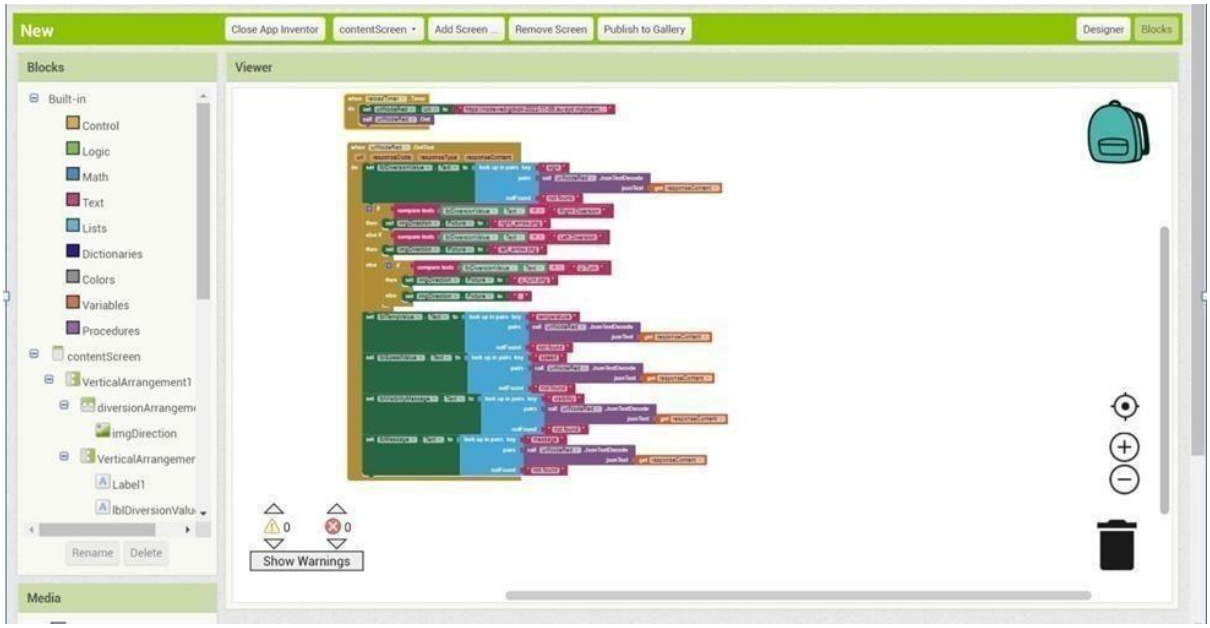
7.2.2. MIT APP INVENTOR LOGIN PAGE CREATION



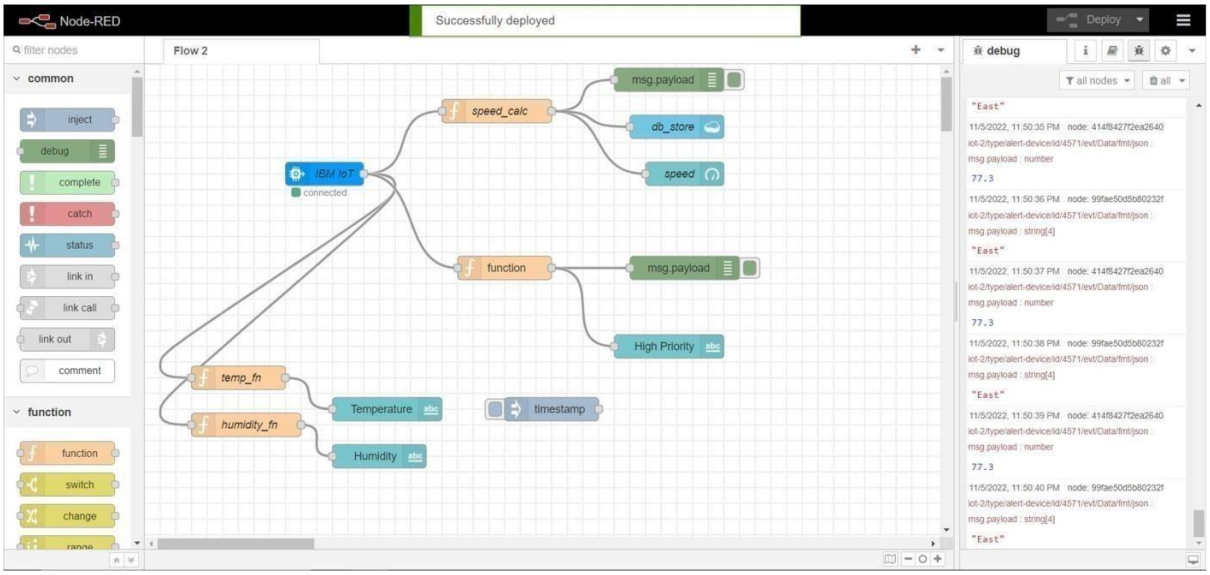
LOGIN PAGE FRONT-END AND BACK-END



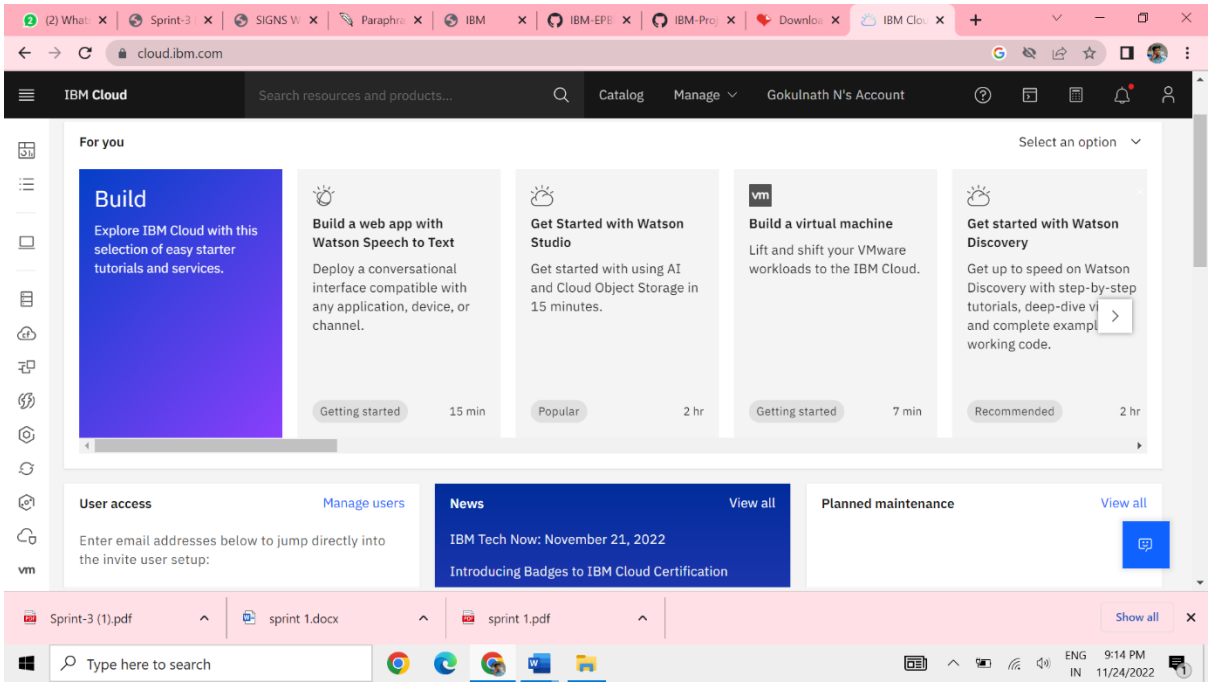
MIT APP INVENTOR WORKING



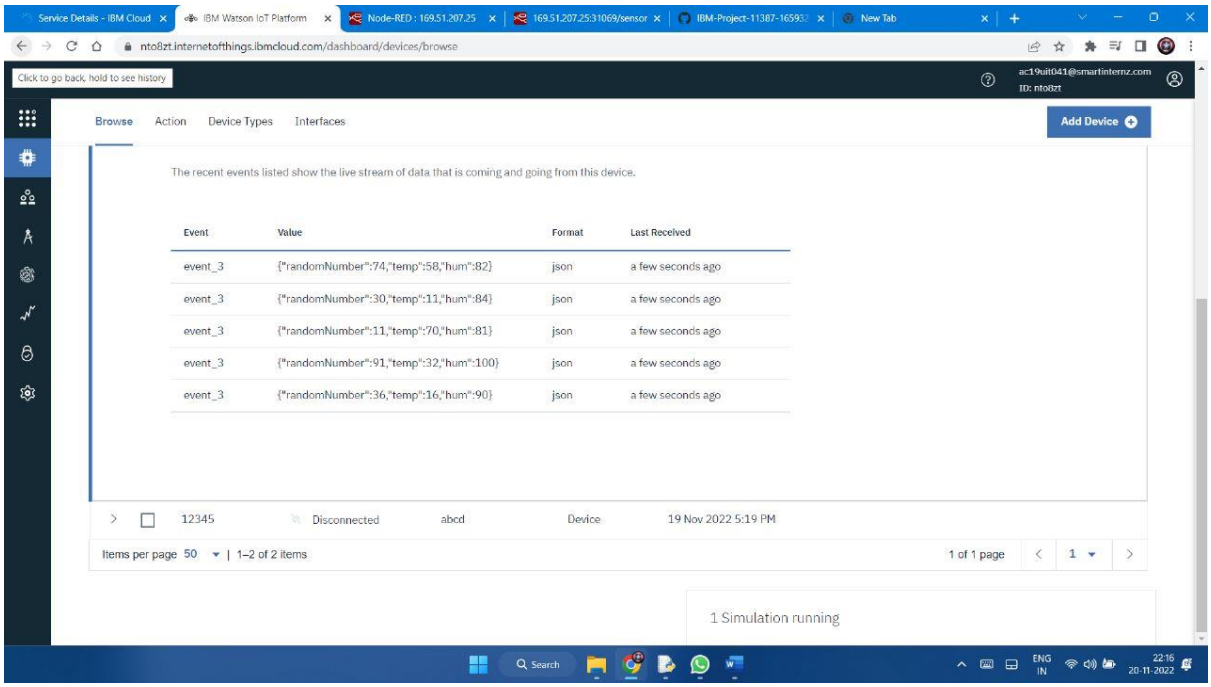
7.2.3. NODE-RED CREATION



7.2.4. CREATING IBM CLOUD



CREATING A IOT DEVICE



CHAPTER 8

TESTING

8.0. Definition

Test cases help guide the tester through a sequence of steps to validate whethera software application is free of bugs, and working as required by the end-user. Learning how to write test cases for software requires basic writing skills, attention to detail, and a good understanding of the application under test (AUT).

8.1. TEST CASES

1.Verify user is able to see the home page or not.
2.Verify the UI elements in Home page.
3.Verify the user is able to enter the details.
4.Verify user is able login or not.
5. Check the device is works or not.

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 iswhat 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.

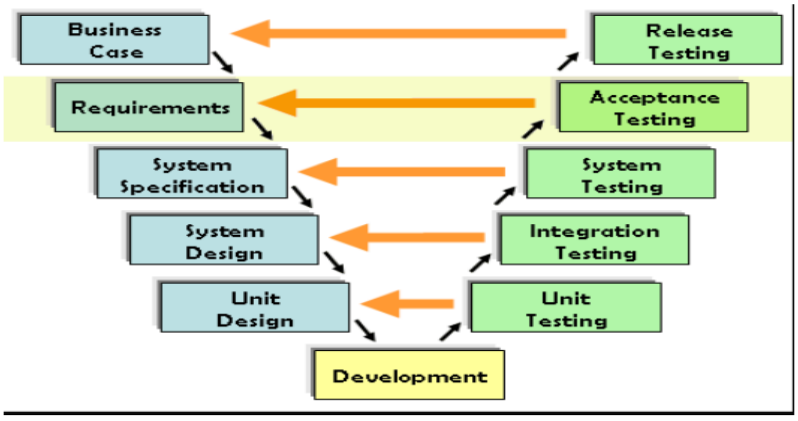
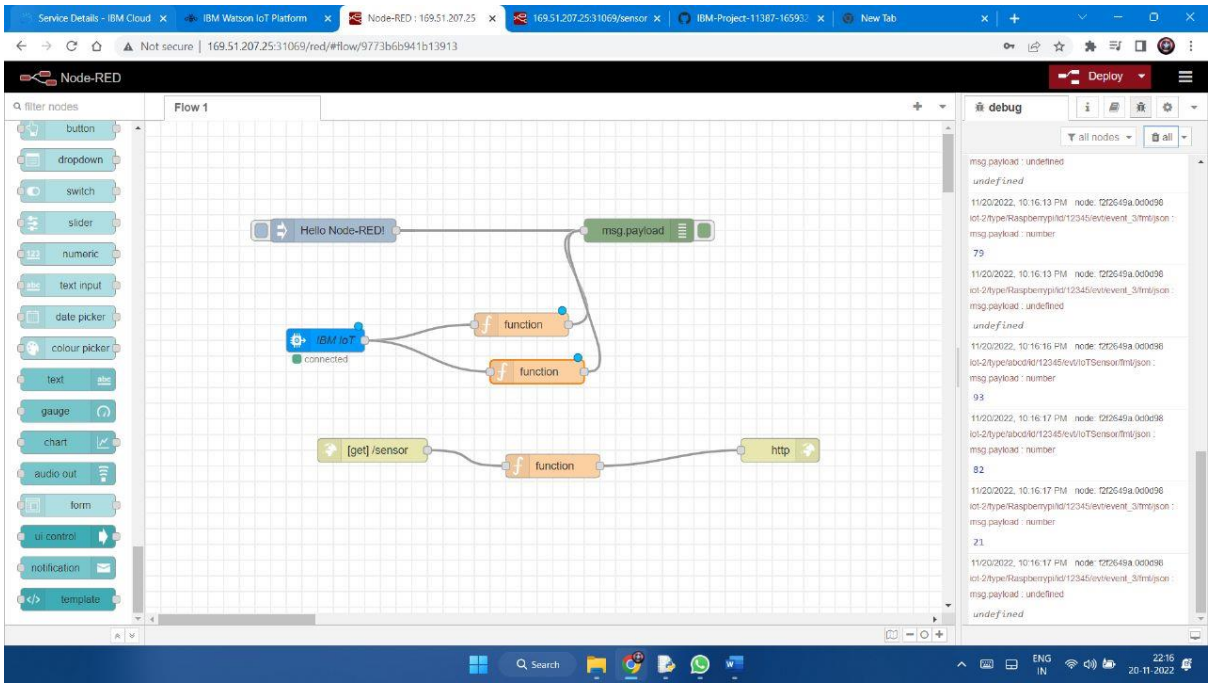
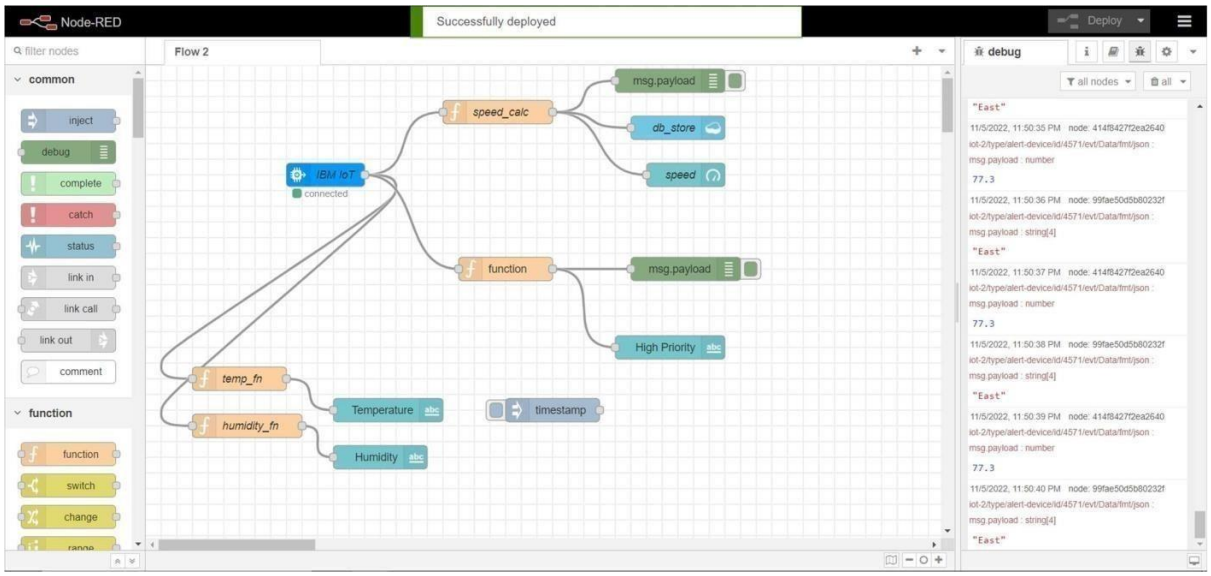


Fig 8.2.1. User Acceptance Flowchart

8.2.1. DETECT ERRORS



8.2.2. TEST CASE ANALYSIS



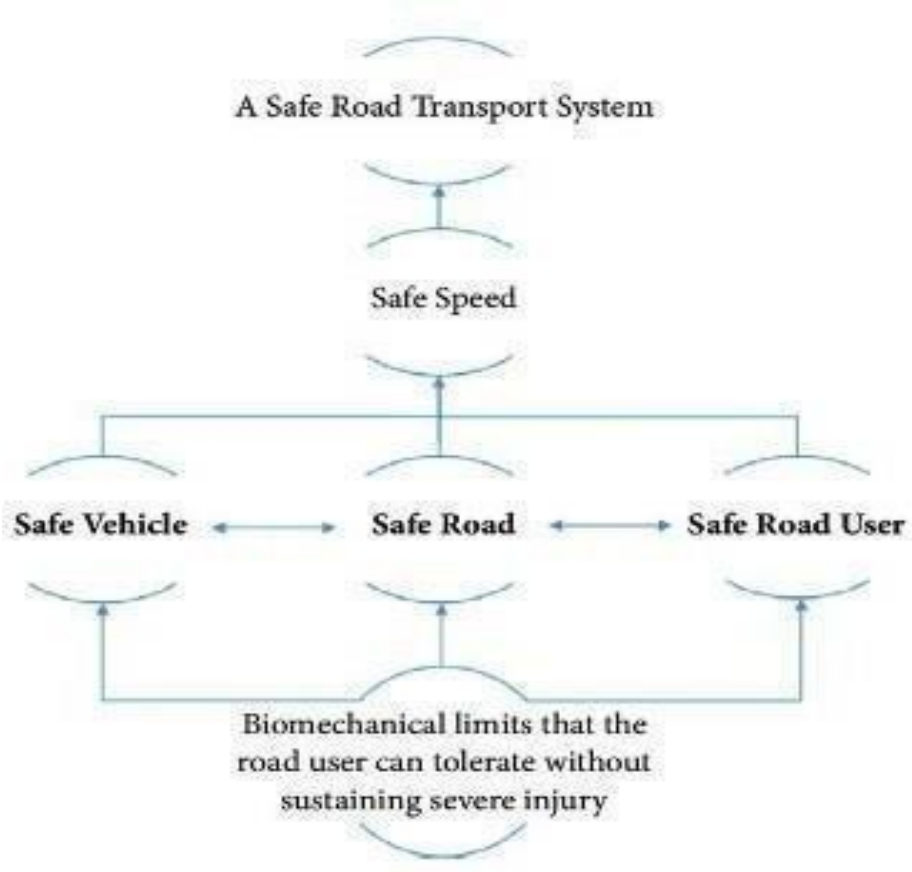
CHAPTER 9

RESULTS

9.1 PERFORMANCE MARICS

Model Summary:

Working system:



CHAPTER 10

ADVANTAGE & DISADVANTAGE

ADVANTAGES

- Multimodalsensorsandedgecomputinghelpspeeduptheflowoftrafficwithreal-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).

CHAPTER 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.

CHAPTER 12

FUTURE SCOPE

The proposed model in this project work can be extended to image recognition. The entire model can be converted to application software using python to exe software. The real time image classification, image recognition and video processing are possible with help of OpenCV python library. This project work can be extended for security applications such as figure print recognition, iris recognition and face recognition.

CHAPTER 13

APPENDIX

CODING SNIPPETS

```
#IBM Watsin IOT Platform

#PIP install wiotp-sdk

import wiotp.sdk.device

import time

import random

myConfig = {"identity":{"orgId":"nto8zt","typeId":"abcd","deviceId":"12345" },"auth":
{"token":"12345678"}

}

def myCommandCallback(cmd):

print("Message Received from IOT IBM Platform: %s" % cmd.data['command'])

m=cmd.data['command']

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

client.connect()

while True:

temperature=random.randint(-10,120)

vechicles_on_the_road=random.randint(0,100)

roadwork_on_distance=random.randint(0,50)

accidentalzone_distance=random.randint(1,25)

p="Prefered Speed"

q="speed limit is 35kms"

r="Take another route"

s="Your wish"

t="Go slow"

u="Moderate Speed"

v="Accidental Zone !! Drive carefully"

w="Beyond the accidental zone ! Have a safe journey"
```

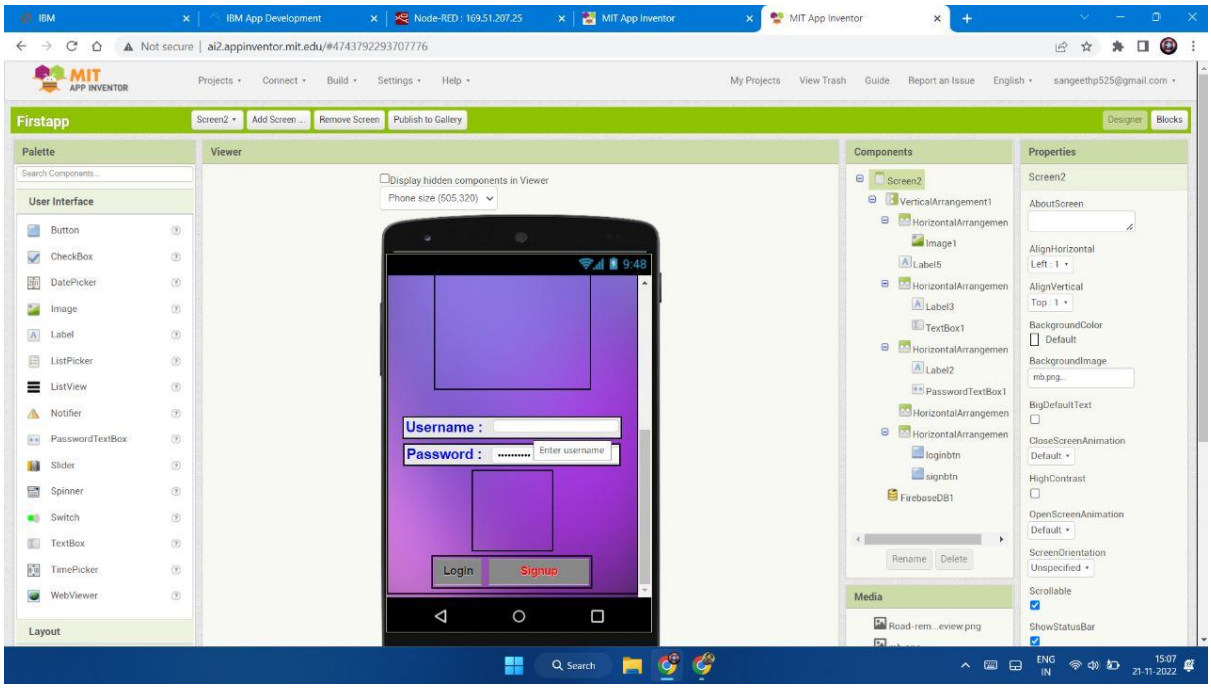
```
a={'Speed_cond1':p}

b={'Speed_cond1':q}

c={'Direction-cond':r}

d={'Direction_cond':s}

e={'Speed_cond2':t}

f={'Speed_cond2':u}

g={'Drive_cond':v}

h={'Drive_cond':w}

myData1={'Temperature':temperature}

myData2={'Vechichles_count':vechicles_on_the_road}

myData3={'Roadwork_in_distance':roadwork_on_distance}

myData4={'Accidental_area_distance':accidentalzone_distance}

client.publishEvent(eventId="status",msgFormat="json",data=myData1,qos=0,onPublish=No
ne)

print("Published:%s:,myData1")

if temperature>=22:

client.publishEvent(eventId="status",msgFormat="json",data=a,qos=0,onPublish=None)

print(a)

print("\n")

else:

client.publishEvent(eventId="status",msgFormat="json",data=b,qos=0,onPublish=None)

print(b)

print("\n")

client.publishEvent(eventId="status",msgFormat="json",data=myData2,qos=0,onPublish=No
ne)

print("Published:%s:,myData2")

if vechicles_on_the_road>=50:

client.publishEvent(eventId="status",msgFormat="json",data=c,qos=0,onPublish=None)

print(c)

print("\n")
```

```
else:
client.publishEvent(eventId="status",msgFormat="json",data=d,qos=0,onPublish=None)
print(d)
print("\n")
client.publishEvent(eventId="status",msgFormat="json",data=myData3,qos=0,onPublish=None)
print("Published:%s:,myData3")
if  roadwork_on_distance>=5:
client.publishEvent(eventId="status",msgFormat="json",data=f,qos=0,onPublish=None)
print(f)
print("\n")
else:
client.publishEvent(eventId="status",msgFormat="json",data=e,qos=0,onPublish=None)
print(e)
print("\n")
client.publishEvent(eventId="status",msgFormat="json",data=myData4,qos=0,onPublish=None)
print("Published:%s:,myData4")
if accidentalzone_distance>=4:
client.publishEvent(eventId="status",msgFormat="json",data=h,qos=0,onPublish=None)
print(h)
print("\n")
else:
client.publishEvent(eventId="status",msgFormat="json",data=g,qos=0,onPublish=None)
print(g)
print("\n")
client.commandCallback=myCommandCallback
time.sleep(10)
```

APPENDIX B

RESULT PAGE SCREENSHOTS

Login Page



Result Page:


Home
Speed Limit
Speed Limit
80
kmph
0
100
Environment Data
Temperature
23.4
Humidity
63
High Priority Vehicle Direction
High Priority
Towards North