SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

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CONTENTS

Introduction:

Roads are the foremost source of linking between cities and villages. Due to theease of traveling by road, vehicles have become the main way people travel. The chances of vehicular accidents (Vas) have increased with the growing number of vehicles on the roads. During a journey, one does not know what will happen on the next road, particularly during bad weather conditions (BWC). In such a situation, driving can be difficult due to bad visibility, which can lead to an accident. It was alsonoticed that in BWC, multiple vehicle collisions (MVCs) can occur owing to delays in receiving information about an incident. According to one study by the Islamabad police, there were 9582 accidents from 2016 to 2017 all over Pakistan, involving 11,317 vehicles, leading to 5047 fatalities and 12,696 persons injured

Digital technologies like the Internet of Things (IoT) are reshaping road safetymeasures. Many technology initiatives are undertaken the world over to make smarter and safer roads, the ones that can interact with traffic and pedestrians. Assuming that bygiving in vehicle technology information to the driver, accidents can be averted, severaltechnology-based products have been developed. The latest technology researchers are working on is based on the Internet of Things (IoT). IoT is all about data. Data is becoming a valuable resource for our world.

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 impactsin 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 SafeSystem approach, which is a holistic approach to road safety that parts from traditionalmanagement solutions by emphasizing safety by design.

Mobile-phone-based applications use built-in sensor data to detect the speed limitbased on environmental situations.

The main contributions of this research are,

1. Abriefsurveyonthestateoftheartrelatedtopre-accidentaswellaspost-accident models, frameworks, and techniques;

2.Identificationandreportingoflimitationsinpreviousstudiesrelatedtoaccident 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.

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.

Purpose:

A large amount of research is being carried out in the domain of accident avoidance and accident alarms by a large number of researchers and practitioners. To avoid accidents, many approaches are utilized to enhance safety. For ease of reference, the literature on accident detection and avoidance is separated into three approaches: stand-alone, cooperative, and hybrid. Stand-alone approaches use sensors, such as radar and light detection and ranging (LiDAR), for accident avoidance and detection, whereas cooperative approaches rely on V2X technology and hybrid approaches.

LITERATURE SURVEY:

Abstract:

In present Systems the road signs and the speed limits are Static. But the road signs can be changed in some cases. We can consider some cases when there are road diversions due to heavy traffic or due to accidents then we can change the road signs accordingly if they are digitalized. This project proposes a system that has digital signboards on which the signs can be changed dynamically. If there is rainfallthen 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 trafficaccident datasets, an accuracy of 98% was attained in the detection of accidents, demonstrating a strong capacity for detection independent of theroad 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 forpredicted patterns and can fail due to the unpredicted behavior of traffic.

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

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Problem Statement Definition

A problem statement is a concise description of an issue to be addressed or a condition to be improved upon. It identifies the gap between the current (problem) state and desired (goal) state of a process or product. Focusing on the facts, the problem statement should be designed to address the Five Ws. The first condition of solving a problem is understanding the problem, which can be done by way of a problem statement.

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

IDEATION & PROPOSED SOLUTION:

Empathy MapCanvas:

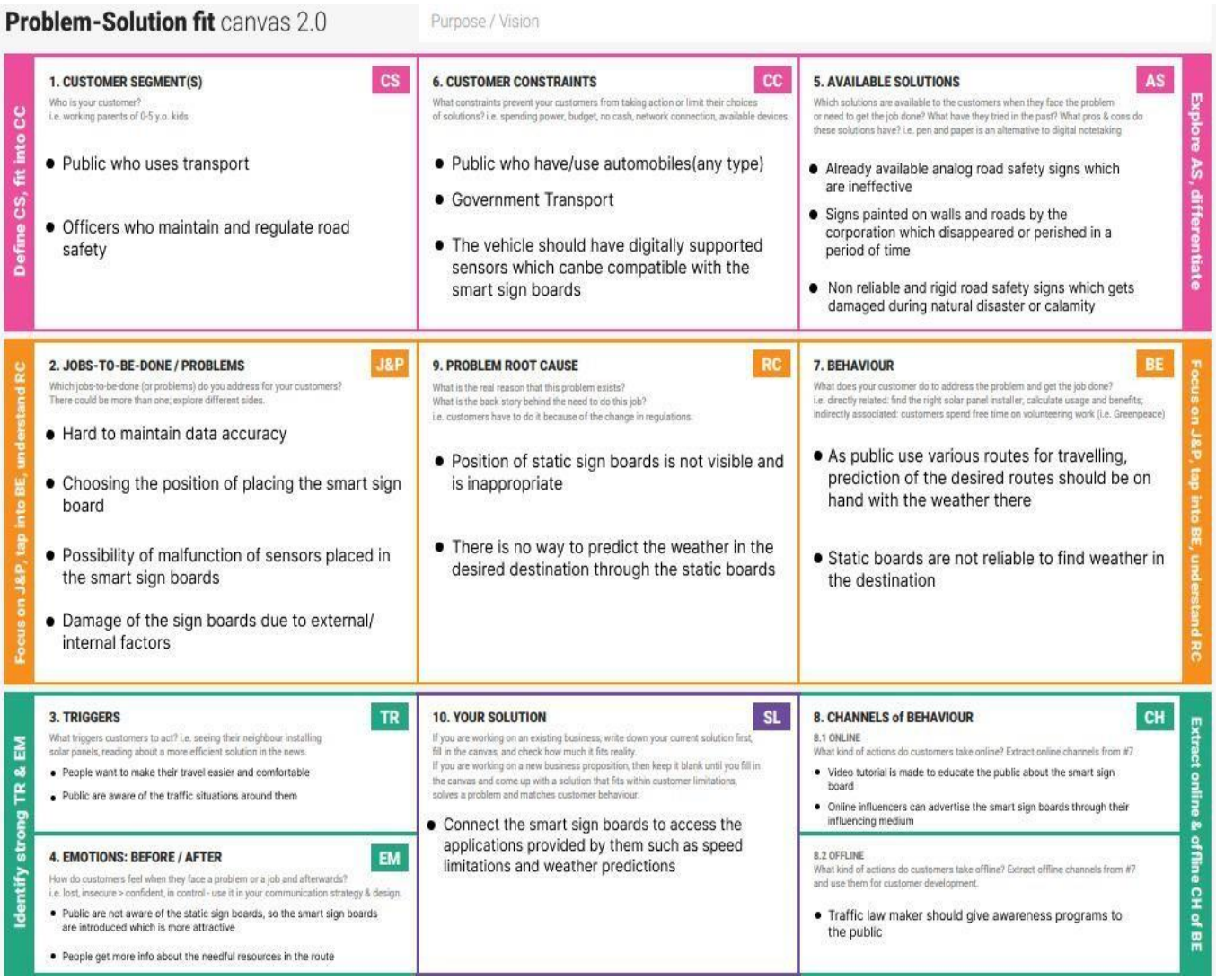
Ideation &Brainstorming:

Proposed Solution:

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

Parameter	Description
Problem Statement(Problem to be solved)	To replace the static signboards, smart connected sign boards are used which get the speed limitations from a web app usingweather API and update automatically.
Idea/Solution description	Predicting the speed limit from data acquired through weather map and pass through a web user interfacewhich in turn used by user
Novelty/Uniqueness	Controlling the speed limit by weather map.
Social Impact/Customer Satisfaction	Based on traffic diversion signs ,guide signs and warning signs are displayed to the public.
Business Model(Revenue Model)	Smart connectivity and better road safety model.
Scalability of the Solution	The process of understanding and operating this Model is easy and its highly scalable withproper efficiency.

Problem Solution fit:



REQUIREMENTANALYSIS:

Functional requirement:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Visibility**	Sign Boards should be made with LED's whichare bright colored and are capable of attractingthe 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.

Non-Functional requirements:

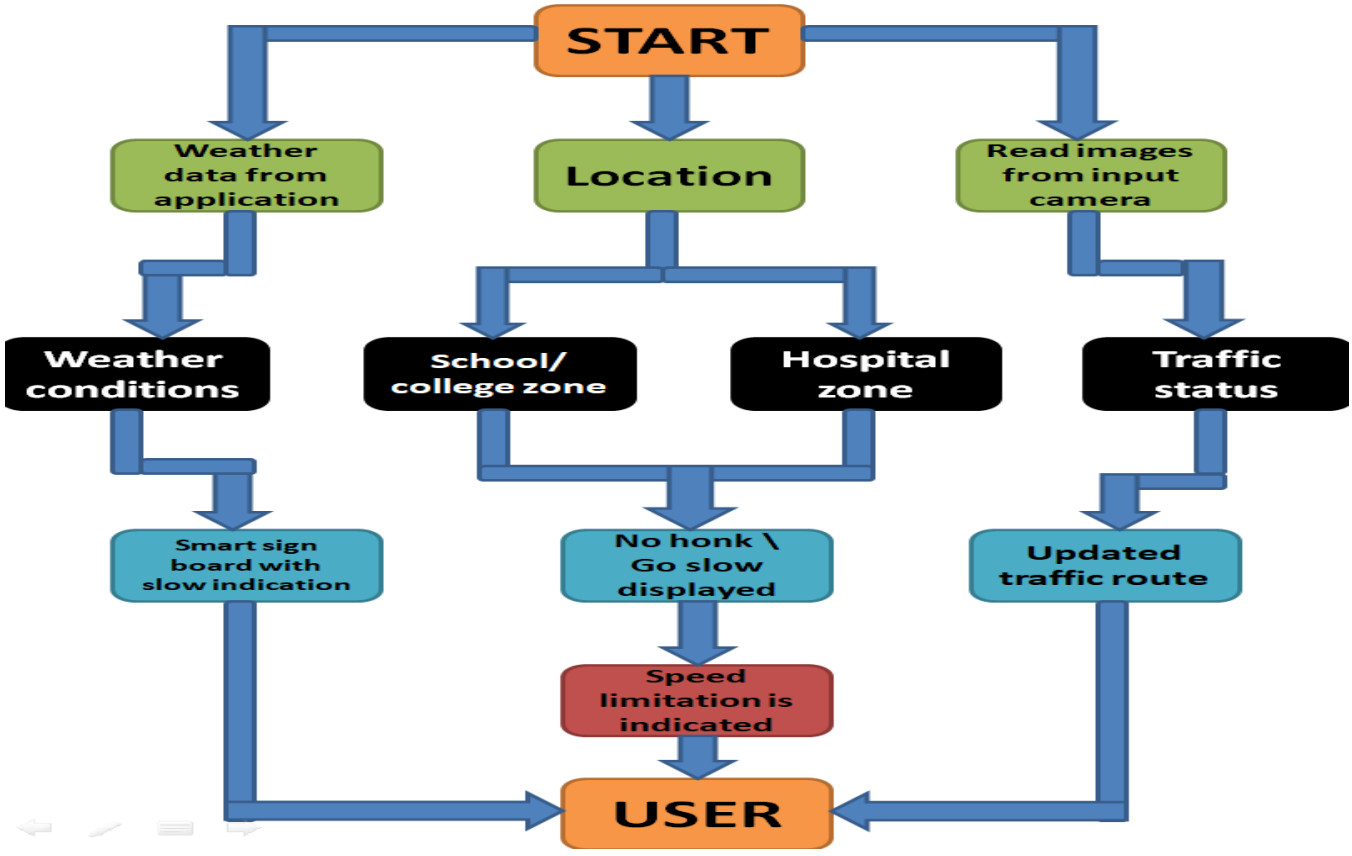
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	It should be able to Upgrade and Update whenthere is a need for it.
NFR-2	**Security**	It should have good security system so that noother person is able to hack and display their own directions.
NFR-3	**Reliability**	It should be able 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.

PROJECTDESIGN:

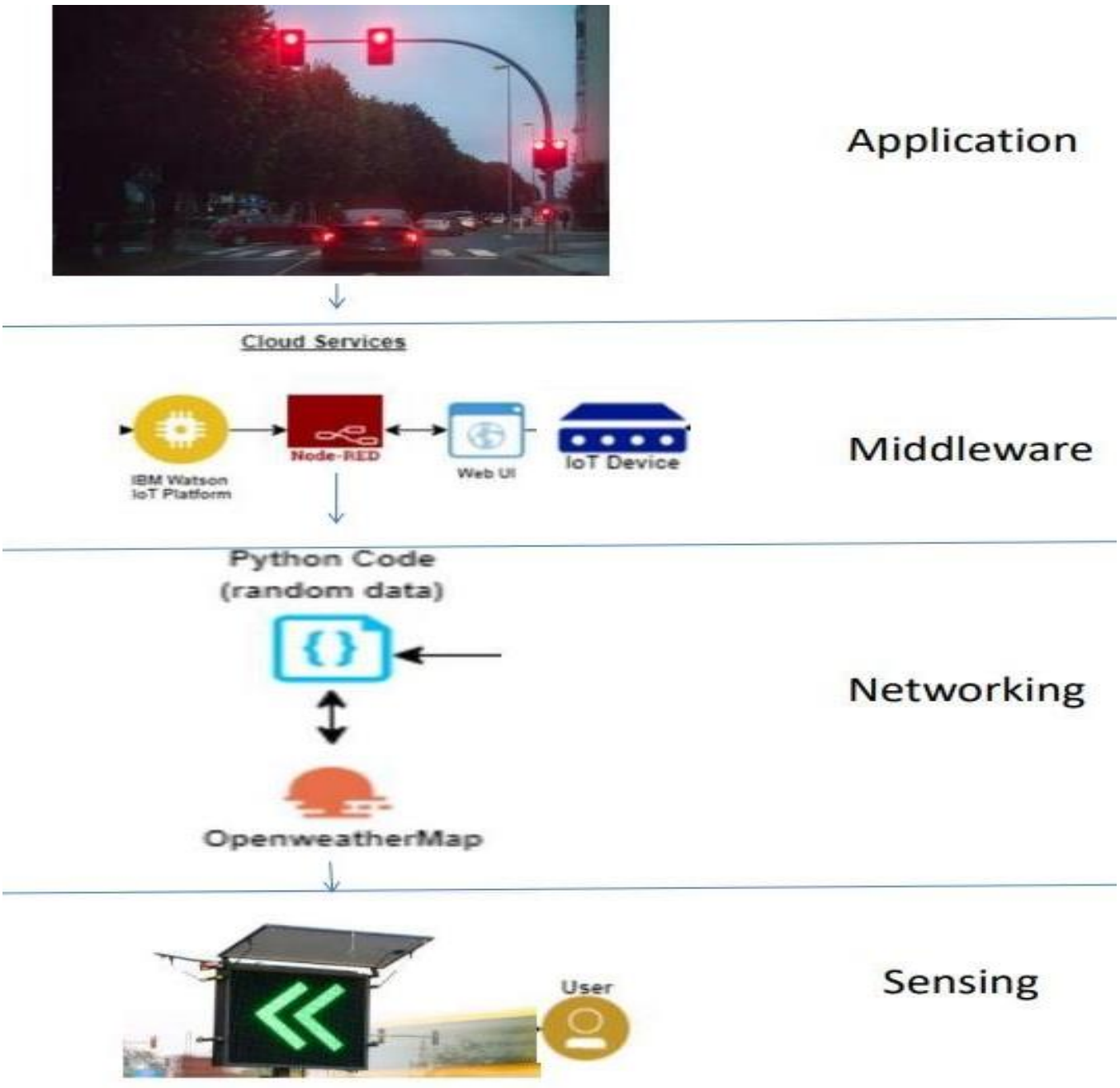
Project design is an early phase of the project lifecycle where ideas, processes, resources, and deliverables are planned out. A project design comes before a project plan as it's a broad overview whereas a project plan includes more detailedinformation.

Data Flow Diagrams:

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



Solution &Technical Architecture:



User stories:

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

User Type	Functional Requirement (Epic)	User Story Number	**User Story/Task**	**Acceptance crite ria**	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 accordingto 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 inmy 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 thesign boards haveto maintain it through periodic monitoring.**	**Officials can monitor the sign boards forproper functioning.**	Medium	Sprint-2
			entering my email, password, and confirming my password	**dashboard**		

PROJECT PLANNING &SCHEDULING

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

Sprint Planning &Estimation:

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story/Task	Story Points	Priority
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
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High
Sprint-1		USN-3	As a user, I can register for the Application through Facebook	2	Low
Sprint-1		USN-4	Asa user , I can register for the applicationthrough Gmail	2	Medium
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email &password	1	High
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

Sprint Delivery Schedule:

Project Tracker, Velocity & Burndown Chart:

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	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
Prepare Empathy Map	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
Ideation-Brainstorming	Brainstorming is a group problem-solvingmethod that helped us together and organize various ideas and thoughts from team members.	17September2022
Define Problem s tatement	The Customer Problem Statement helps us to focus onwhat matters to create experiences people will love. A well-articulated customer problemstatement allowed us to find the ideal solution for the challenges customers face.	19September2022
Problem Solution Fit	It helped us understand and analyze all.The thoughts of our customer , their choiceof options , problems , root cause,Behavior and emotions.	26September2022

Proposedsolution	It helped us analyze and examine our solution more in the grounds of uniqueness, socialimpact , business model, scalability etc.	28 September2022
Solution Architecture	Solution architecture is a complex process – with many sub-processes –that bridges the gap between business problems andtechnology solutions. It helped us understand the features and components used to Complete the project.	1 October2022
Customer journey map	It helped to analyse the various steps, interactions, goals and motivation, positives, negatives and opportunities.	7 October2022
Solution requirements	It briefs about functional and non-functional requirements.It involves the various stepsin the entire process. Italso specifies features usability ,security, reliability, performance ,availability andscalability.	12October2022
Technologystack	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 varioustechnologies that needs tobe implemented in the project.	15October2022

Dataflow	A Data Flow Diagram(DFD) is a traditional visual representation of	11October2022
	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 October2022
Prepare milestone and activity list	Helps us understand and evaluate our progress and accuracy so far.	23October2022
Project Development-DeliveryofSprint-1	Develop and submit the developed code bytesting 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)

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

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.

CODING & SOLUTIONING:

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

Feature 1 (coding and result):

```
importwiotp.sdk.devi
ce import time
import random
importibmiotf.applic
ationimport
ibmiotf.device
import requests, json

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

#Receiving callbacks from IBM IOT
platformdefmyCommandCallback(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
CITY = "Nagercoil"
URL = BASE_URL + "q=" + CITY + "&units=metric"+"&appid=" +
"01df65417ab3968e3fc2a38c4aee27bb"

while True:
response =
requests.get(URL) if
response.status_code ==200:
data = response.json()
main = data['main']
temperature
=main['temp']
humidity =
main['humidity']pressure =
main['pressure'] report =
data['visibility']

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

#Speed Limit part

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

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

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

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

Output:

project.py - C:\Users\Madhu Sundaran Nair\OneDrive\Desktop\project.py (3.7.9)

File Edit Format Run Options Window Help

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

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

#Receiving callbacks from IBM IOT platform
def myCommandCallback(cmd):

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

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

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

while True:
    response = requests.get(URL)
    if response.status_code == 200:
        data = response.json()
        main = data['main']
        temperature = main['temp']
        humidity = main['humidity']
        pressure = main['pressure']
        report = data['visibility']

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

Ln: 1 Col: 4

Python 3.7.9 Shell

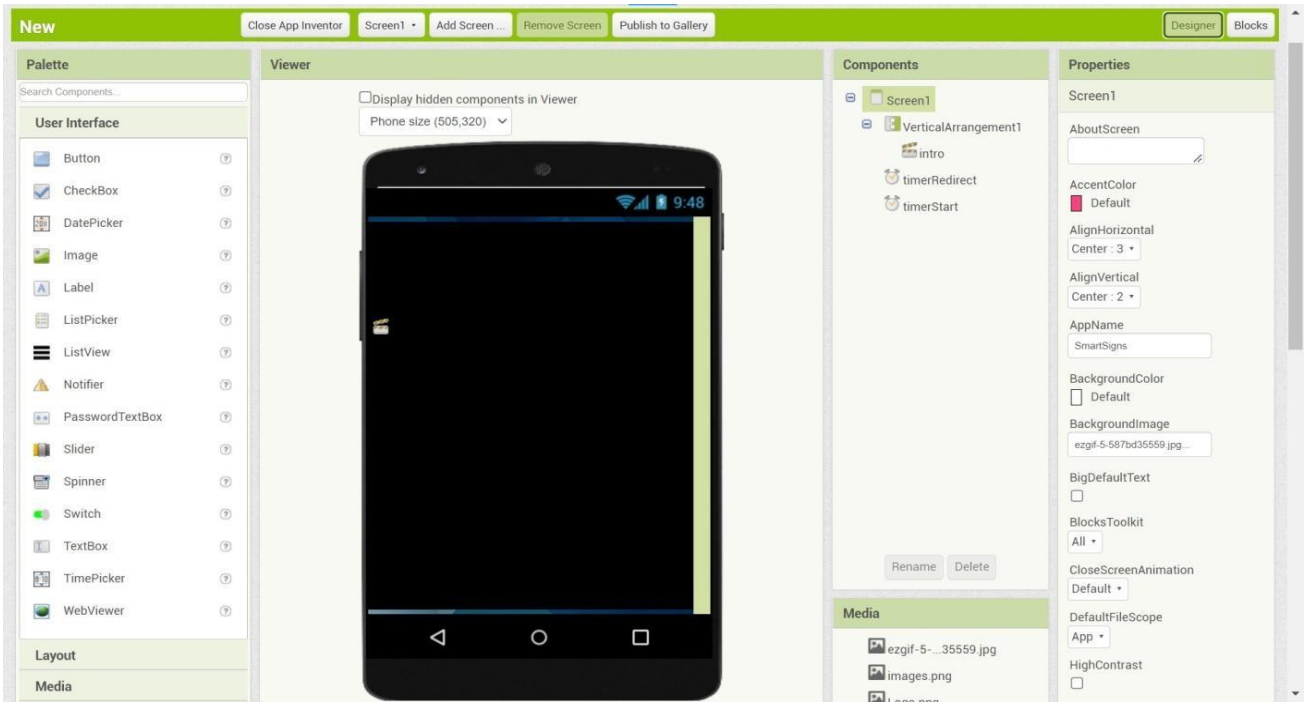
File Edit Shell Debug Options Window Help

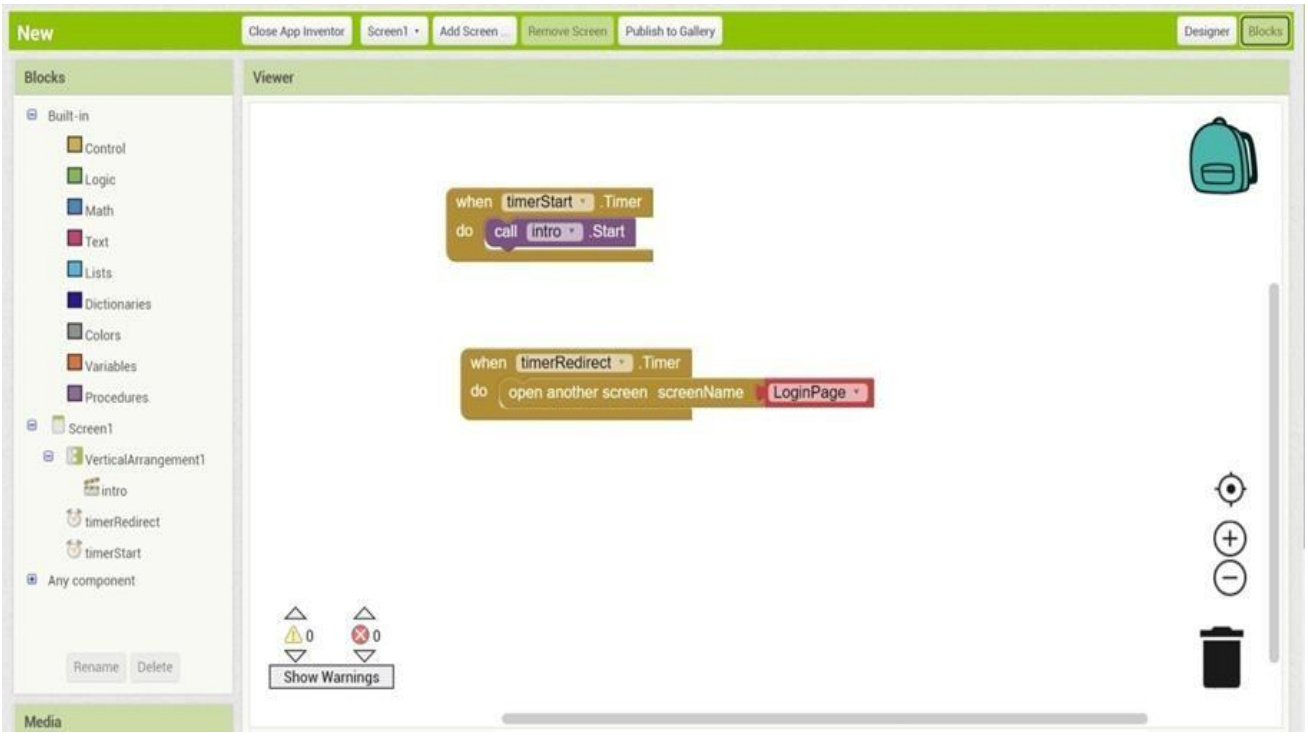
```
>>>
======= RESTART: C:\Users\Madhu Sundaran Nair\OneDrive\Desktop\project.py ======
2022-11-14 19:07:23,504   wiotp.sdk.device.client.DeviceClient  INFO    Connecte
d successfully: d:3dpjnk:Sign_Board:Board_1
Published data Successfully: %s {'Temperature': 77, 'Message': 'SLOW DOWN, SCHOO
L IS NEAR',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

Ln: 5 Col: 0

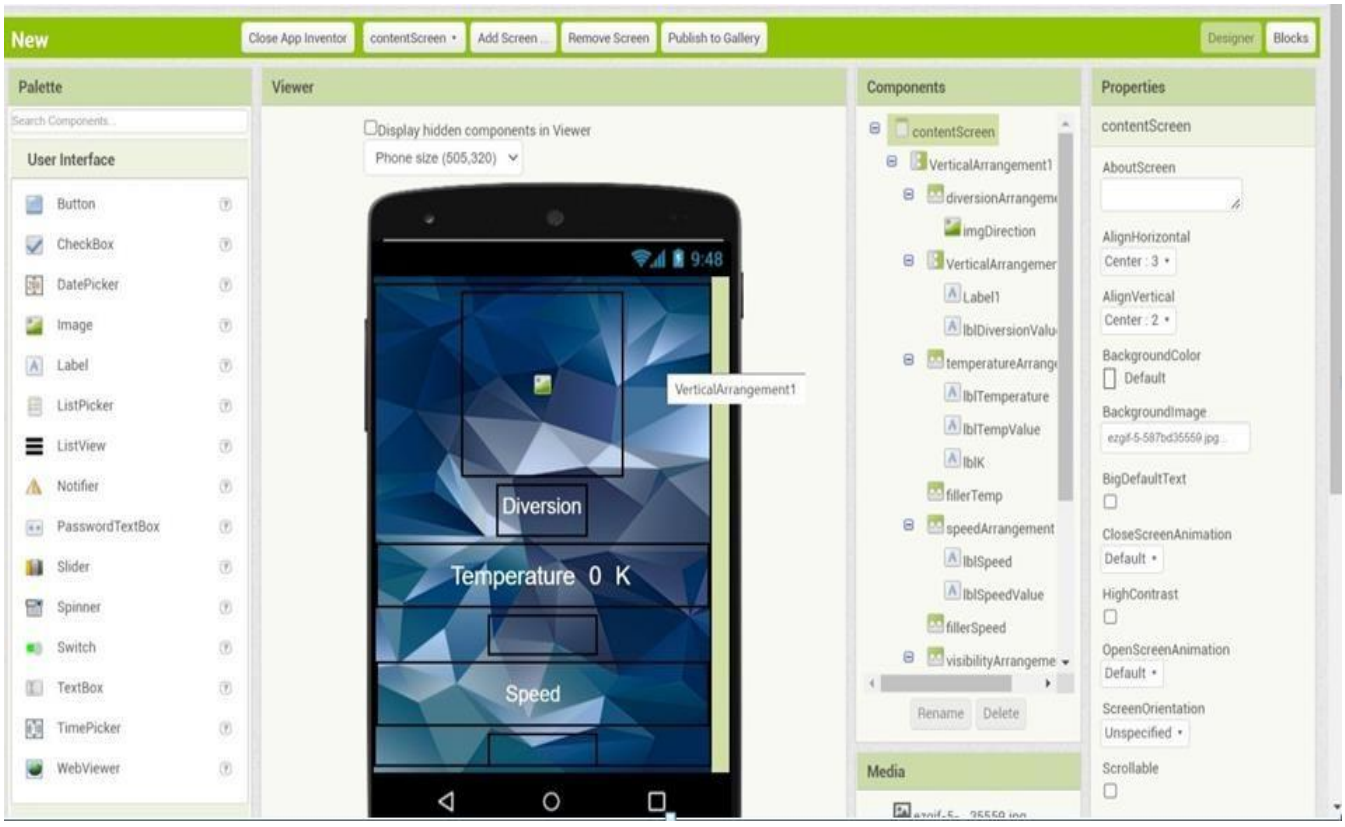
Feature 2: (MITAPPINVENTER):

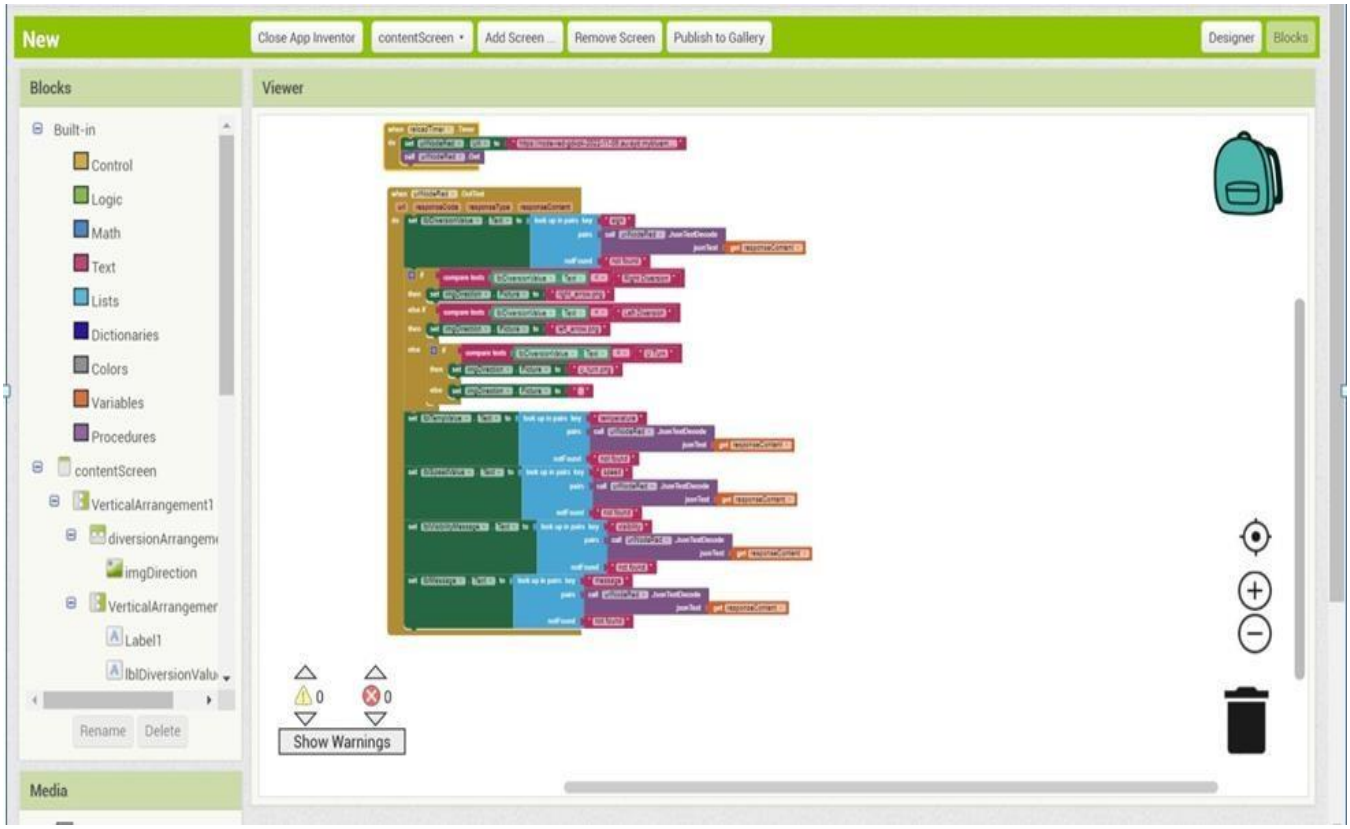
MIT APP INVENTOR: ICON PAGE:






New
Close App Inventor
LoginPage
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
LoginPage
loginPageArrangemen
loginArrangement
imgLogo
fillerAfterLogo
usernameArrangem
lblUsername
Rename
Delete
Media
Viewer
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


New
Close App Inventor
contentScreen
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Palette
Search Components...
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Viewer
Display hidden components in Viewer
Phone size (505,320)
9:48
VerticalArrangement1
Diversion
Temperature 0 K
Speed
Components
contentScreen
VerticalArrangement1
diversionArrangeme
imgDirection
VerticalArrangemer
Label1
lblDiversionValu
temperatureArrang
lblTemperature
lblTempValue
lblK
fillerTemp
speedArrangement
lblSpeed
lblSpeedValue
fillerSpeed
visibilityArrangeme
Rename
Delete
Media
Properties
contentScreen
AboutScreen
AlignHorizontal
Center : 3
AlignVertical
Center : 2
BackgroundColor
Default
BackgroundImage
BigDefaultText
CloseScreenAnimation
Default
HighContrast
OpenScreenAnimation
Default
ScreenOrientation
Unspecified
Scrollable

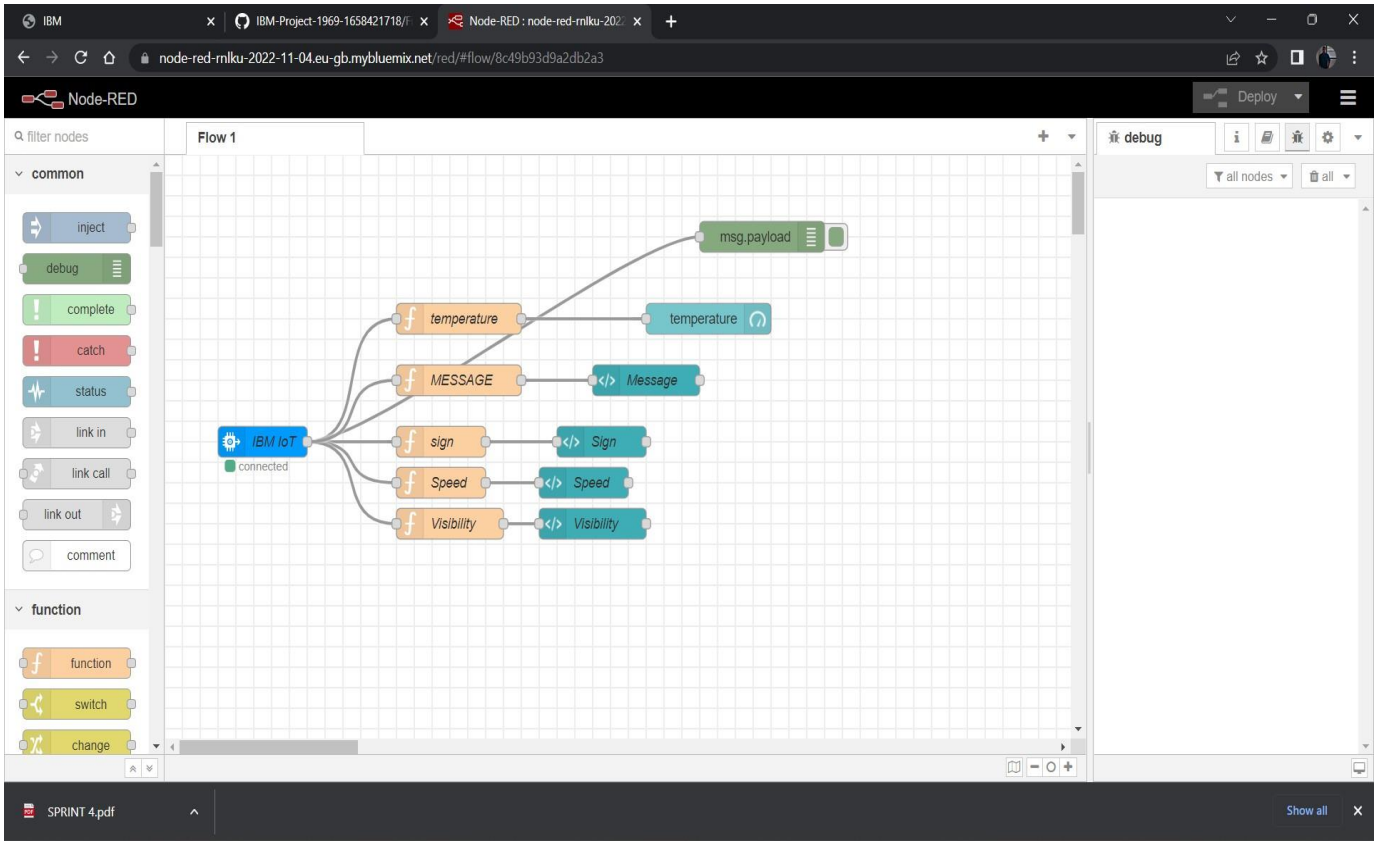

New
Close App Inventor
contentScreen
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
contentScreen
VerticalArrangement1
imgDirection
Label1
Rename
Delete
Media
Viewer
Show Warnings

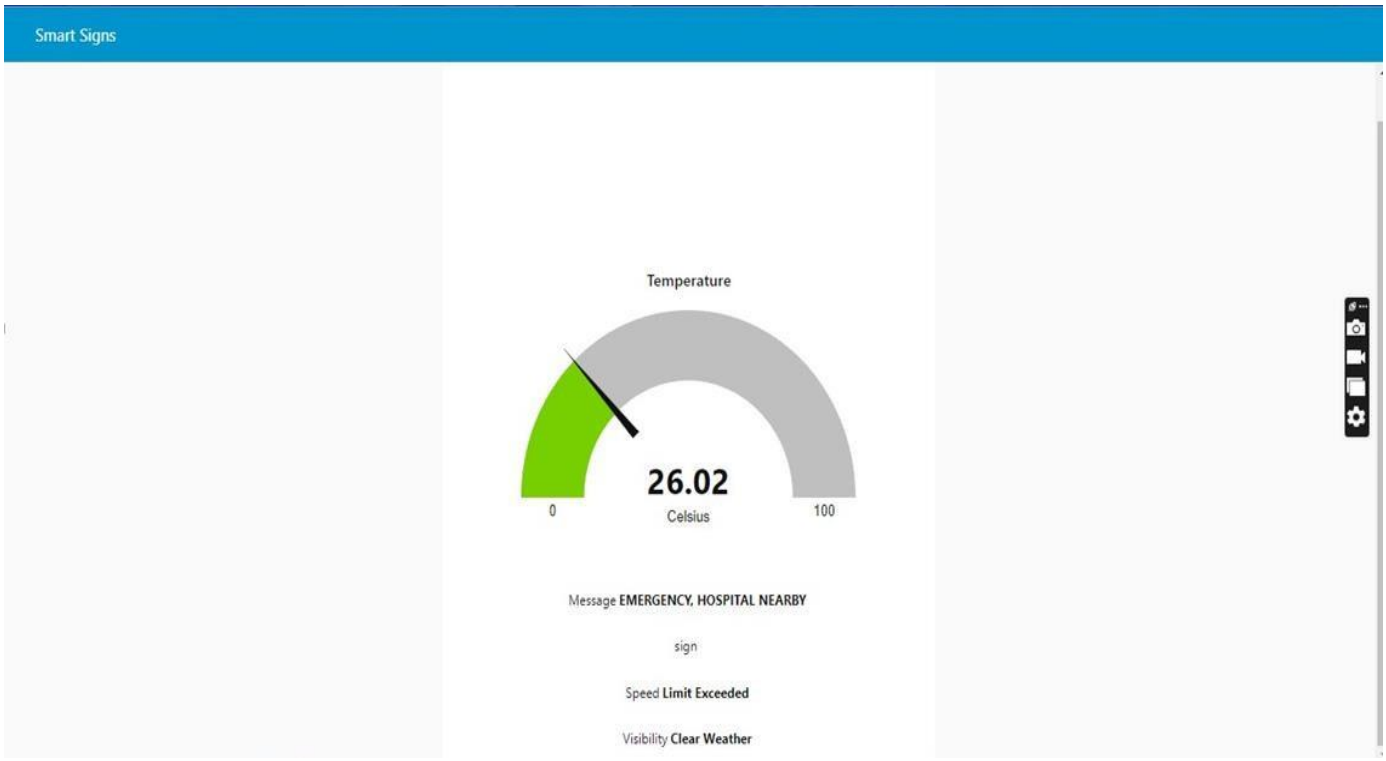
TESTING:

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

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

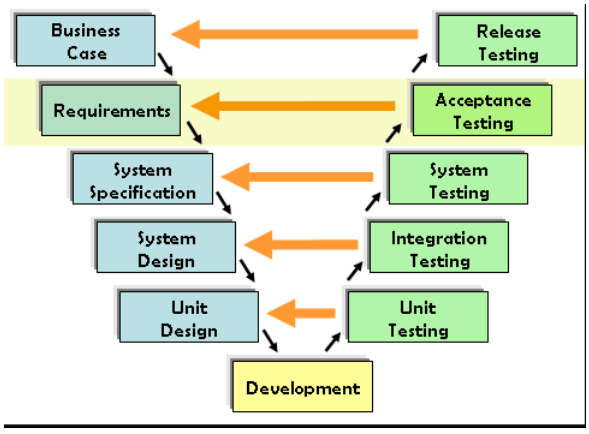
Test Cases:





User Acceptance Testing:

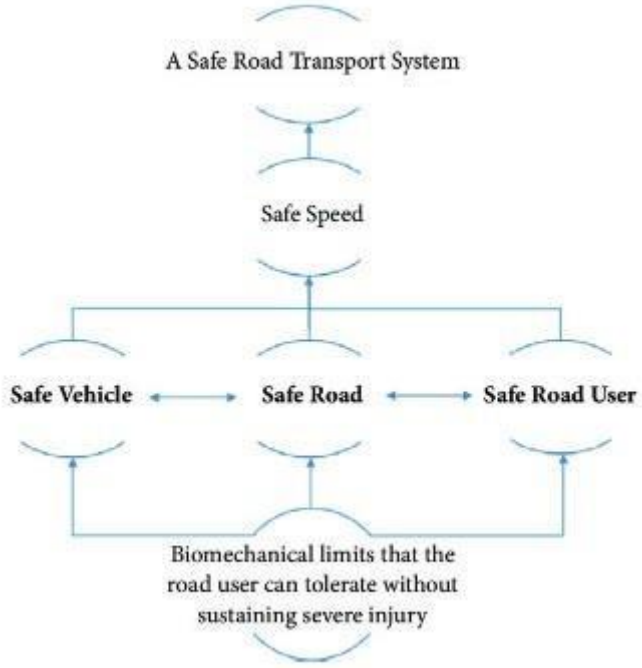
UAT consists, in practice, of people from the target audience using the application. The defects they find are then reported and fixed. This scenario iswhat most closely resembles "the real world." The process allows users to "get their hands dirty" with the application. They can see if things work as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



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

RESULTS:

Performance Metrics:



ADVANTAGES & DISADVANTAGES

Advantages:

- Connected vehicles have various benefits such as

➢ 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 ofover-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 thetraffic, IoT drivers can receive updated information on the state of the roads, i.e., potholes, ice, grade changes, black spots, etc.

DISADVANTAGES:

➢ Security and privacy. Keeping the data gathered and transmitted by IoT devices safe is challenging, as they evolve and expand in use....

➢ Technical complexity....

➢ Connectivity and power dependence....

➢ Integration....

➢ Higher costs (time and money)

CONCLUSION:

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

FUTURESCOPE:

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

APPENDIX:

Source Code:

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

myConfig = {
#Configuration
```

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

#Receiving callbacks from IBM IOT
platform
defmyCommandCallback(cmd):print("Mess
age received from IBM IoT Platform:
%s" % cmd.data['command'])
m=cmd.data['command']

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

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

while True:
response =
requests.get(URL) if
response.status_code
==200:
data = response.json()
main = data['main']
temperature
=main['temp']
humidity =
main['humidity']pressure
= main['pressure'] report =
data['visibility']

#messge part
msg=random.randint(0,5
) if msg==1:
```

```
message="SLOW DOWN, SCHOOL IS NEAR"
elifmsg==2:
message="NEED HELP, POLICE STATION AHED"
elifmsg==3:
message="EMERGENCY, HOSPITAL NEARBY"
elifmsg==4:

   message="DINE IN, RESTAURENT AVAILABLE"
else:
message=""

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


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

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

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

GitHub Link :

https://github.com/IBM-EPBL/IBM-Project-51803-1660984698

Project demo link :

https://youtu.be/YkWyR9k2pQo