PROJECT REPORT

TEAM MEMBERS:

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1.INTRODUCTION:

1.1 Project overview :

Budgets for public infrastructure are always tight, and constructing roads and bridges is always expensive. Signs with Smart Connectivity help municipal and regional transportation departments to cope with the situation — quickly and cost-effectively. Integrating smart traffic technology helps them affordably get better performance from their existing infrastructure.

The problems plaguing our streets and highways are well known. Traffic slow-downs can cause debilitating congestion and add to urban air pollution. Businesses suffer from delivery delays and lost productivity. Emergency vehicles are slowed down by bottlenecks, potentially putting lives at risk. And all of it diminishes the city's overall quality of life.

Meanwhile, cities and regional governments continually ask their traffic management teams, civil engineers and highway maintenance crews to do more with less. In the face of these challenges, innovative cities — "Smart Cities" — are using a coordinated array of hardware, software and cloud solutions to increase traffic flow and improve safety. Signs with Smart Connectivity , which are included in the umbrella of “intelligent transportation systems” and sometimes called “intelligent traffic management,” are automated systems that incorporate the latest advances in Internet of Things (IoT) technology.

1.2 Purpose:

Some of the key purposes that the cities achieve with these systems include the following:

- **Congestion detection:** With cameras and sensors constantly monitoring intersections, technicians can monitor the entire city from the city's traffic signals and determine the conditions of the roads .

- **Adaptive control:** Congestion detection also enables adaptive control, which causes dynamic adjustments to systems including traffic lights, on-ramp signaling, and bus rapid transit lanes.

- **Connected vehicle:** This up-and-coming technology enables vehicles to communicate directly with intersections. The Signs WIth Smart Connectivity, can include a connected vehicle roadside unit for this purpose.

- **Emergency routing:** A critical application of the Signs With Smart Connectivity the ability to give priority access to police, fire and ambulance services.

All of these functions require monitoring, detection, reliable high-speed data transfer and automation. One purpose-built Digi cellular router can provide the communications backbone to manage all of these systems.

2.LITERATURE SURVEY:

2.1 Existing Problem:

1. The vehicle owners find it difficult to reduce their wait time due to the non coordinated traffic signals making their whole journey frustrated .

2. The overall performance of their traffic networks, with high performance, secure, redundant and reliable communications solutions that can help streets and highways carry more traffic in greater safety . Currently these are a problem that need to be addressed.

3. In order to withhold the increasing traffic the roads are widened leading to the loss of the trees and the other flora and fauna that are present along the roadside . This is also an existing problem .

4. Road signals are not digitized .

5. Automated decisions for driver and pedestrian safety are a problem .

6. As the quantity of urban vehicles develops rapidly comes about development of traffic, the deregulation of traffic signs has turned into a common sympathy toward all police furthermore it prompts the mishaps close to the activity signals.

7. Road traffic, which is increasing day by day, is causing more and more deaths worldwide. The world needs a product that would reduce the number of road accidents.

2.2 References :

1. **DYNAMIC MANAGEMENT OF TRAFFIC SIGNALS THROUGH SOCIAL IOT** - MS Roopa, Ayesha Siddiq, Rajkumar Buyya, KR Venugopal, SS Iyengar, LM Patnaik.
2. **SMART TRANSPORTATION SYSTEM USING IOT** - PS Sarika, K Sandhya, T Sudha.
3. **TRAFFIC SIGNAL BREACH VEHICLE STOP SYSTEM USING IOT** - Chereddy Sekhar, K Kranthi, M Kalyan Chakravarthi.
4. **INTEGRATING IOT AND BLOCKCHAIN FOR ENSURING ROAD SAFETY** - AN UNCONVENTIONAL APPROACH - Deepak Prashar, Nishant Jha, Sudan Jha, Gyanendra Prasad Joshi, Changho Seo.
5. **DIGITALIZATION OF HIGHWAYS FOR VULNERABLE ROAD SAFETY DEVELOPMENT WITH INTELLIGENT IOT SENSORS AND MACHINE LEARNING** - Rajesh Singh, Rohit Sharma, Shaik Vaseem Akram, Anita Gehlot, Dharam Buddhi, Praveen Kumar Malik, Rajeev Arya .

2.3 Problem Statement Definition :

In the current scenarios the road signs not being dynamic , just static , are causing a lot of problems to the people who travel by roads . We can change the road signs in certain cases such as with heavy rains decreasing the speed limits and making the vehicles take diversions in case of accidents .

Hence we propose a solution making the speed limits dynamic , automatic diversion system and much more coordinated way of traffic systems with the use of the Iot technology.

3.IDEATION & PROPOSED SOLUTION :

3.1 Empathy Canvas Map :

3.2 Ideation & Brainstorming :

The Ideation , brainstorming and the idea lists consists of :

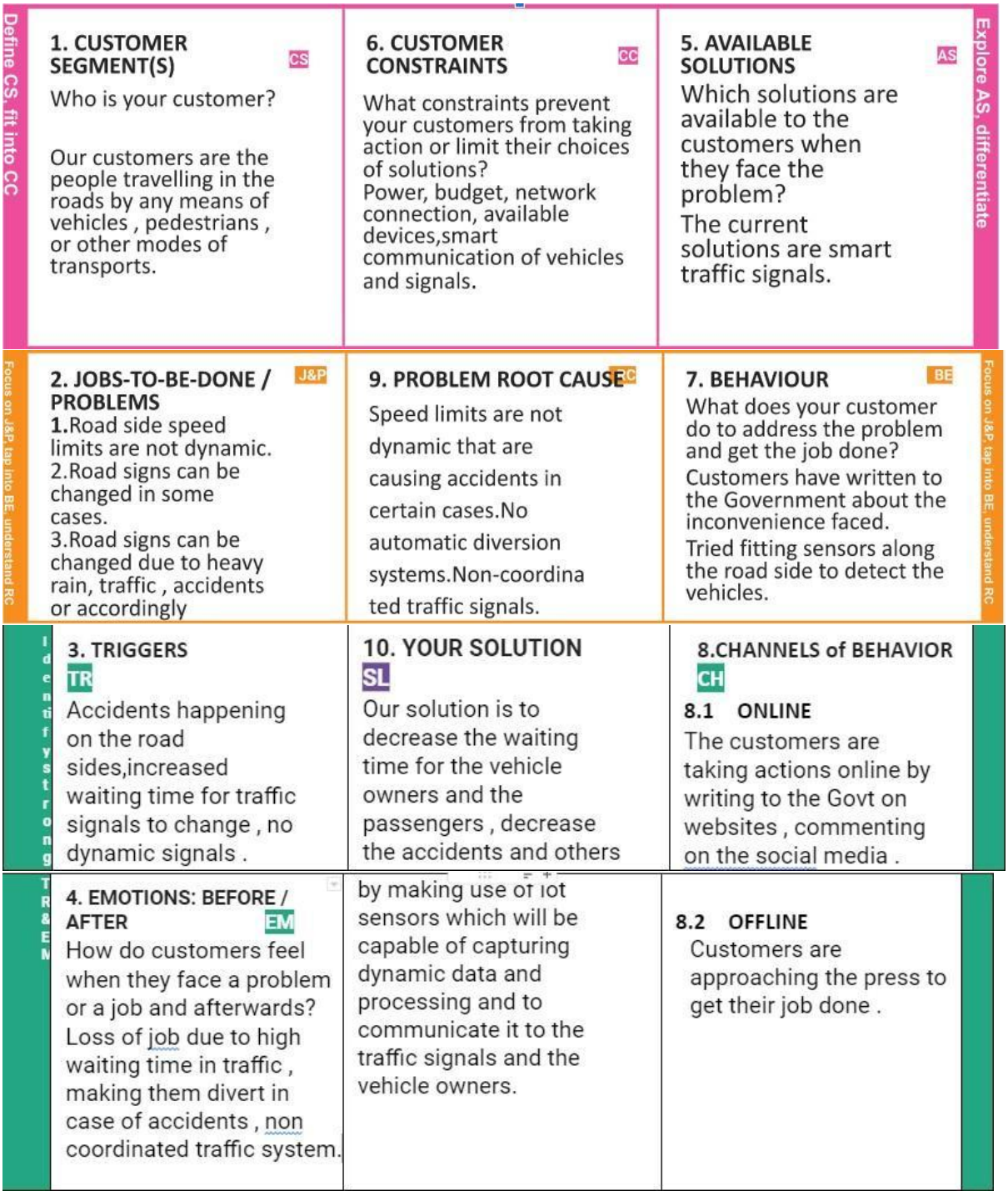
1. Checking the road conditions.
2. Fixing the signs according to the road and the weather conditions .
3. Creating signs that can be understood by everyone .
4. Brainstorming all the problems that can occur on the road .
5. Diverting or Routing the vehicles according to the traffic .
6. Work in progress alert systems .
7. Weather condition based traffic routing systems .
8. Comparing the traffic with the previous day traffic .
9. Limiting the speeds based on the road and weather conditions .
10. No need for long waiting periods on deserted roads.
11. Slippery , muddy and watery road alerts .
12. Accident prone zone alerts .
13. School zone , pedestrian , wildlife crossing zone alerts .
14. Slow down vehicle alerts .
15. Ambulance alerts .

3.3 Proposed Solution :

S.NO	PARAMETERS	DESCRIPTION
1	**Problem Statement (Problem to be solved)**	To develop dynamic , independent problem- solving and an innovative smart sign board to solve the biggest challenges in road safety in the today's changing environment in terms of weather, population and technology.
2	**Idea / Solution description**	Our proposed idea is to build a smart sign board with inbuilt IoT devices that are connected to the internet and uses the cloud technology for processing and giving dynamic signs in the smart sign board based on the current environment situation.
3	**Novelty / Uniqueness**	Our design is dynamic, connected to the internet so it can use the cloud technology and ML for providing better results,collects and stores data for better improvement in safety,each sign boards can independently change the signs and very reactive to the changes,power efficient by using sleep modes,provides extra features like diversion system and traffic signals coordination .
4	**Social Impact / Customer Satisfaction**	1. Improved road Safety 2. Saves life 3. Saves time by providing better traffic diversion.

5	**Business Model (Revenue Model)**	1. Selling Products and services. 2. Revenue from the National and state highways for providing better road safety . 3. By displaying advertisements below the sign boards. 4. Revenue from the government for collecting fine amounts violating laws.
6	**Scalability of the Solution**	1. By increasing the number of sign boards and cloud capacity for increasing the efficiency. 2. A signboard can be useful to at least 50 vehicles at a time and can be expanded.

3.4 Problem Solution Fit :



4. REQUIREMENT ANALYSIS :

4.1 Functional Requirement :

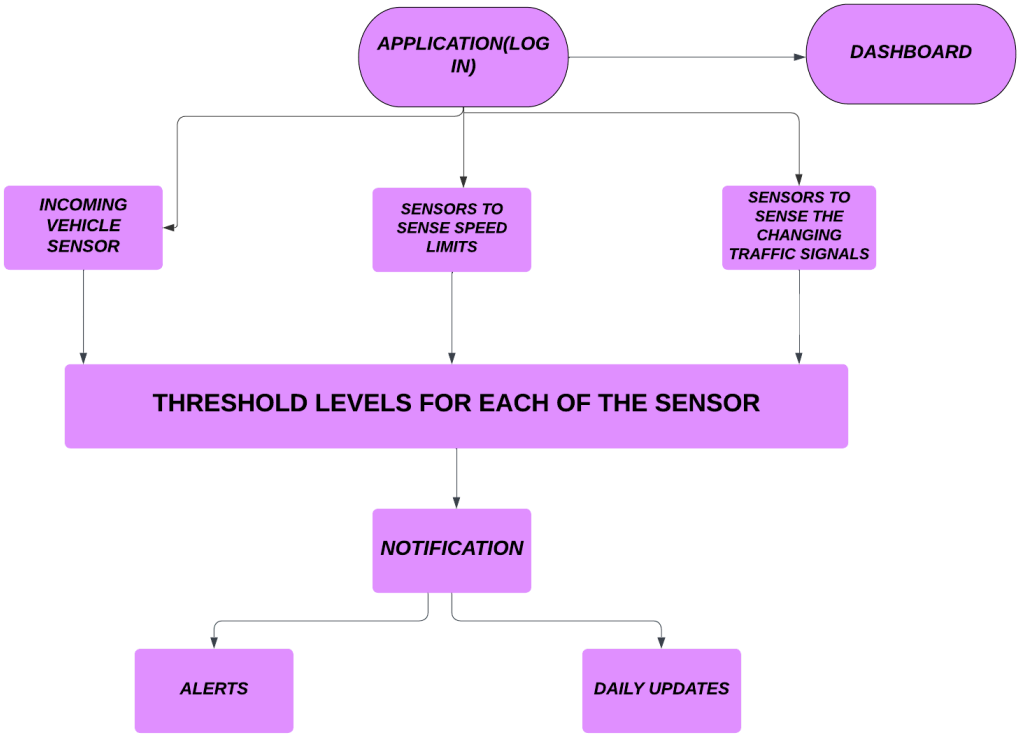
FR NO.	FUNCTIONAL REQUIREMENT (EPIC)	SUB REQUIREMENT (STORY / SUB-TASK)
FR-1	VISIBILITY OF THE ROAD SIGNS	The boards that show signs such as accident prone zones, pedestrian zones, wildlife crossing zones and others according to the data that were previously collected should be clearly visible to the end users and the people who travel by road.
FR-2	TIMELY UPDATES OF THE ROAD SIGNS AND THE TRAFFIC SIGNALS	The information that was collected from the Iot sensors that were set up along the road signs will be used to indicate the speed limits , accident zones and others in order to intimate the end users even faster.Hence timely updates play an important role.
FR-3	RESOURCE CONTROL	A system built using the RA shall be able to remotely control and configure devices. The remote monitoring device may be configured via the M2M network by the M2M application entities. These configuration capabilities will span simple parametric changes, such as, reporting rates, event or alarm trigger levels and others.
FR-4	QoS,DATA HANDLING & COMMUNICATION, USAGE	We can initiate communication with the persons traveling via road for a number of reasons.
FR-5	DISCOVERY & LOOKUP, GEOLOCATION	High value assets need to be tracked down to its very location such as the exact location of the deployed Iot sensor, exact location where there has been any routing of traffic and for even remote monitoring.

4.2 Non - Functional Requirements :

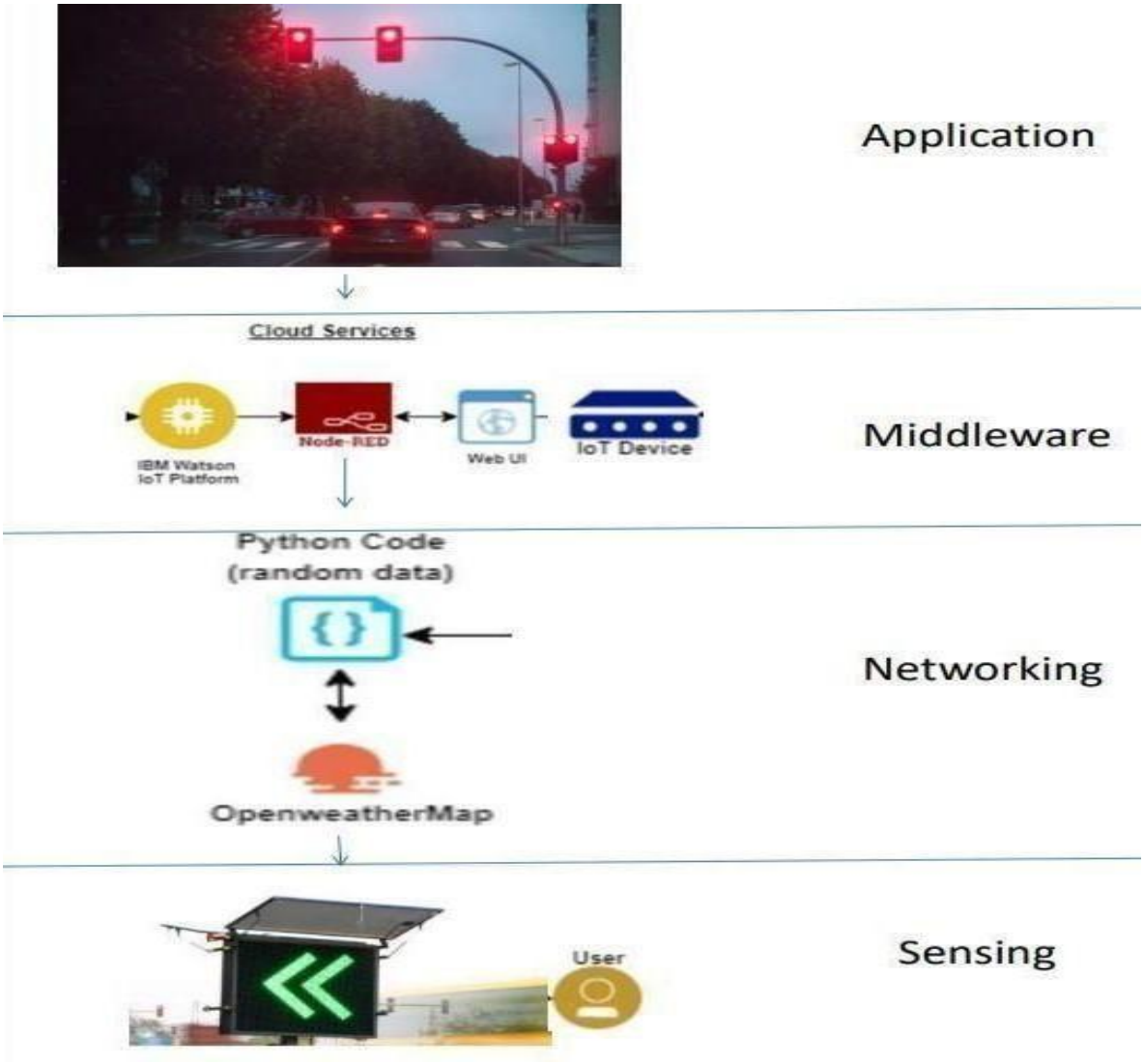
FR NO.	NON-FUNCTIONAL REQUIREMENT	DESCRIPTION
NFR-1	**Usability**	The Iot sensors deployed, the computational environment all will be able to function on it's own way making the application user friendly.
NFR-2	**Security**	A system built using the ARM shall provide ways to ensure security and resilience
NFR-3	**Reliability**	The information displayed on the road signs and the warning messages and alert messages will be correct and errorless in-order to make it reliable.
NFR-4	**Performance**	The system should be able to update itself properly at times if fatal conditions and provides necessary driving measures.
NFR-5	**Availability**	The information and the alarm messages, warning messages will always be available on the cloud for tracking and the information displayed from the sign boards will always be available irrespective of the unfavorable conditions.
NFR-6	**Scalability**	The system will be compatible for any number of devices that are connected to the Iot hub.

5. PROJECT DESIGN :

5.1 Data Flow Diagram:



5.2 Solution & Technical Architecture :



5.3 User Stories :

USER TYPE	FUNCTIONAL REQUIREMENT (EPIC)	USER STORY NUMBER	USER STORY/TASK	ACCEPTANCE CRITERIA	PRIORITY	RELEASE
Customer (End user)	Registration	USN -1	As a user, I can register for the application by entering my email and password(login credentials) and confirming my password.	I can access my account / dashboard.	High	Sprint - 1
		USN -2	As a user , I can register the type of vehicle that I am driving.	I can get the necessary details about the vehicles.	Medium	Sprint - 2
		USN - 3	As a user , I can obtain the real time updates of the vehicles and the conditions of the road.	I can know about the thresholds of each condition listed down.	High	Sprint - 1
		USN - 4	As a user , I can receive notifications(alerts) in case of any emergency or other unfavorable conditions .	I can act efficiently in case of any emergency.	High	Sprint - 1
	Login	USN - 5	As a user, I can use the applications by entering password and email.	I can log into the application.	High	Sprint - 2
	Dashboard	USN - 6	As a user , I can choose among the information listed about the various other vehicles.	I can select among the vehicles .	Medium	Sprint -2

	Generating Data	USN - 7	As a user , I am able to view the thresholds and the information of the other vehicles too.	Better understanding about the thresholds and various other conditions.	High	Sprint - 1

USER TYPE	**FUNCTIONAL REQUIREMENT (EPIC)**	**USER STORY NUMBER**	**USER STORY/TASK**	**ACCEPTANCE CRITERIA**	**PRIORITY**	**RELEASE**
	Notification and Alerts	USN - 8	As a user , I can get the notifications in the form of timely updates and also even emergency alerts .	I can receive timely updates as well as the alerts .	High	Sprint - 1
Customer Care Executive	Efficient functioning	USN - 9	As an executive exclusively for customer care , I can help the customers use the application in a better way .	Efficient management and better road safety	High	Sprint - 2
Developer	Develop the application	USN - 10	As a developer , I can develop the application using the data collected by the IoT sensor and make the best use of it .	Development of the applications using the data collected	High	Sprint - 2
Administrator	Administration of the data	USN - 11	As an admin , I am able to get through the interface and administer the data functionally .	Easy administration of the data when it is updated .	High	Sprint - 2
	Notification	USN - 12	As an admin , I can send timely updates as well as the emergency alerts .	Timely notifications	High	Sprint - 2

6. PROJECT PLANNING & SCHEDULING :

6.1 Sprint Planning & Estimation :

Sprints are the backbone of any good Agile development team. And the better prepared you are before a sprint, the more likely you are to hit your goals. Spring planning helps to refocus attention, minimize surprises, and (hopefully) guarantee better code gets shipped. The main event during agile methodology is the sprint, the stage where ideas turn into innovation and valuable products come to life. On one hand, agile sprints can be highly effective and collaborative. At the same time, they can be chaotic and inefficient if they lack proper planning and guidance. And for this reason, making a sprint schedule is one of the most important things you can do to ensure that your efforts are successful.

We categorized the sprint as 4 phases for creating the application.

SPRINT 1 : Creation and Installation of softwares such as IBM cloud , weather app , IBM Watson , Node Red , Python.

SPRINT 2 :

1. Creation of python script to extract the important data such as temperature , humidity and other weather conditions.
2. Push the code from Sprint 1 to cloud so it can be accessed from anywhere .
3. Creation of device , board , Node Red service and other required software installation for the connection of python script with the cloud .
4. Creation of UI using MTI app inventor.

SPRINT 3: Creation of function and Debugging

SPRINT 4: UI/UX Optimization & Debugging

6.2 Sprint Delivery Schedule:

SPRINT	FUNCTIONAL REQUIREMENT (EPIC)	USER STORY / TASK	STORY POINTS	PRIORITY	TEAM MEMBERS
Sprint-1	Creation and Installations of software	Create an account and install the required software - IBM cloud , weather app , IBM Watson , Node Red , Python.	1	LOW	Naveen Kowsanth Harish Raji
Sprint-2	Local Server/Software Run	Creation of python script to extract the important data such as temperature , humidity and other weather conditions.	1	MEDIUM	Kowsanth Naveen Harish Raji
Sprint-2	Push the server/software to cloud	Push the code from Sprint 1 to cloud so it can be accessed from anywhere .	2	MEDIUM	Kowsanth Naveen Harish Raji
Sprint-2	Creation of other important parameters in the node red .	Creation of device , board , Node Red service and other required software installation for the connection of python script with the cloud .	2	MEDIUM	Kowsanth Naveen Harish Raji
Sprint-2	Creation of UI	Creation of UI using MTI app inventor.	2	HIGH	Kowsanth Naveen Harish Raji
Sprint-3	Creation of function and Debugging	Sending data from the weather app to the cloud . Sending data from cloud to the node red and pre-process the data.	2	HIGH	Kowsanth Naveen Harish ,Raji
Sprint-4	UI/UX Optimization & Debugging	Creation of UI dashboard in Node Red.Final output is displayed . Data is transferred from cloud to the MTI app inventor.	2	HIGH	Kowsanth Naveen Harish Raji

6.3 Project Tracker :

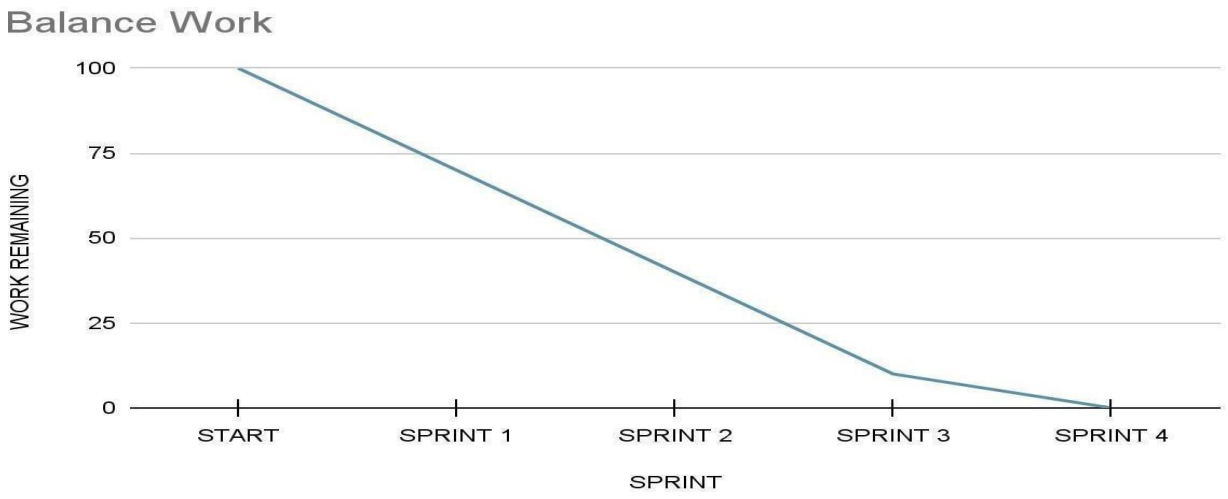
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	23 Oct 2022	28 Oct 2022	20	30 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	07 Nov 2022	20	31 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	13 Nov 2022	20	08 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	20 Nov 2022	20	19 Nov 2022

6.4 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)

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

6.5 Burndown Chart :



7. CODING AND FEATURES :

7.1 Weather Map API :

Creation of python script to extract the important data such as temperature , humidity and other weather conditions.

1. A weather API is ideally suited for use cases that need large volumes of weather data or need to access weather data in an automated way.
2. A weather API allows you to retrieve that exact weather conditions at any given time and location directly in your code.
3. Good weather APIs provide both historical weather data and forecast data via an easy-to-use, well-defined programming interface.
4. The best APIs have dozens of weather measures, near-real-time current conditions reporting, and decades of worldwide historical weather reports.
5. Ideally both historical and forecast look-ups would be combined into the same API entry point with the addition of an ultra-long-range forecast based on climate statistics.

7.2 Ibm Watson :

Sending data from the weather app to the cloud .

1. A fully managed, cloud-hosted service with capabilities for device registration, connectivity, control, rapid visualization and data storage.
2. To completely manage your IoT landscape and make better business decisions. Using a secure, smart and scalable platform as the hub of IoT, get real-time analysis of user, machine and system-generated data .

7.3 Python Code :

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
import requests
a="https://api.openweathermap.org/data/2.5/weather?lat=9.939093&lon=78.121
719&appid=774e289f963ae64e2b43500df7bd1053"
r = requests.get(url=a)
data = r.json()

temp = data["main"]["temp"]
hum = data["main"]["humidity"]
print("Temperature is :",temp)
print("Humidity is :",hum)

#Provide your IBM Watson Device Credentials
organization = "zdo1c1"
deviceType = "123"
deviceId = "ibm"
authMethod = "token"
authToken = "12345678"

# Initialize GPIO
def myCommandCallback(cmd):
```

```
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="lighton":
        print ("led is on")
    elif status == "lightoff":
        print ("led is off")
    else :
        print ("please send proper command")

try:
        deviceOptions = {"org": organization, "type": deviceType, "id": deviceId,
"auth-method": authMethod, "auth-token": authToken}
        deviceCli = ibmiotf.device.Client(deviceOptions)
        #.....................................

except Exception as e:
        print("Caught exception connecting device: %s" % str(e))
        sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an
event of type "greeting" 10 times
deviceCli.connect()

while True:
        #Get Sensor Data from DHT11

        temp = data["main"]["temp"]
```

```
Humid = data["main"]["humidity"]
speed =  random.randint(10,100)
if speed < 50 :
   speed = 80
else :
   speed = 60
traffic =random.randint(50,100)
road = random.randint(50,100)
if(road<75):
   road="Blocked"
else :
   road="Clear"
if(traffic<75):
   traffic="Go Straight"
else :
   traffic="Take Diversion"



data = { 'temp' : temp, 'Humid': Humid, 'speed': speed, 'traffic' : traffic,
'road': road}
#print data
def myOnPublishCallback():
   print ("Published Temperature = %s C" % temp, "Humidity = %s %%" %
Humid,"Speed = %s km/hr" % speed, "traffic = %s " % traffic, "Road status = %s
" % road, "to IBM Watson")
```

success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on_publish=myOnPublishCallback)

if not success:

print("Not connected to IoTF")

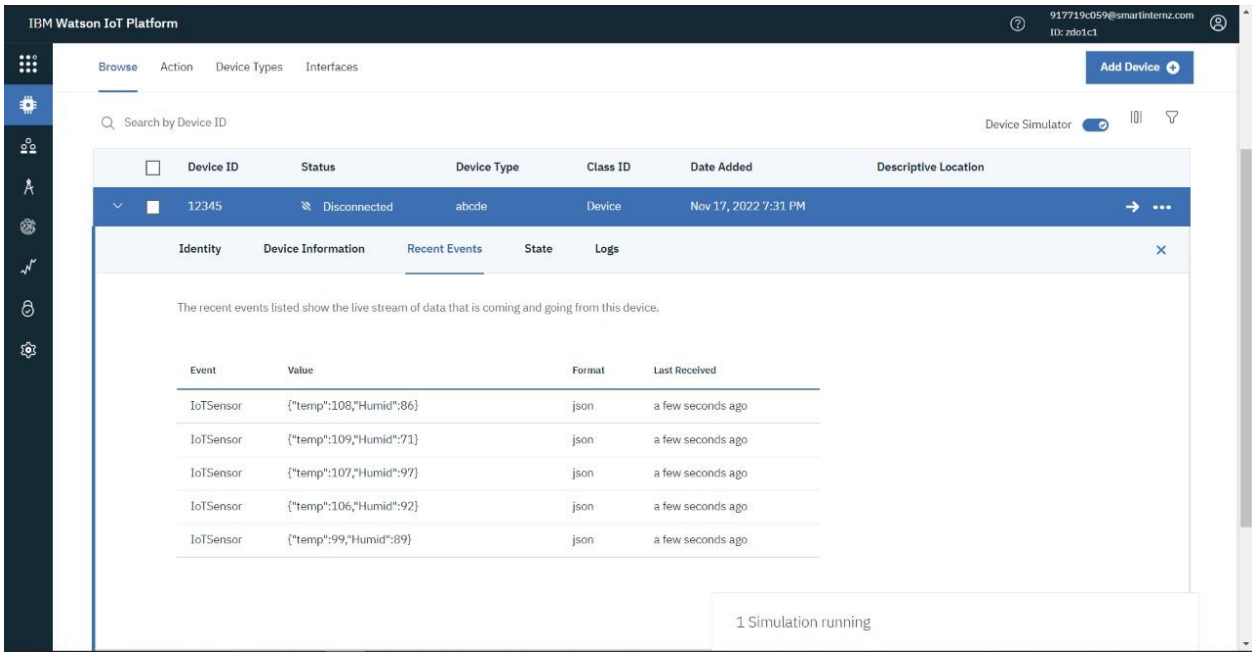
time.sleep(10)

deviceCli.commandCallback = myCommandCallback

 # Disconnect the device and application from the cloud

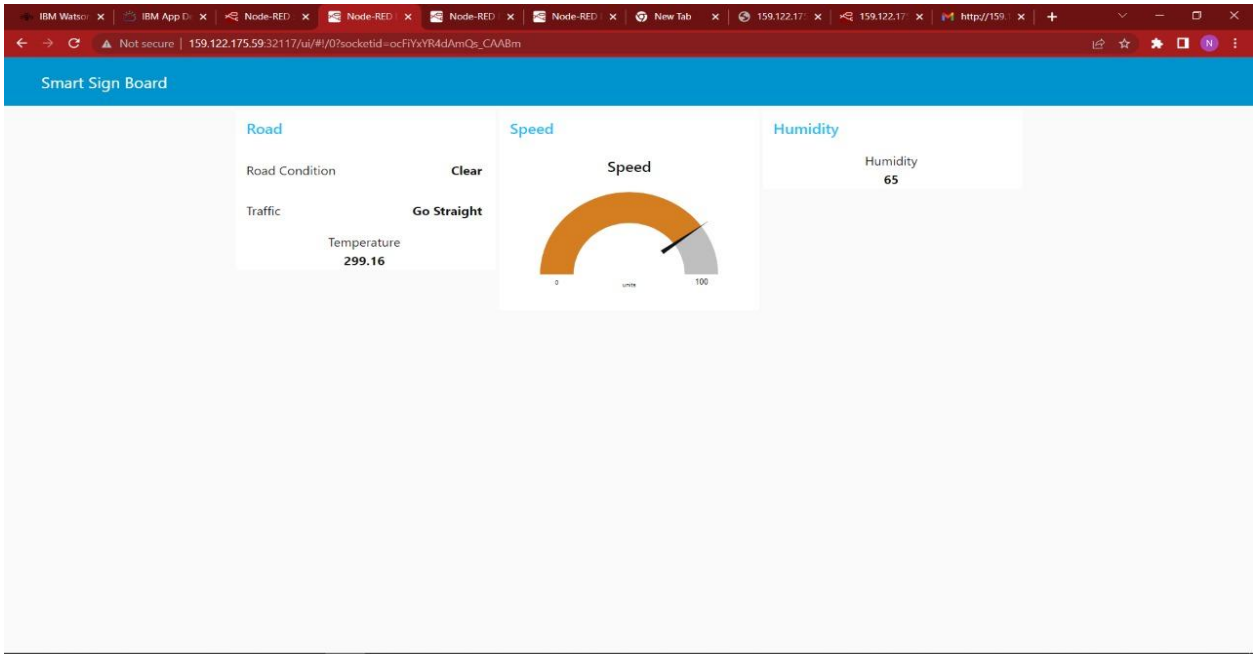
deviceCli.disconnect()

7.4 Database Schema:



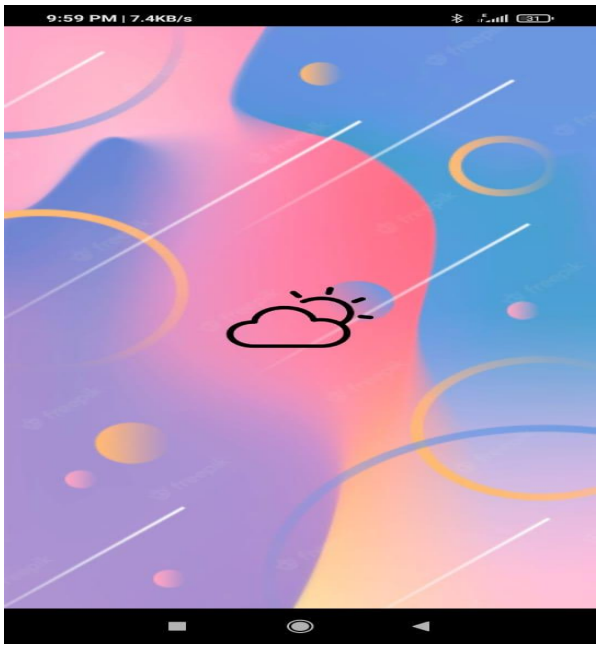
8. RESULTS :

8.1 Dashboard :

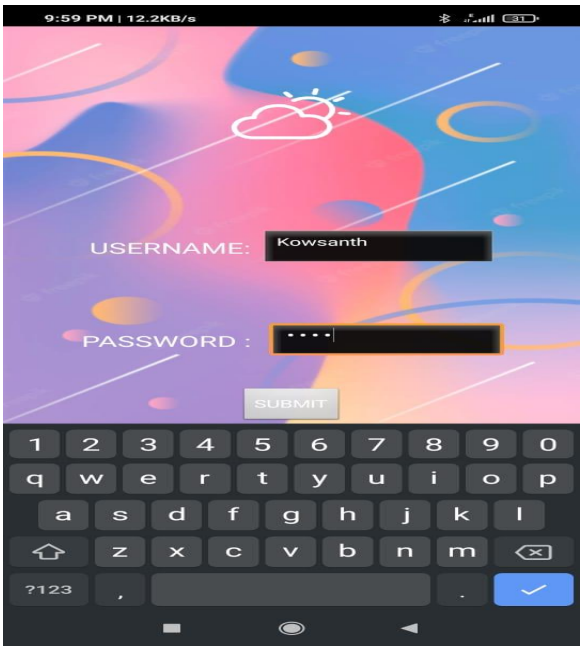


8.2 Frontend :

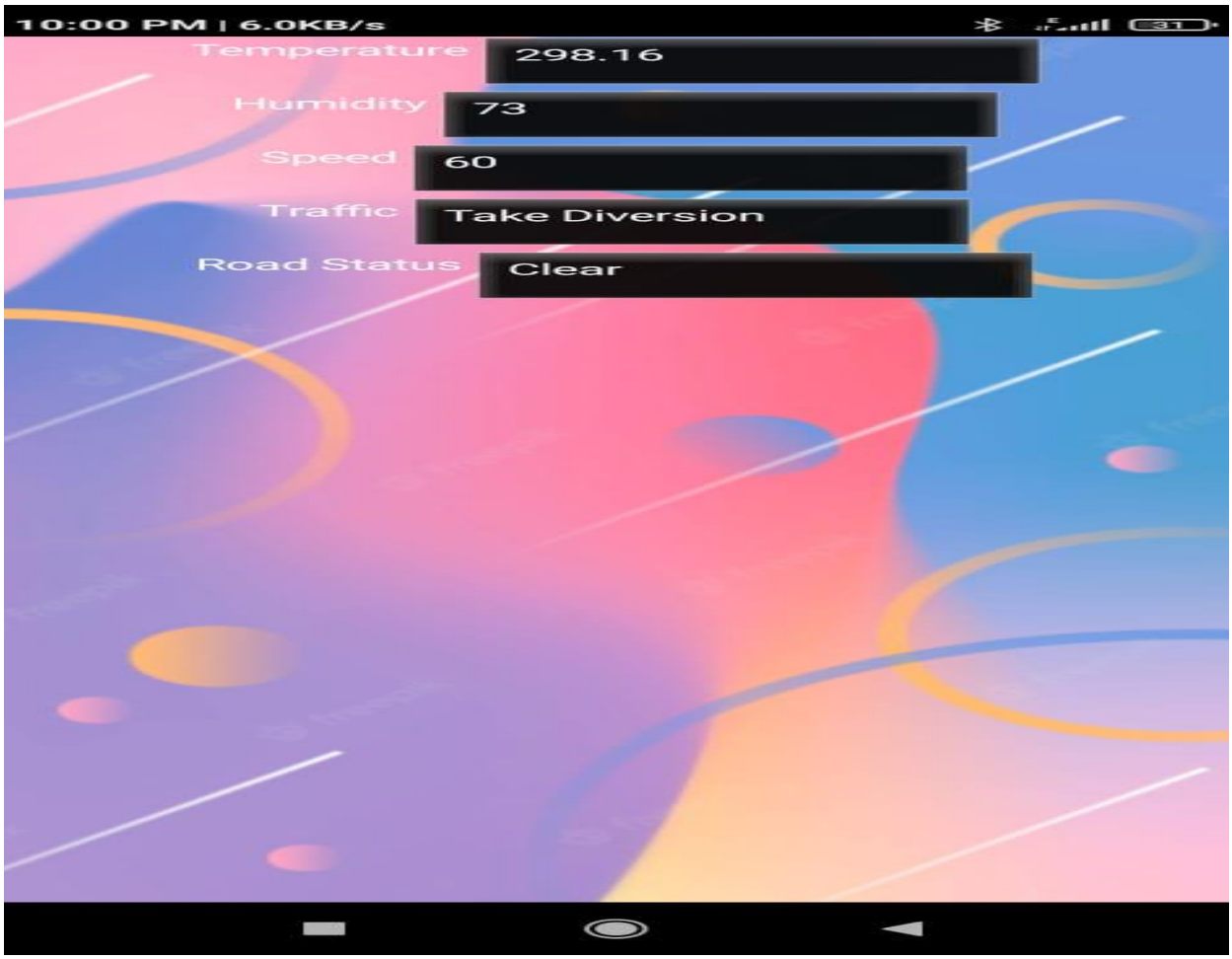
Home page :



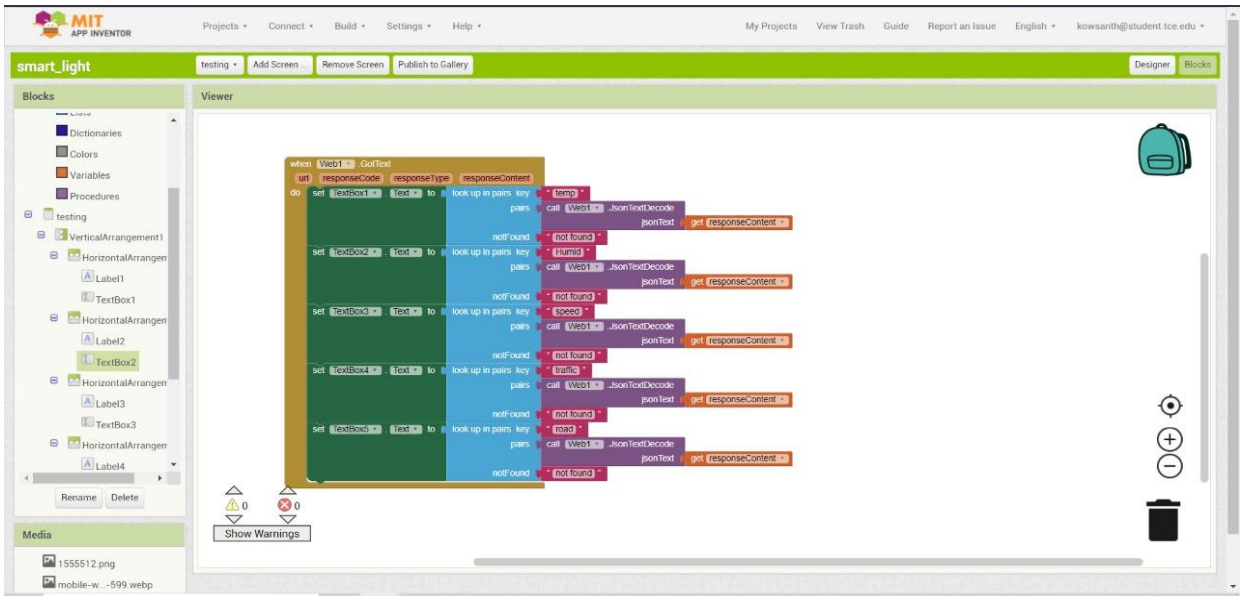
Login Page :



Dashboard in Mobile App :



8.3 Backend :



9. ADVANTAGES AND DISADVANTAGES :

Advantages :

1. **Speed :**

   This website is fast and offers great accuracy as compared to manual registered keeping.

2. **Maintenance :**

   Less maintenance is required

3. **User Friendly :**

   It is very easy to use and understand. It is easily workable and accessible for everyone.

4. **Fast Results :**

   It would help you to provide plasma donors easily depending upon the availability of it.

Disadvantages :

1. **Internet :**

   It would require an internet connection for the working of the website.

2. **Auto- Verification :**

   It cannot automatically verify the genuine users.

10 . CONCLUSION :

Signs with Smart Connectivity has been developed by using multiple features of software components in IoT. Traffic optimization is achieved using the IoT platform for efficient utilization and allocating varying time to all traffic signals according to available vehicles count in the road path. Smart Traffic Signals is implemented to deal efficiently with the problem of congestion and perform rerouting at intersections on a road.

This research presents an effective solution for rapid growth of traffic flow particularly in big cities which is increasing day by day and traditional systems have some limitations as they fail to manage current traffic effectively. Keeping in view the state of the art approach for traffic management systems, a smart traffic management system is proposed to control road traffic situations more efficiently and effectively. It changes the signal timing intelligently according to traffic density on the particular roadside and regulates traffic flow by communicating with local servers more effectively than ever before. The decentralized approach makes it optimized and effective as the system works even if a local server or centralized server has crashed. The system also provides useful information to higher authorities that can be used in road planning which helps in optimal usage of resources.

11. FUTURE SCOPE :

For future directions, different priority levels for multiple incidents and scenarios can be considered. The main issue with IoT is that the security of the entire system has to be concentrated on and not a particular IoT layer, device or software. Hence, integrating the entire traffic management system with multiple layer security for various data generated from various sources can be another subject of future scope.

12. APPENDIX :

GITHUB LINK :

https://github.com/IBM-EPBL/IBM-Project-27538-1660059532

SOURCE CODE LINK :

https://github.com/IBM-EPBL/IBM-Project-27538-1660059532/blob/main/FINAL_DELIVERABLES/final.py

IMPLEMENTATION LINK :

https://github.com/IBM-EPBL/IBM-Project-27538-1660059532/blob/main/FINAL_DELIVERABLES/WhatsApp%20Video%202022-11-19%20at%201.55.08%20AM.mp4