SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

Domain : IOT

A PROJECT REPORT

Submitted by

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INTRODUCTION

1.1 PROJECT OVERVIEW

Smart Plug-in device employing Internet of Things (IoT), Intelligent Transport System (ITS), cloud computing and sensor-based road side units with capabilities to provide wireless access to automobiles plying on the roads, and gathering and distributing relevant real-time information would play a pivotal role in passenger safety. It provides real-time information to the vehicle drivers regarding the traffic conditions, moisture levels, landslides, presence of human beings and wildlife, traffic congestion and ensure optimal routing as well as traffic efficiency. The use sensors such as temperature sensors, accelerometers, GPS Sensors, RADAR Sensors in the smart plug-in device also plays a crucial role in monitoring the transport infrastructures such as bridges, tunnels or viaducts as damages caused to the infrastructure due to natural disasters, corrosion or poor maintenance can prove fatal. Wireless sensors are utilized to detect and monitor road surfaces for any irregularities such as potholes in a road. Remote sensors to measure humidity, temperature, and various other similar parameters. The Basic chip is ESP-32 in which the sensors are built in. DHT22 Sensor, Accelerometer Sensor, GPS Sensor, Gravity Sensor, RADAR Sensor are connected with ESP-32 to collect the various information about the road in which we are traveling. The IBM cloud storage is used as the backend. The Open Weather API is used to provide the temperature and humidity details on specific cities. MIT App inventor is used to design the front-end and it will collect all the datum from the IBM Cloud. The collected datum will be directly sent to the User's Mobile.

1.2 PURPOSE

With a surge in traffic, the manual interface becomes a challenge to control and prevent road accidents, and traffic management especially in the hilly terrains. Traffic Police intervention, convex mirrors installation, and other techniques, though helpful in these situations, become difficult to manage in severe and extreme conditions like rainfall, snow, foggy weather and high number of sharp curves. In those circumstances , these Smart Plug-in device for vehicles will be very useful .These Plug-in device will be more useful in transportation engineering since it produces smart signs which gets changed dynamically. This technique will not only reduce the accident risk in sharp curves, but will also help in reducing human intervention on traffic counts, management and helps in quick decision making. This will give the capability of normal cars to behave like a smart car. It is more applicable when the road in which we are going to travel is under construction. Since during construction the roads will have some pits and holes and take diversion board. These boards and the damaged roads will be a huge problem in night – time travelling. In such cases this device can give the information and road's condition to the user's device itself. With this Plug-in device the user can feel an extra level of security. Since it is dynamic and uses advanced technologies, it will create a great need in the future.

CHAPTER 2

LITERATURE SURVEY

- Mubashir Murshed , Md Sanaullah Chowdhury –**An IoT Based CarAccident Prevention and Detection System with Smart Brake Control**

Car accidents are considered one of the most destructive phenomena. Though there are many different reasons behind car accidents occur due to driver's unawareness and uncontrolled speed. Also there seems to be a problem reaching the spot of accidents in time for lack of awareness . As a solution, the advent of internet of Things(IOT) technologies can reduce the number of accidents. In this paper ,a smart system is described that alerts and controls the speed of vehicle also notifies the individual accordingly when an accidents occurs. This system always monitors the distance between vehicles and obstacles that are in front, using distance sensors. It will alerts the driver to control the speed and reduce the speed by itself when a critical distance comes. Whenever an accident takes place for uncertain condition ,an email alert will be send to the accountable individual with car details.

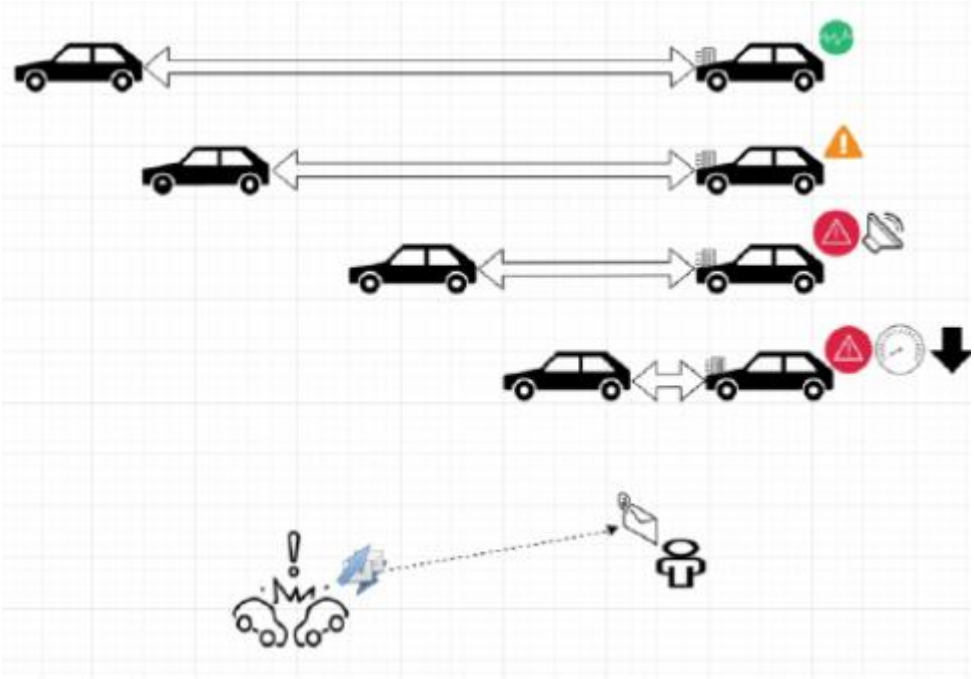


Fig 2.1 Diagram of how the system works

- Fengyu Wang, Daniel Dajun Zeng, Liuqing Yang-**Smart cars on smart roads**

A research performed by IEEE Intelligent Transportation Systems Society (ITSS) on intelligent transportation systems is presented. The aim of ITSS is to bring together engineers and scientists working in theoretical, experimental, and operational aspects of electronics and electrical engineering and information technologies as applied to intelligent transportation systems. The present generation of vehicles is equipped with various sensors, CPUs, software systems, and communication capacities. In future, active in- and out-vehicle environment sensing will become standard, enabling intelligent driver and passenger assistance and increasing driver safety, efficiency, and comfort. Intelligent spaces are environments that can continuously monitor the functions, communicate, make decisions, and can act on decisions. Agent-based control offers an ideal approach to transportation management, addressing its geographically distributed and alternately busy-idle operating characteristics.

- Maria-Adelina Sirbu, Andrei Baiasu,Razvan Bogdan,Mihaela Crișan-Vida- **Smart Traffic Sign Detection on Autonomous car**

The development and improvement of technology has enable the use of more and more processing and power in nowadays cars. “Ubiquitous computing” has given the possibility of creating smarter, faster, low-power and smaller computing systems which can be integrated in automotive ECUs. Thus cars can perform more complex operations by including ECUs with multiple cores ,which can now provide multiple active safety features like real-time traffic sign detection using powerful cameras, obstacle detection using radar systems and more often highly automated cars

- P S Saarika ,K. Sandhya ,T. Sudha - **Iot For a Smart Tranportation System**

  Nowadays the concept of smart cities became more popular. The evolution of internet of things (IoT) helps the idea of smart city more achievable. A major branch of smart city is smart transportation. Problems such as traffic congestion, road safety, accident detection, automatic fare collection and limited car parking facilities can be resolved by IoT. In this paper, an IoT based smart parking system along with an intelligent signboard is proposed. The smart parking system composed of intelligent sensors deployed on site and are used to monitor and inform the availability of parking spaces. A mobile or internet application can be provided to check the availability of parking slot. The sign board with embedded RF module and connected sensors working with solar energy as well as in battery will show the place, distance to that place, weather condition, temperature and different routes to those places.

- UNAIZA ALVI,MUAZZAM A. KHAN KHATTAK ,BALAWAL SHABIR , ASAD WAQAR MALIK , SHER RAMZAN MUHAMMAD - **AComprehensive study on iot based accident detection systems for smart vehicles**

With population growth, the demand for vehicles has increased tremendously, which has created an alarming situation in terms of traffic hazards and road accidents. The road accidents percentage is growing exponentially and so are the fatalities caused due to accidents. However, the primary cause of the increased rate of fatalities is due to the delay in emergency services. Many lives could be saved with efficient rescue services. The delay happens due to traffic congestion or unstable communication to the medical units. The implementation of automatic road accident detection systems to provide timely aid is crucial. Many solutions have been proposed in the literature for automatic accident detection. The techniques include crash prediction using smartphones, vehicular ad-hoc networks, GPS/GSM based systems, and various machine learning techniques. With such high rates of deaths associated with road accidents, road safety is the most critical sector that demands significant exploration. In this paper, we present a critical analysis of various existing methodologies used for predicting and preventing road accidents, highlighting their strengths, limitations, and challenges that need to be addressed to ensure road safety and save valuable lives.

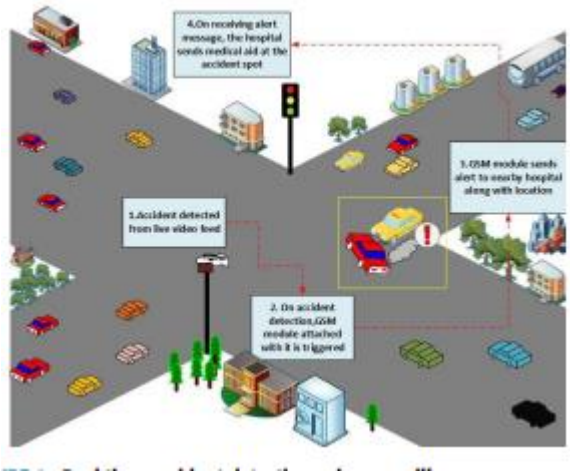


Fig 2.2 Real time accident detection using surveillance cameras.

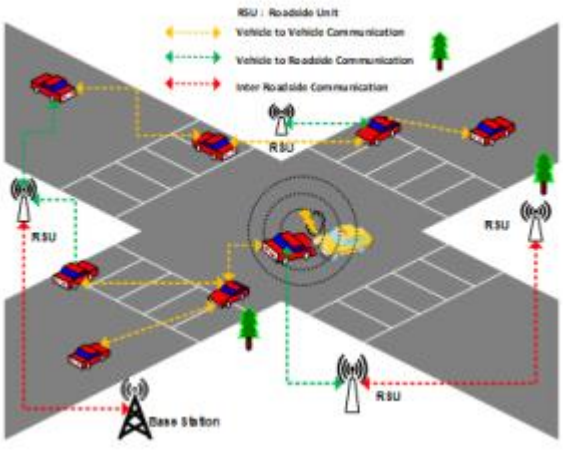


Fig 2.3 Accident reporting scenario in VANET

2.2 REFERENCES:

S.No	TITLE	AUTHOR	TECHNOLOGY	ADVANTAGES	DISADVANTAGES
1	Smart Traffic Sign Detection on Autonomous Scar	1.MariaAdelina Sirbu 2.AndreiBaiasu 3.MihaelaCrisan-Vida 4.RazvanBogdan	1.Histogram equalization 2.CLACHE(Contrast -limited adaptive histogram equalization) 3.Haar-Haar cascade	***** Haar cascades provide a better performances at a runtime. * Better detection. *It reduce the road accident	***** worst-case scenario, either the obstacle came too closer or another obstacle which cannot be avoided appear then a decision to stop is made.
2	An IOT Based Car Accident Preventation And Detection System With Smart Brake Control	*Mubashir Murshed *Md Sanaullah Chowdhury	*Raspberry pi *Ultrasonic sensor ***** Servo motor	***** This will allow the car both changes the speed and make it stop at the same time. *The servo motor placed in gearbox or break paddle will attached in the most effective way *The email send to the responsible person	*If the manual transmission car it will operate on the gearbox and clutch by changing a gears.This allow the car to both change speed and stop it completely without turning off the engine *Cost is high.
3	Iot For a Smart Tranportation System	*Ahmedy.Awad *Seshadri mohan	*GPS and Assisted GPS *Raspberry pi * GPS sensor *SUPL *ESMLC *Cloud unit	***** To fixed the servomotor in the gear to reduce the speed *if the car is accident the meg will automatically send to the authorized person	***** High cost *It some times to fail to reduced the speed
4	Smart Cars On Smart Roads	*Fei-Yue Wang *Daniel Zeng *Liuqing Yang	GPS , ad hoc network,and sensors are used *Pervasive computing methodology and ITS technology	*Easy to track the location *Find the objects for efficiency	***** If the rainy time the signal is week it does not detect the locations.
5	Automatic Vehicle Accident Detection and Messaging System Using	*C.Prabha *R.Sunitha *R.Anitha	*MEMS sensor (Micro electro mechanical system. *ARM controller *GSM and GPS	*Easy to operate. *Sophisticated security. *Simple and Reliable Design. *Isolates both GSM and GPS signal.	*It does not work without network

	GSM and GPS Modem				
6	A Comprehensive study on iot based accident detection systems for smart vehicles	*Unaiza Alvi *Muazzam A.Khan Khattak *Balawal Shabir *Asas Waqar Malik *Sher Ramzan Muhammad	*VANET *RF module *MEMS sensor *temperature sensor *Vibration sensor *GPS ana GSM	*The VANET is safety *Sending the message immediately	*Using the VANET it's a major problem is security *Server issue

2.3 PROBLEM STATEMENT DEFINITION:

Problem Statement:

- While a person driving a vehicle, He/she might get frightened about accidents due to the unexpected road conditions that include Pits and holes in the roads, Construction works on the roads, Bare guards etc.,
- To avoid these kinds of issues and to enjoy the traveling there should be a road which can sense the road's condition and intimate to the car's directly and to inform the driver to maintain a level of speed.

CHAPTER 3

IDEATION PHASE

3.1 Empathy Map Canvas

An **empathy map** is a collaborative visualization used to articulate what we know about a particular type of user. It externalizes knowledge about users in order to

1) create a shared understanding of user needs, and

2) aid in decision making.

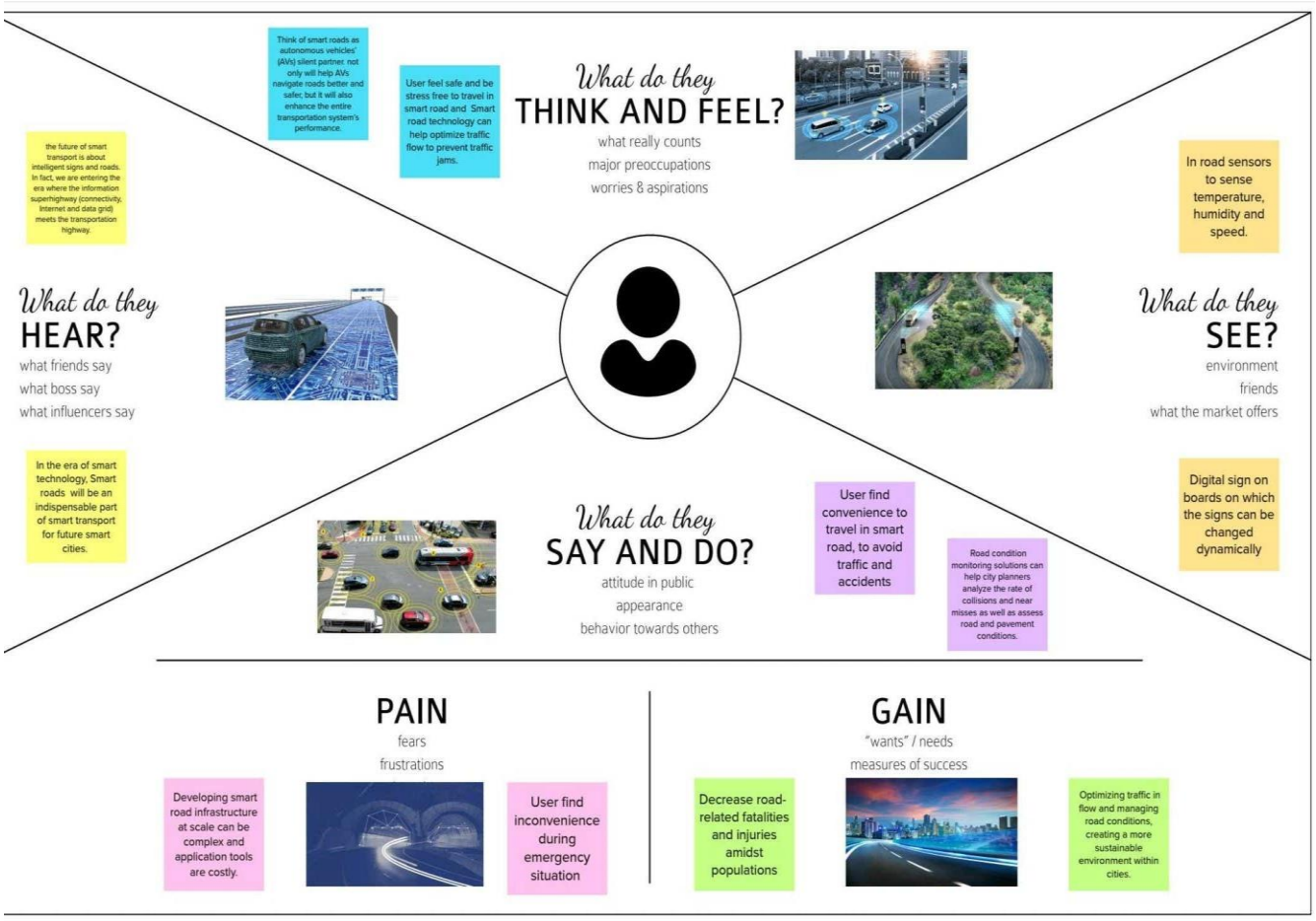


Fig 3.1 Empathy Map Canvas

Explanation:

What do they think and feel?

- User feels safety while driving.
- Stress – free traveling in smart roads.
- Navigates through roads in a better way

What do they see?

- Road sensors to sense weather.
- Dynamic digital sign boards.

What do they say and do?

- Convenience Travelling.
- More Suitable for smart cars.
- Can avoid unwanted pollutions.

What do they hear?

- This might be an enhancing technology in the future of Transportation Engineering.
- Smart roads will be an indispensable part of smart transport.

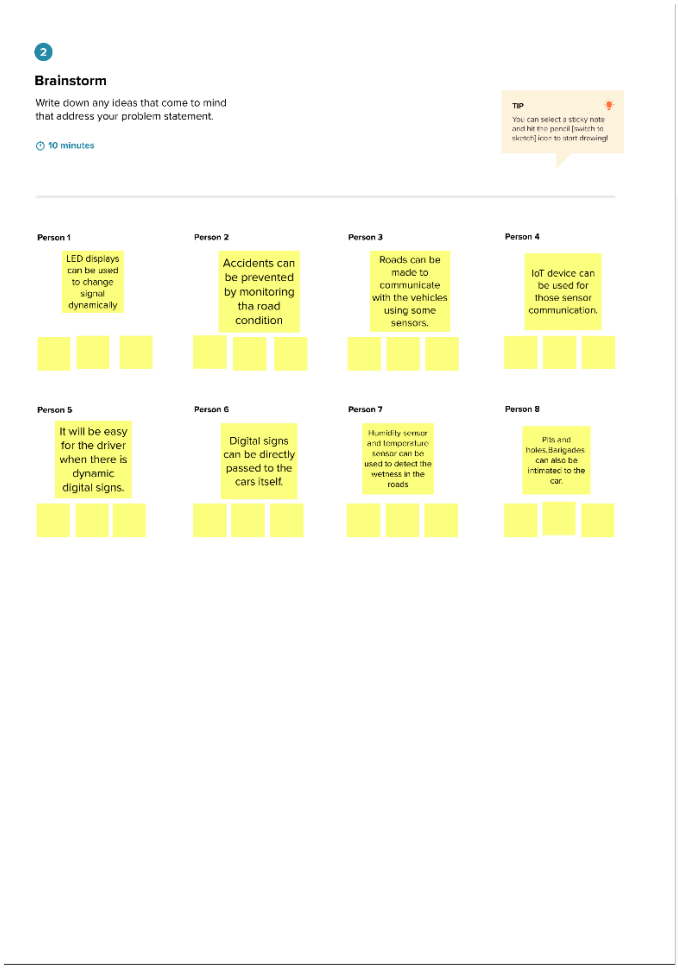
3.2 Ideation and Brainstroming

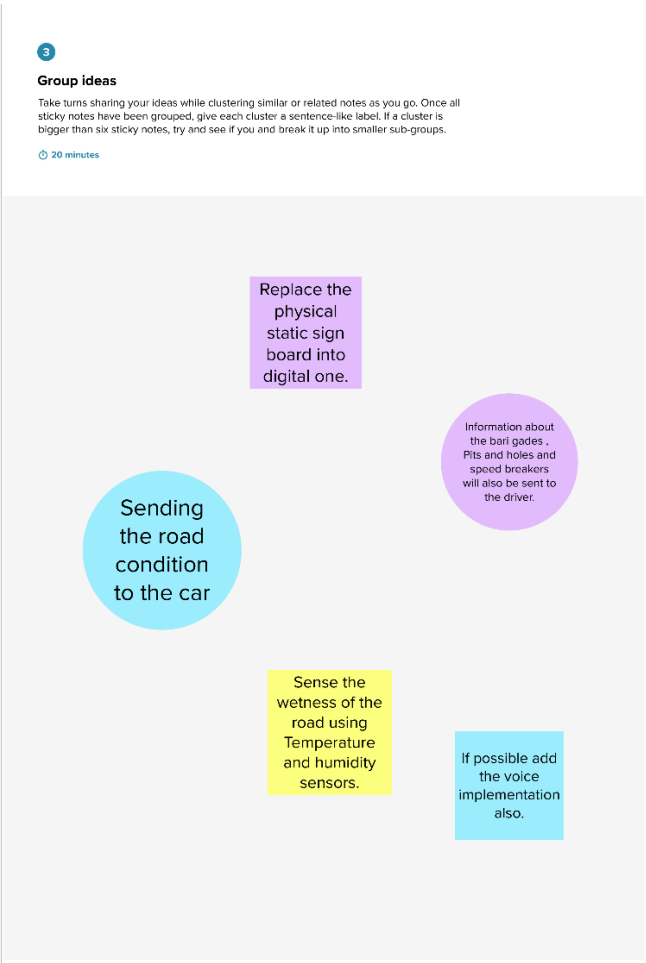
Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate,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

Step-1: Team Gathering, Collaboration and Select the Problem Statement

Team ID: PNT2022TMID48642

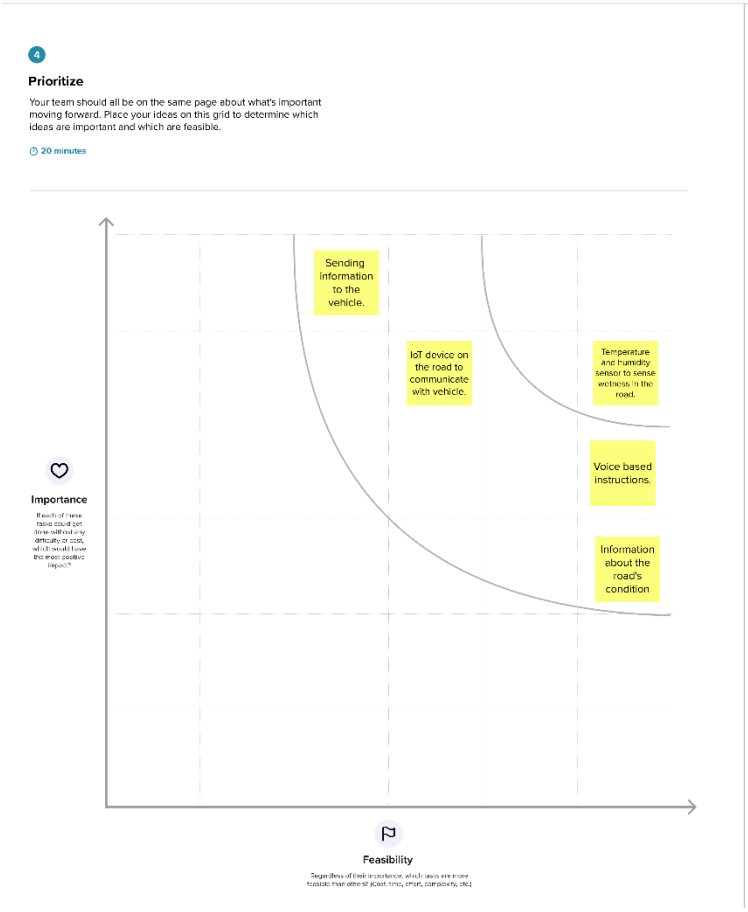
Step-2: Brainstorm, Idea Listing and Grouping





Team ID: PNT2022TMID48642

Step-3: Idea Prioritization



3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	While a person driving a vehicle, He/she might get frightened about accidents due to the unexpected road conditions that include Pits and holes in the roads, Construction works on the roads, Bare guards etc.,
2.	Idea / Solution description	Vehicles can be attached with an plug-in devices that contain some IoT sensors like temperature, humidity, PIR and radar sensors to intimate the Road's condition to the vehicle by providing digital signs.
3.	Novelty / Uniqueness	➢ The signals can be changed dynamically and there will be no need of any boards in the roads. ➢ Along with the digital signs it can also sense the humidity and inform the driver about the speed level. ➢ Pits and Holes on the roads can be monitored and can guide the user by providing right way.
4.	Social Impact / Customer Satisfaction	➢ It enhances the use of smart cars. ➢ Stress – free traveling in smart roads. ➢ Navigates through roads in a better way.
5.	Business Model (Revenue Model)	The plug-in device can be attached in the car. so, the revenue will be based on the number of devices sold out.
6.	Scalability of the Solution	Due to our proposed system, the Road safety can be enhanced to a greater level since it has the ability to sense the weather condition, Road condition and vehicle detection.

3.4 Problem Solution Fit:

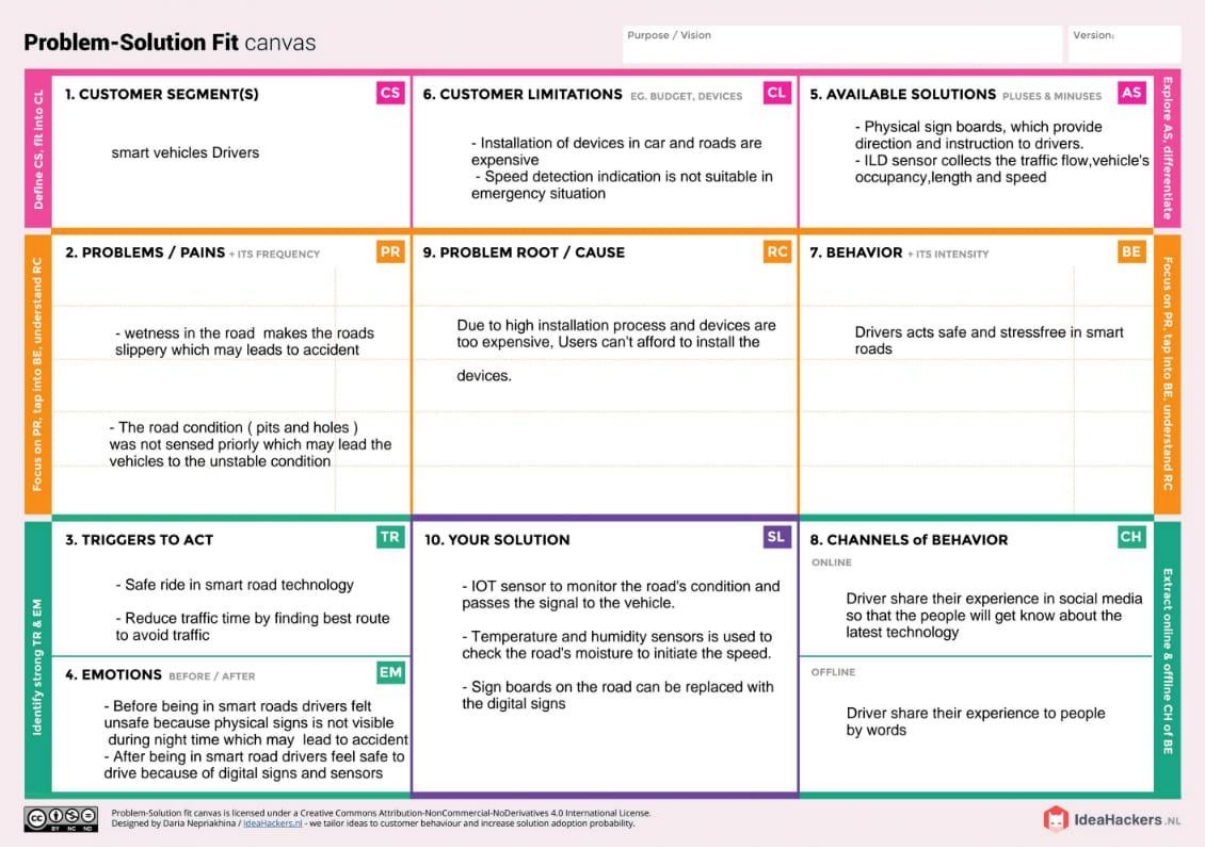


Fig 3.4 Problem Solution Fit

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Functional requirements may involve calculations, technical details, data manipulation and processing, and other specific functionality that define what a system is supposed to accomplish. Behavioral requirements describe all the cases where the system uses the functional requirements, these are captured in use cases.

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	ESP 32 Board	It is the board in which the sensors are going to integrate.
FR-2	Sensors: • DHT22 • RADAR	**DHT22** – To sense the temperature and humidity of the road. **RADAR** – To detect the vehicle's existence
FR-3	Sensors: • Accelerometer Sensor • GPS Sensor • Gravity Sensor	These 3 sensors are used to intimate the road's condition as speed control, location tracking etc.,
FR-4	IBM Cloud Storage	To store the information gathered by the Sensors
FR-5	MQTT Protocol	To connect the cloud storage and Users Device

4.2 NON FUNCTIONAL REQUIREMENTS

Non-Functional Requirements are the constraints or the requirements imposed on the system. They specify the quality attribute of the software. Non-Functional Requirements deal with issues like scalability, maintainability, performance, portability, security, reliability, and many more.

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The user who drives the car can easily identify the road condition and speed limits.
NFR-2	**Reliability**	It is reliable since all the sensors will sense the same thing and intimate the messages
NFR-3	**Performance**	Using this as a plug-in device in car will improve its performance by assuring the safety driving.
NFR-4	**Availability**	The user can get this as a plug-in device and it will help the user in a great manner
NFR-5	**Scalability**	The Road safety can be enhanced to a greater level since it has the ability to sense the weather condition, Road condition and vehicle detection.

CHAPTER 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

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

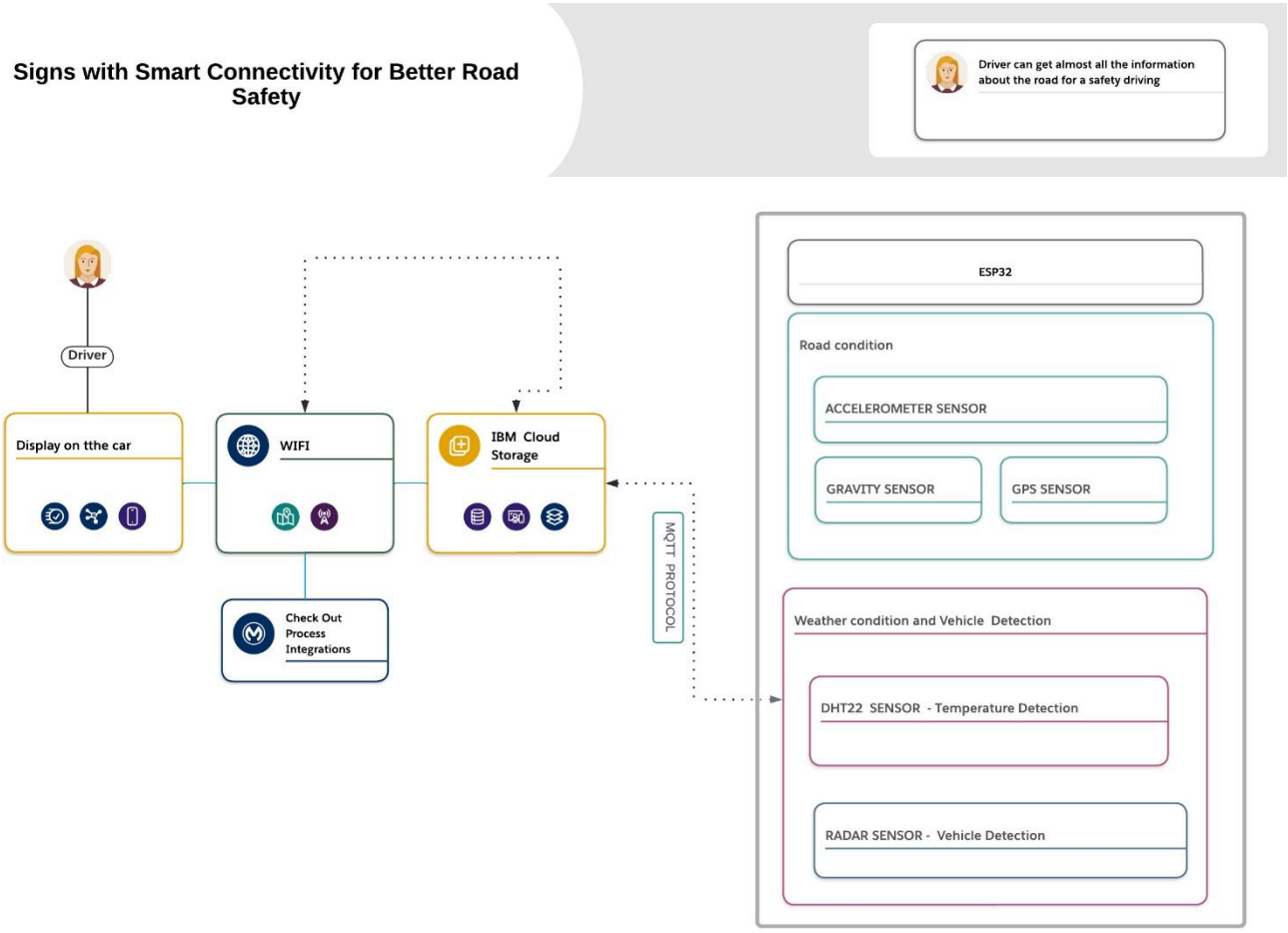


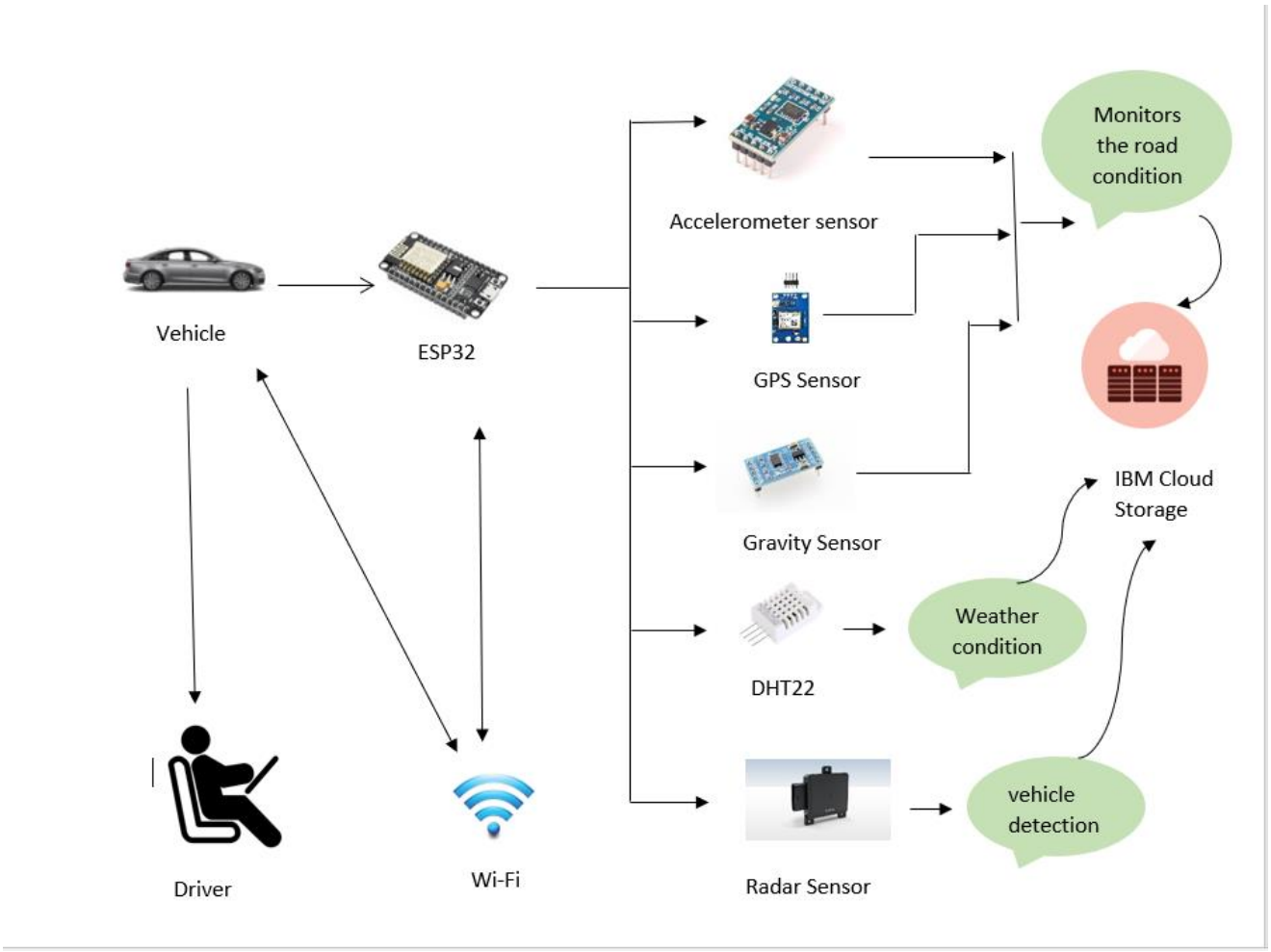
Fig 5.1 Data Flow Diagram

5.2 SOLUTION AND TECHNICAL ARCHITECTURE:

5.2.1 SOLUTION ARCHITECTURE:

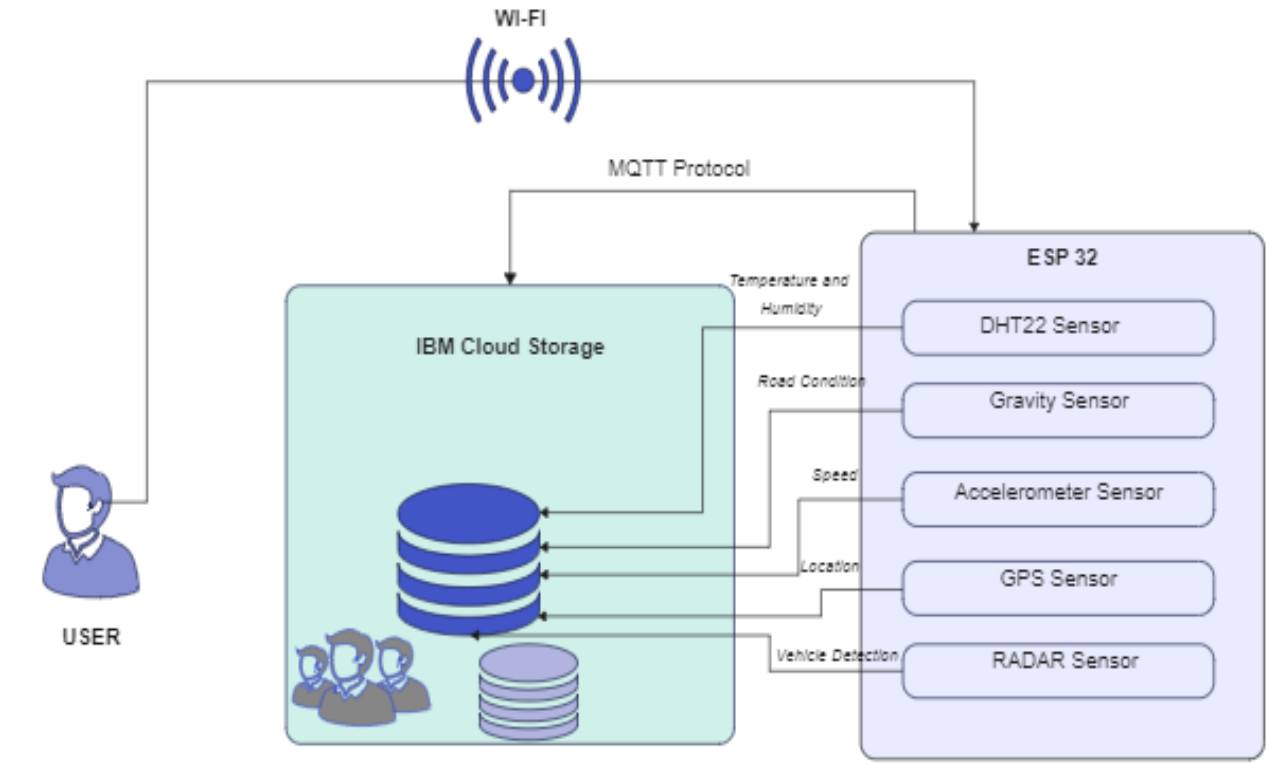
Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.



5.2.2 TECHNICAL ARCHITECTURE

Technology architecture deals with the deployment of application components on technology components. A standard set of predefined technology components is provided in order to represent servers, network, workstations, and so on.



5.3 USER STORIES:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Driver)	Temperature and humidity on road	USN-1	As a user, I need the humidity level on my road to limit my speed.	I can get it on the display	High	Sprint-1
	Intimate the speed limit	USN-2	As a user, I want to get intimated by the speed limit and dynamic signs.	I can receive that information.	High	Sprint-1
	Vehicle detection	USN-3	As a user, I want to get information about the vehicles on my way.	I can get the information.	High	Sprint-1
	Voice Implementation	USN-4	As a user, I will be useful when there is a voice assistant.		Medium	Sprint-2
	Plug-in device	USN-5	As a user, I will be like that all these functionalities can be attached to my car.	I can attach all tha sensors as a Plug-in device in my car.	High	Sprint-1
Cloud Storage	IBM Cloud	USN-6	As a user, I will be in need to get all such information on time and in a fastest manner	IBM cloud will be helpful for this	High	Sprint-1

CHAPTER 6

PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	IDE	USN-1	Installing all the softwares which is required like python IDE	2	High	M.Shajitha Begum R.Monica P.Poornima Devi N.DevaDharshini
Sprint-1	Checking the simulation with conditions	USN-1	Simulating the circuits and experimenting	2	High	M.Shajitha Begum R.Monica P.Poornima Devi N.DevaDharshini
Sprint-2	Software	USN-2	IBM Watson IOT NodeRed Integration	2	High	M.Shajitha Begum R.Monica P.Poornima Devi N.DevaDharshini
Sprint-2	Software	USN-2	Test the device and workflow	2	High	M.Shajitha Begum R.Monica P.Poornima Devi N.DevaDharshini
Sprint-3	Application Development	USN-3	Using MIT App Inventor create an App	2	High	M.Shajitha Begum R.Monica P.Poornima Devi N.DevaDharshini
Sprint-3	Testing	USN-3	Testing the Application	2	High	M.Shajitha Begum R.Monica P.Poornima Devi N.DevaDharshini

Sprint-4	WEB UI	USN-4	User Interface with the software	2	High	M.Shajitha Begum R.Monica P.Poornima Devi N.DevaDharshini

6.2 SPRINT DELIVERY SCHEDULE:

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planne)**	**Story Points Completed (as on Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	31 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	07 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	14 Nov 2022

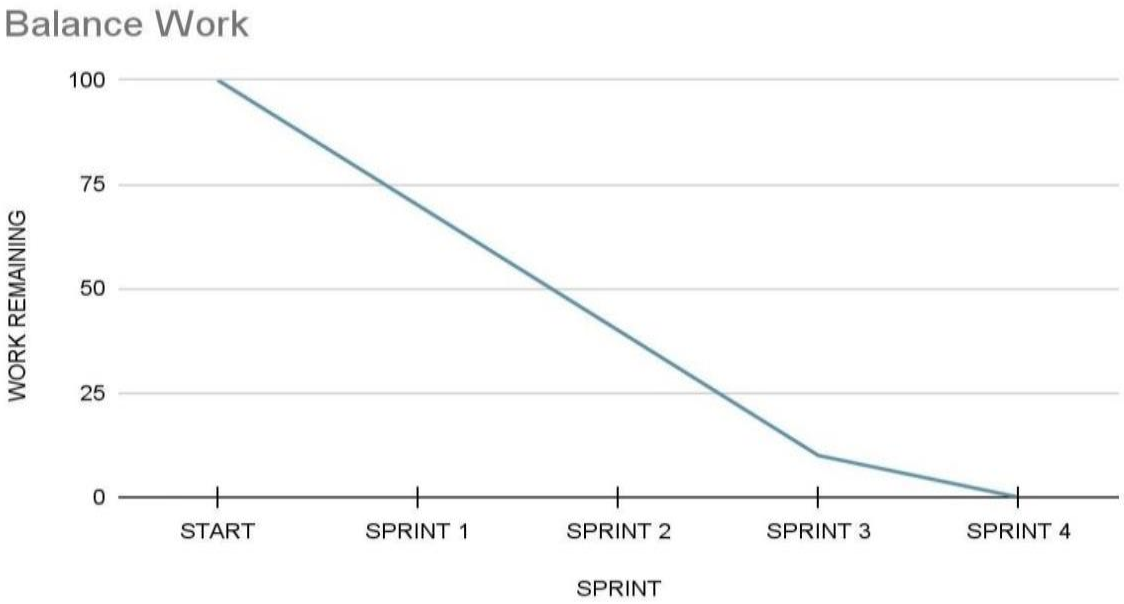
Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let’s calculate the team’s average velocity (AV) per iteration unit (story points per day)

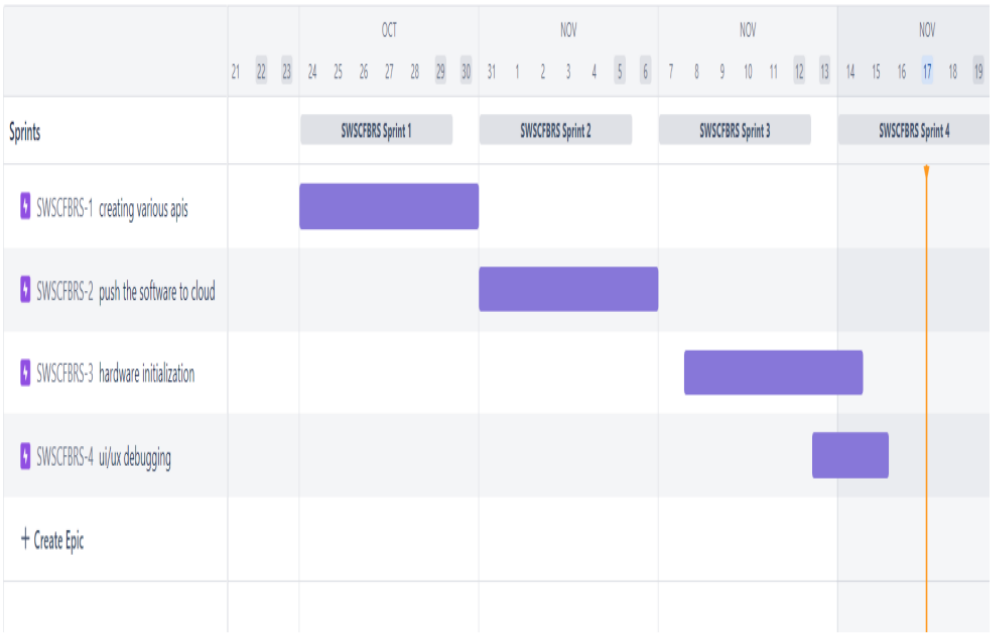
$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



6.3 REPORTS FROM JIRA:



CHAPTER 7

CODING AND SOLUTIONING

7.1 FEATURE 1

7.1.1 Creating IBM Watson device and getting simulation:

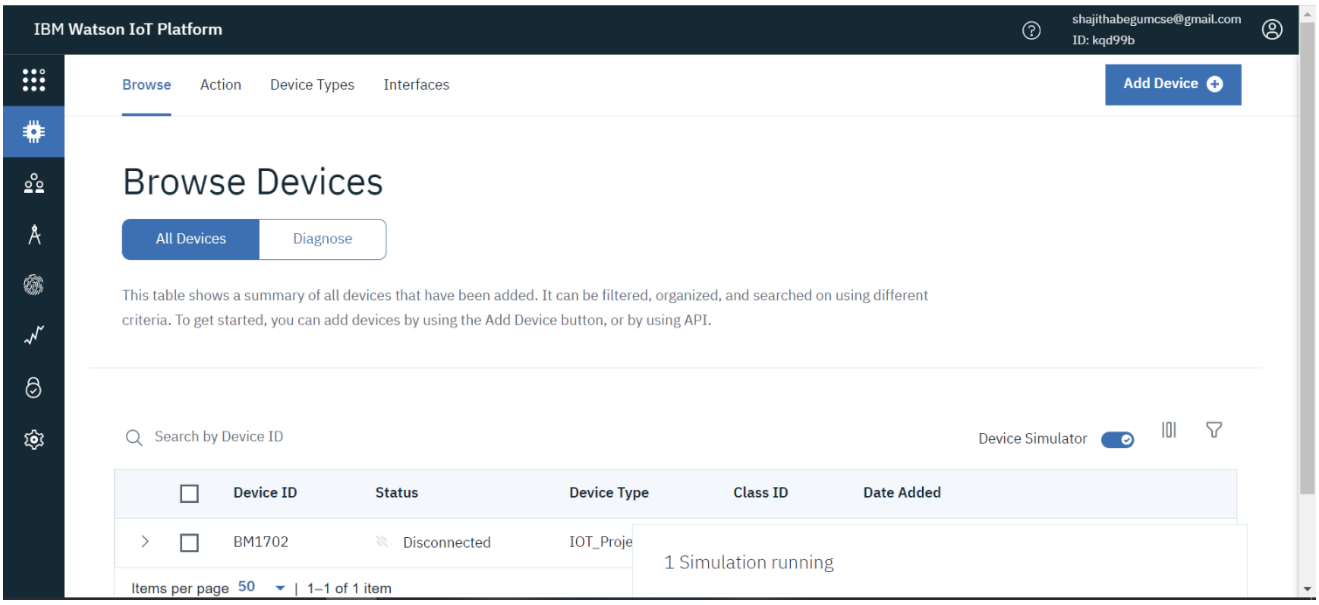


Fig 7.1.1 Creating IBM Watson device and getting simulation

The IBM Watson Device is created and it was coded with JSON language to get the simulation.

7.1.2 Creating NODE-RED Service that displays the simulation:

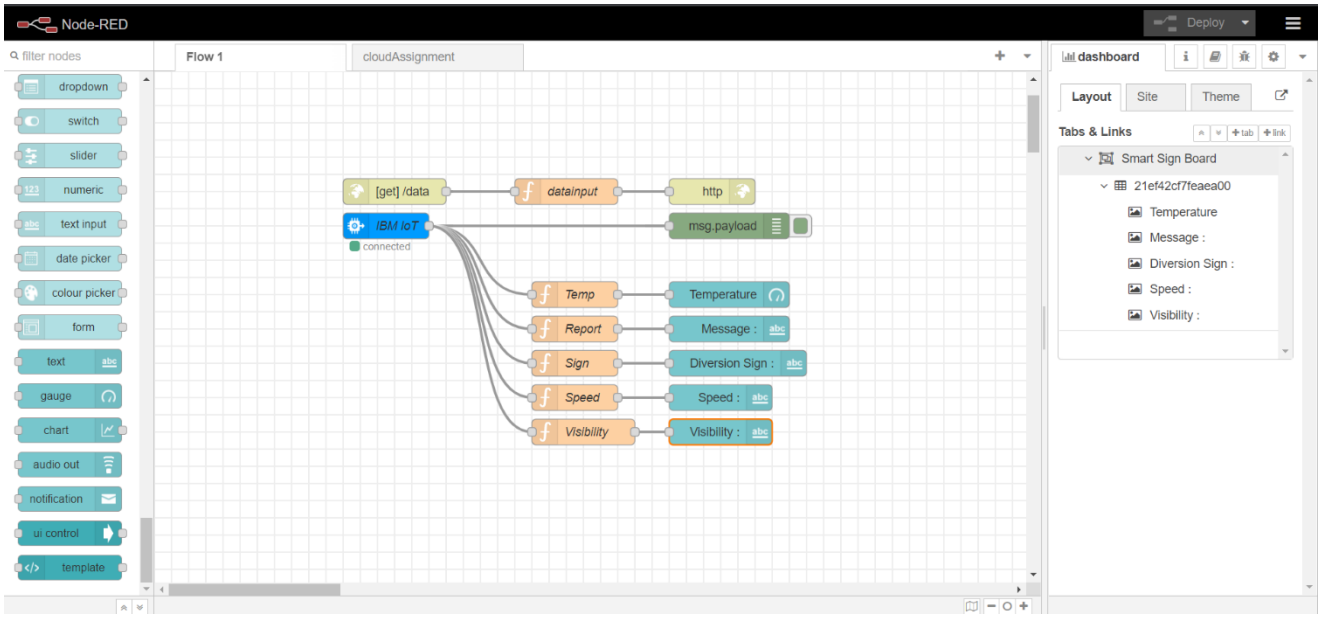


Fig 7.1.2 Creating NODE-RED Service that displays the simulation

7.1.3 Web UI design:

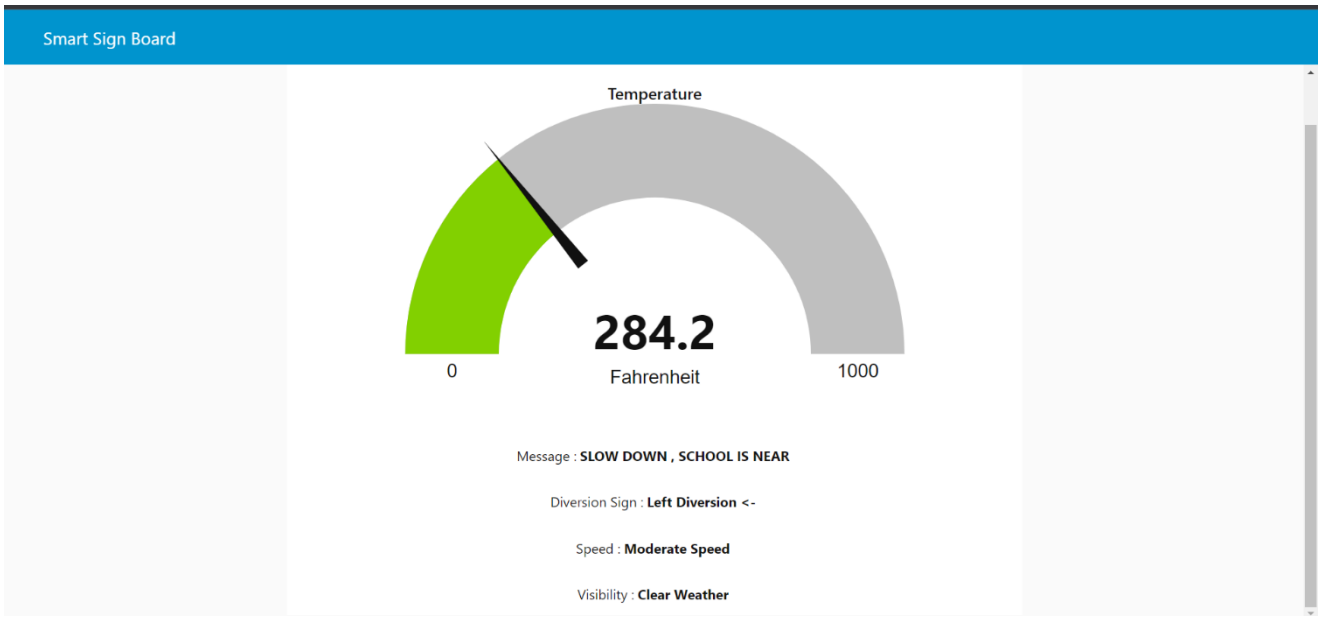
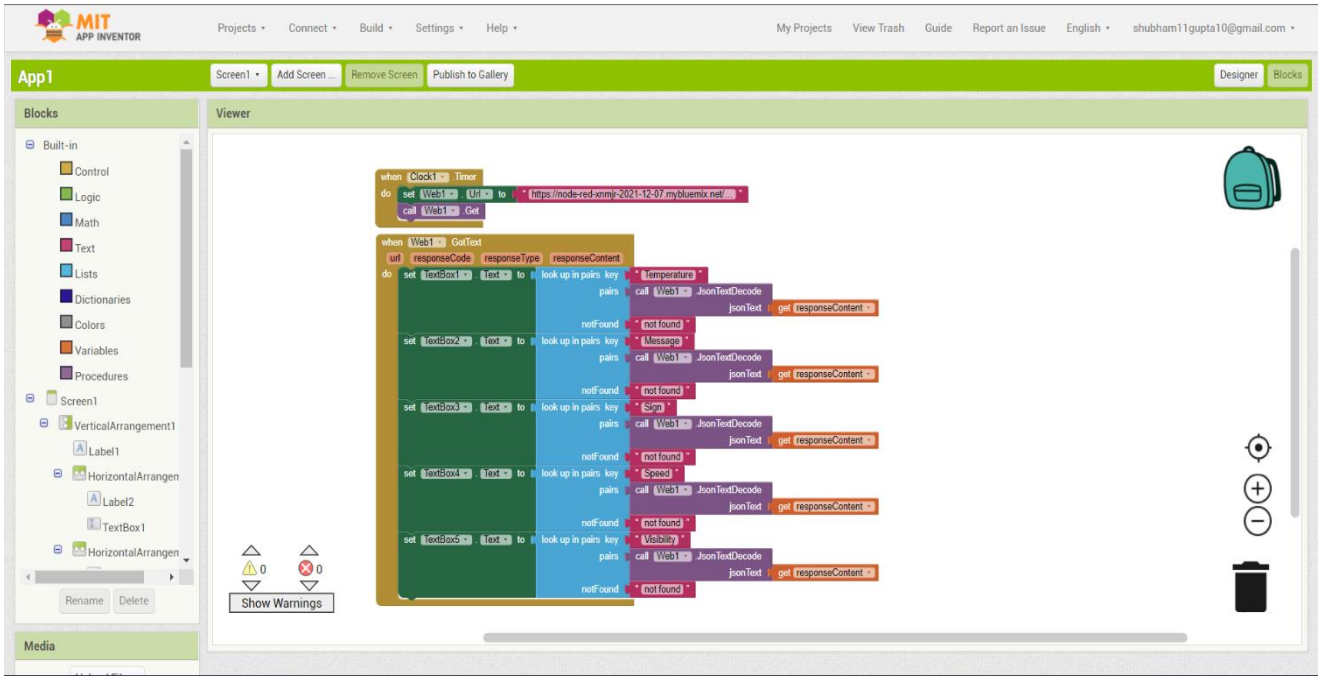


Fig 7.1.3 Web UI Design

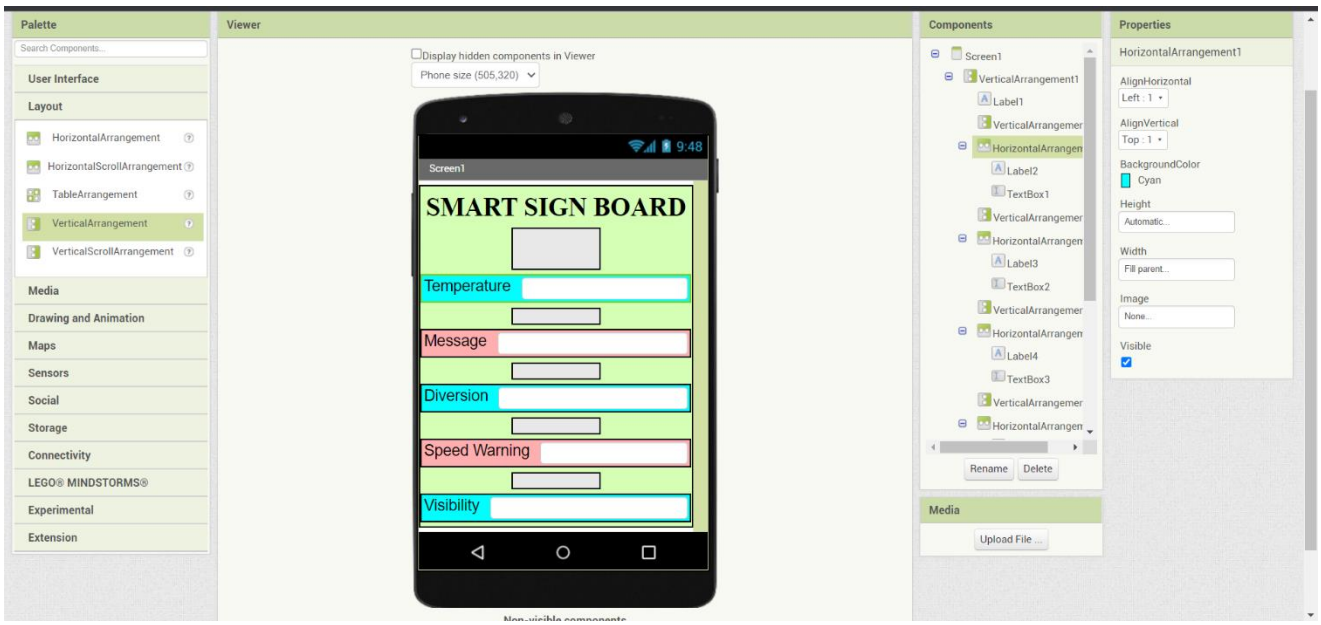
7.2 FEATURE 2

7.2.1 MIT App Inventor Backend



The MIT App inventor is used to connect the NODE-RED Output to the user's device . A link from the NODE-RED has to be generated to make use of MIT App Inventor. The designed front-end will be displayed on the User's device itself.

7.2.2 MIT App Inventor Frontend



CHAPTER 8

TESTING

8.1 TEST CASES:

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the temperature and humidity informtion in their mobile device	Necessary information is should displayed	1.User verifies the device in the car 2.Click on the required and necessary information 3.Verify popup information is displayed or not	IOT DEVICE	Working as expected	pop up notification is displayed	Pass	Easy to access	Y		Tester_testerid001
LoginPage_TC_OO2	UI	Home Page	Verify the UI elements in the device	Temperature,Message ,Diversion,Speed warning ,Visibility information should displayed	1.User verifies the device in the car 2.Click on the required and necessary information 3.Verify popup information is displayed with UI elements a. Temperature notification b. Message notification c.Diversion notification d.Speed warning notification e.Visibility notification	IOT DEVICE	Working as expected	Application should show following UI elements a.Temperature is displayed b.Humidity is displayed c.Diversion is displayed d.Speed warning is displayed e.visible	Pass	Every notification displayed	Y		Tester_testerid001
LoginPage_TC_OO3	Functional	Home page	Verify , user is able to connect into device with Valid credentials	Temperature,Message ,Diversion,Speed warning ,Visibility information should displayed	1.User verifies the device in the car 2.Click on the required and necessary information 3.Verifiy popup information is displayed or not 4.Temperature information is displayed 5.Message information is displayed 6.Diversion notification is displayed 7.Speed warning notification is displayed 8.Visibility notification is displayed	Temperature -36 Humidity-20 Diversion-Take diversion Speed warning-limit speed Visibility-Visible	a.Temperature is displayed b.Humidity is displayed c.Diversion is displayed d.Speed warning is displayed e.visible	Working as expected	Pass	Every notification displayed	Y		Tester_testerid001
LoginPage_TC_OO4	Functional	Home page	Verify, user is able toconnect into device with InValid credentials	Temperature,Message ,Diversion,Speed warning ,Visibility information should displayed	1.User verifies the device in the car 2.Click on the required and necessary information 3.Verify popup information is displayed or not 4.Temperature information is not displayed 5.Message information is displayed 6. Diversion notification is displayed 7. Speed warning notification is displayed 8.Visibility notification is displayed	Temperature -error Humidity-20 Diversion-Take diversion Speed warning-limit speed Visibility-visible	a.Temperature is not displayed b.Humidity is displayed c.Diversion is displayed d.Speed warning is displayed e.visible	Working as not expected	Fail	Tempeature information is not displayed	N	BUG 1234	Tester_testerid001
LoginPage_TC_OO5	Functional	Home page	Verify, user is able toconnect into device with InValid credentials	Temperature,Message ,Diversion,Speed warning ,Visibility information should displayed	1.User verifies the device in the car 2.Click on the required and necessary information 3.Verifiy popup information is displayed or not 4.Temperature information is displayed 5.Message information is not displayed 6.Diversion notification is displayed 7.Speed warning notification is displayed 8.Visibility notification is displayed	Temperature -36 Humidity-error Diversion-Take diversion Speed warning-limit speed Visibility-visible	a.Temperature is displayed b.Humidity is not displayed c.Diversion is displayed d.Speed warning is displayed e.visible	Working as not expected	Fail	Humidity information is not displayed	N	BUG 1234	Tester_testerid001
LoginPage_TC_OO6	Functional	Home page	Verify, user is able toconnect into device with InValid credentials	Temperature,Message ,Diversion,Speed warning ,Visibility information should displayed	1.User verifies the device in the car 2.Click on the required and necessary information 3.Verifiy popup information is displayed or not 4.Temperature information is displayed 5.Message information is displayed 6.Diversion notification is not displayed 7.Speed warning notification is not displayed 8.Visibility notification is displayed	Temperature -36 Humidity-20 Diversion-error Speed warning-error Visiblity-visible	a.Temperature is displayed b.Humidity is displayed c.Diversion is not displayed d.Speed warning is not displayed e.visible	Working as not expected	Fail	Diversion and speed warning information is ot displayed	N	BUG 1234	Tester_testerid001

8.2 USER ACCEPTANCE TESTING:

8.2.1 Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the IOT device project at the time of the release to User Acceptance Testing (UAT).

8.2.2 Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	8	4	2	1	15
Duplicate	1	0	1	0	2
External	3	2	0	0	5
Fixed	5	1	2	20	28
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	0	1
Won't Fix	0	0	0	1	1
Totals	17	7	7	22	53

8.2.3 Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested.

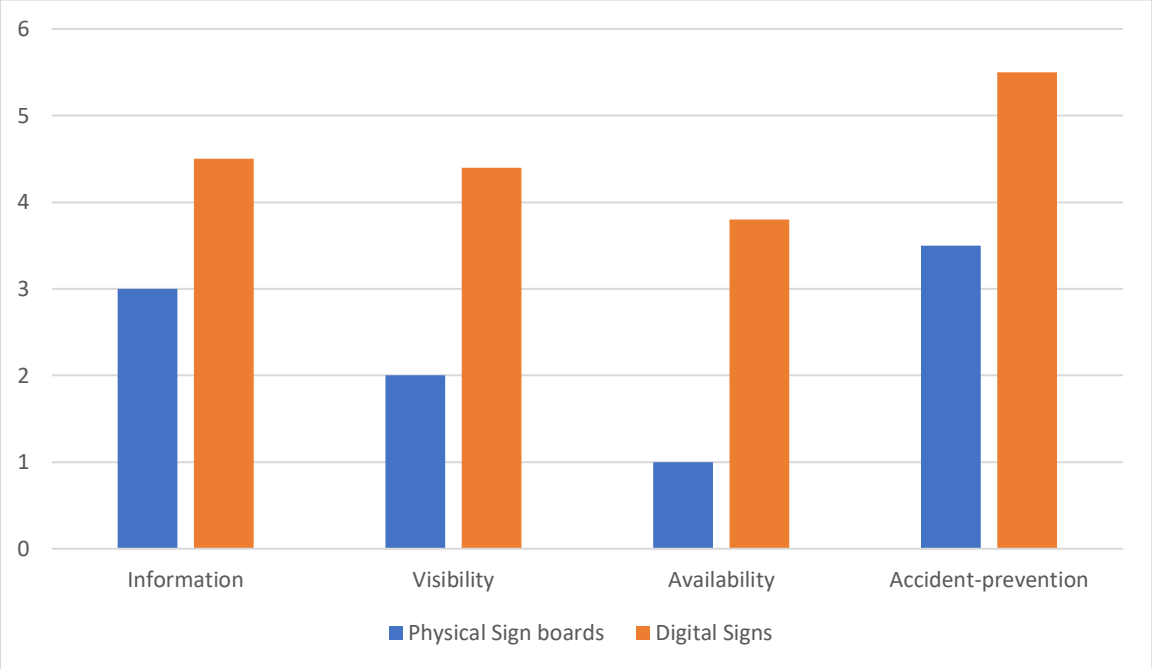
Section	**Total Cases**	**Not Tested**	**Fail**	**Pass**
Print Engine	5	0	0	5
Client Application	45	0	0	45
Security	1	0	0	1

Outsource Shipping	3	0	0	3
Exception Reporting	6	0	0	6
Final Report Output	5	0	0	5
Version Control	3	0	0	3

CHAPTER 9

RESULTS

9.1 PERFORMANCE METRICS



PARAMETERS	PHYSICAL SIGN BOARS	DIGITAL SIGNS
INFORMATION PASSING	Information can be passed to the users in a slow manner.	Information can be passed to the users in a quick manner.
VISIBILITY	Physical sign boards can lost its visibility due to poor weather.	Digital signs will not lost its visibility as long as there is a problem in user's device
AVAILIBILITY	Cannot maintain too many boards on the road	Signals can be sent to the user's mobile phone itself.
ACCIDENT-PREVENTION	Physical sign boards can itself lead to accients by falling down on the road.	Since it is digital signs it may prevents some accidents.

CHAPTER 10

ADVANTAGES & DISADVANTAGES

➢ Advantages

- Digital Signs – Accidents could be avoided.
- Based on humidity of the road , Speeds can be limited.
- Can provide facility to the Smart Cars.
- Can prevent the vehicle from the unstable conditions.

➢ Disavantages

Since there is no voice based assistant as of now user should look at the mobile while traveling.

CHAPTER 11
CONCLUSION

Transport, travel, and roads are an integral part of every country and make a difference in every citizen's life. The well-being and development of a country significantly depend on the road and traffic of the country. India is focusing a lot on smart cities with safe, efficient, and congestion-free transport. With the exponential modernization comes the need for safer and smarter roads, as roads are said to be the nervous system of a nation. IoT has proved its potential in vehicle maintenance, navigation, monitoring leading to improved transportation. IoT can be used to Improved control and safety can be achieved through IoT-enabled cars. In case of over-speeding, the notification gets displayed on the car's windscreen alerting the driver. Further for Ensuring safe driving experience with real-time assistance, navigation, and even monitoring driving patterns and any emergency situation. 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. Our proposed plug-in device can be attached to any cars and it can perform all the above-mentioned detection. Using this as a add-on in our car we can able to see the dynamic signs about the road in which we are traveling .This will enhance the safety measures of the driver and can help them in a good journey.

CHAPTER 12

FUTURE SCOPE

In the future implementation we are going to provide voice implementation that will guide the user by audible sounds. Further it can be provided with emergency alerts in which we can send messages to the close ones , Cops who is nearby on that location and ambulance services in case of any accidents. For this function GPS tracking should be implemented in this plug-in device.

APPENDIX

A1 - SOURCE CODE

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

myConfig = {
    "identity": {
        "orgId": "XXX",
        "typeId": "XXX",
        "deviceId":"XXX"
    },
    "auth": {
        "token": "XXX"
    }
}

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

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

BASE_URL = "https://api.openweathermap.org/data/2.5/weather?"
CITY = "Hyderabad"
URL = BASE_URL + "q=" + "delhi" + "&appid=" +
"c4aa755540f66e8c800cbfd67df6ddcb"

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']
        repo=random.randint(0,5)
        if repo==1:
            prt="SLOW DOWN , SCHOOL IS NEAR"
```

```
        elif repo==3:
            prt="SLOW DOWN , HOSPITAL NEARBY"
        elif repo==5:
            prt="NEED HELP, POLICE STATION NEARBY"
        else:
             prt=""
        speed=random.randint(0,150)
        if speed>=100:
            prt3="SLOW DOWN , Speed Limit Exceeded"
        elif speed>=60 and speed<100:
            prt3="Moderate Speed"
        else:
             prt3=""
        sign=random.randint(0,5)
        if sign==1:
            prt2="Right Diversion ->"
        elif sign==3:
            prt2="Left Diversion <-"
        elif sign==5:
            prt2="U Turn"
        else:
             prt2=""
        if temperature<=50:
            prt4="Fog Ahead, Drive Slow"
        else:
             prt4="Clear Weather"

    else:
        print("Error in the HTTP request")
    myData={'Temperature':temperature, 'Message':prt, 'Sign':prt2, 'Speed':prt3,
'Visibility':prt4}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
    print("Published data Successfully: %s", myData)
    client.commandCallback = myCommandCallback
    time.sleep(5)
client.disconnect()
```

Git Hub Link:

https://github.com/IBM-EPBL/IBM-Project-46605-1660751518

Project Demo Link:

https://drive.google.com/file/d/1M6xSKkthOu_takRkvq13GyUY1YiQRnGM/view?usp=sharing