1. Introduction :

1.1 Project overview :

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 some 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 which has digital sign boards on which the signs can be changed dynamically.If there is rainfall then the roads will be slippery and the speed limit would be decreased.There is a web app through which you can enter the data of the road diversions, accident prone areas and the information sign boards can be entered through web app. This data is retrieved and displayed on the sign boards accordingly.

1.2 Purpose:

Road traffic accident is a major problem worldwide resulting in significant morbidity and mortality. Advanced driver assistance systems are one of the salient features of intelligent systems in transportation. They improve vehicle safety by providing real-time traffic information to the driver. Road signs play an important role in road safety. To be effective, road signs must be visible at a distance that enables drivers to take the necessary actions. However, static road signs are often seen too late for a driver to respond accordingly

2. Literature survey:

2.1 Existing Problem:

- **Preventing Wrong-way Crashes** – As discussed in **a Phys.org article in 2018**, the National Highway Traffic Safety Administration has stated that hundreds of lives are lost annually to wrong-way crashes. In addition, thousands of people sustain injuries in such accidents.Based on research and field tests performed by the Florida.
- **Better Traffic Management and Safety** –When vehicles and smart **traffic control** systems are connected via the cloud, the end results may be more manageable traffic, decreased gridlock, and better traffic
- **Increased Cost Efficiency** – We need to explore more cost-effective ways to **strengthen the infrastructure**. Building roads is expensive. While there is no substitution for new and upgraded roads, smart roadway indicators can be added to increase efficiency.They provide innovative ways to improve traffic flow, reduce congestion, regulate the patterns of traffic, and create an optimal balance of public and private transportation.
- **Combating Poor**

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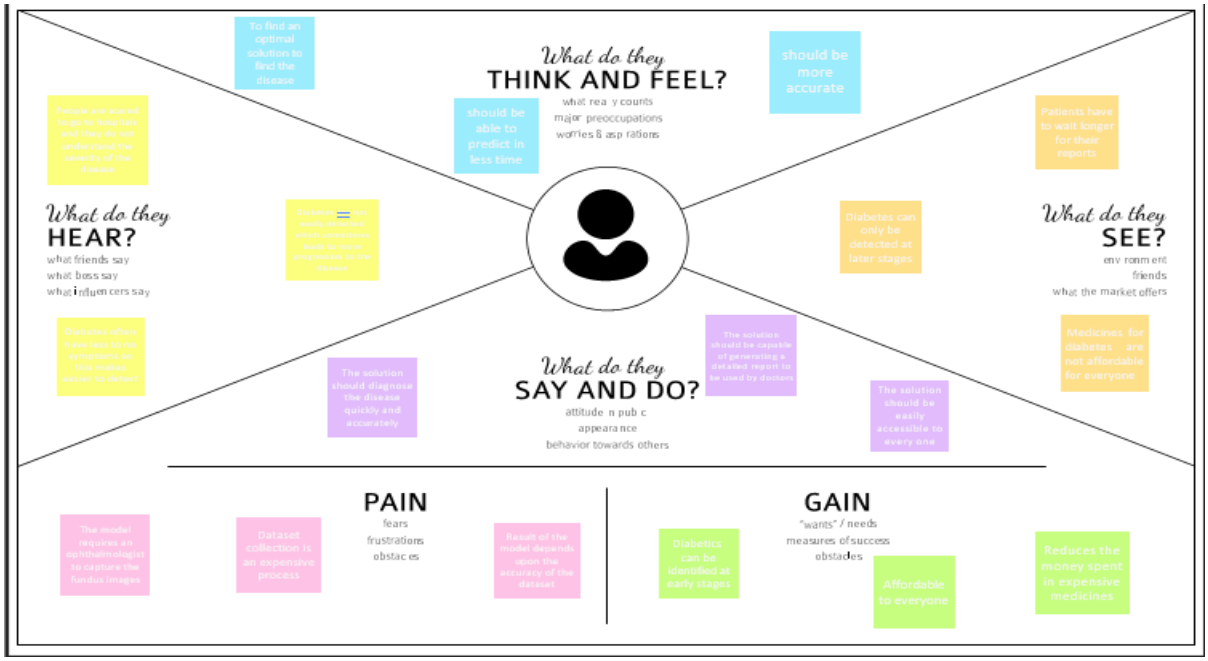
2.3 Problem Statement:

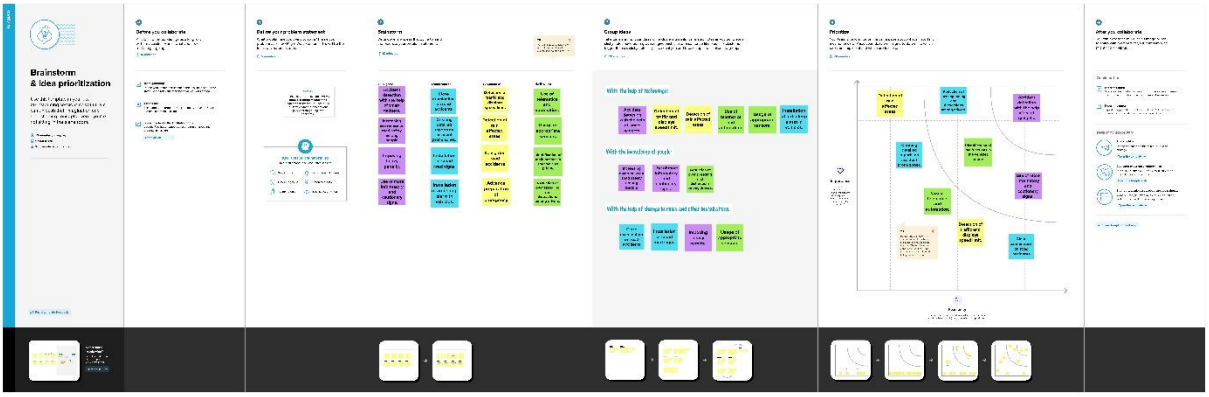
3Problem Statement:

3.IDEATION & PROPOSED SOLUTION

3.1Empathy Map Canvas



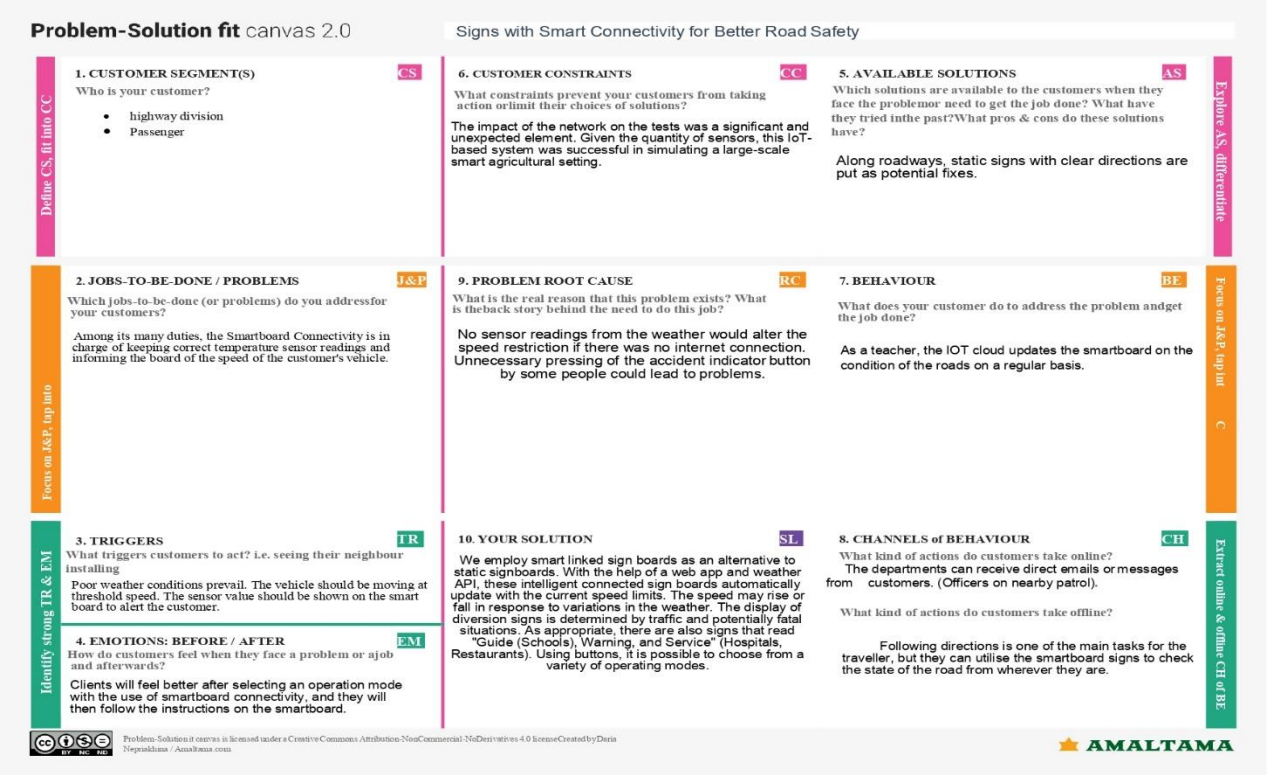
3.2 Ideation & Brainstorming



3.3 Proposed Solution

Based on current research and development efforts, we can all be fairly certain that **smart road signs** will be broadly utilized in the years to come. They serve as one of the major components of an emerging system designed to enhance the current infrastructure. These indicators are useful tools, and they can have a positive impact on all who share the roads. Most importantly, this type of signage has the potential to improve our way of life.

3.4 Problem Solution fit



4.REQUIREMENT ANALYSIS

4.1Functional requirement

Following are the functional requirements of the proposed solution.

model’s

Project Design Phase-II

Solution Requirements (Functional & Non-functional)

Team ID	PNT2022TMID04130
Project Name	Signs with Smart Connectivity for Better Road Safety
Maximum Marks	4 Marks

Functional Requirements:

Following are the functional requirements of the proposed solution.

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

Non-functional Requirements:

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

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

Acceptance Testing
UAT Execution & Report Submission

Date	15 November 2022
Team ID	PNT2022TMID04130
Project Name	**Signs with Smart Connectivity for Better Road Safety**
Maximum Marks	4 Marks

1.Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [Signs with Smart Connectivity for Better Road Safety] project at the time of the release to User Acceptance Testing (UAT).

1.Defect Analysis

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

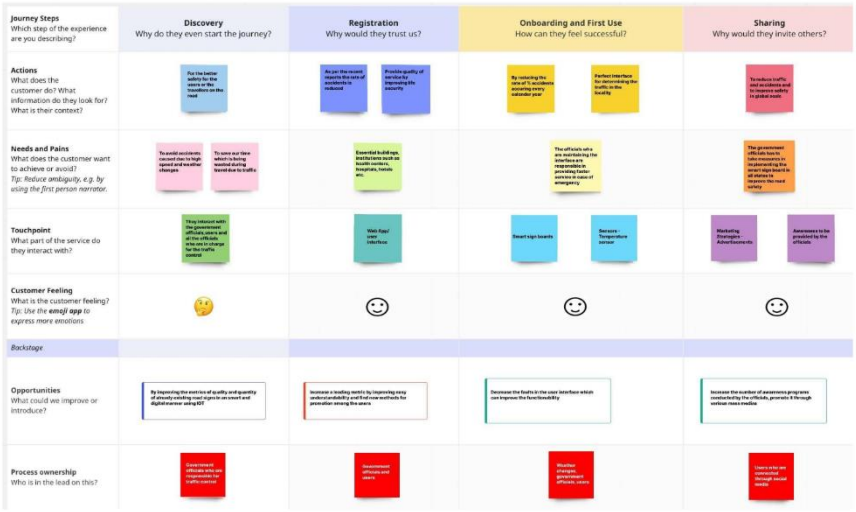
Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	5	4	2	3	14
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	9	2	4	15	30
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	17	14	13	21	65

1. 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	9	0	0	9
Client Application	45	0	0	45
Security	2	0	0	2
Outsource Shipping	3	0	0	3

Customer journey:



Customer Journey

Date	26 October 2022
Team ID	PNT2022TMID04130
Project Name	Signs with Smart Connectivity for Better Road Safety

Phases	Motivation	Information gathering	Analyzes of various products	Chooses the most efficient product	Payment
Actions	Taking action and concerning for roadsafety	Selecting an efficient product in order to improve road safety	Other products are available including static boards	Smart boards are more efficient than static boards	Following product satisfaction
Touchpoints	Buyers are delighted	The government need not worry about traffic safety after the installation	The numerous varieties of products are accessible and it entertains the user	The government will not be concerned about the safety after receiving this	The government acquires the product after determining its worth
Customer Feeling					
Customer Thoughts	The customer believes it will assist to improve the state of the road	The customer believes that it will last for long time	The customer believes that a different option will be offered	They will find it simple and easy to select a product	They believe that, product will be easy to use
Opportunities	The customer is benefited from increased road safety	The customer is aware of the product's manufacturing process	Other products will be made known to the customer	The buyer learns which product is the best	The travel will be enjoyablefor the customer

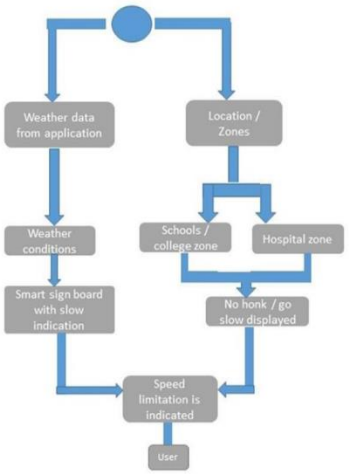
PROJECT DESIGN

5.1Data Flow Diagrams

Project Design Phase-II
Data Flow Diagram & User Stories

Date	26 October 2022
Team ID	PNT2022TMID04130
Project Name	Project - Signs with Smart Connectivity for Better Road Safety
Maximum Marks	4 Marks

Data Flow Diagrams: A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system



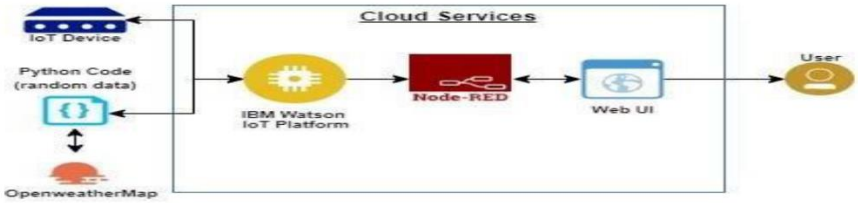
5.2Solution & Technical Architecture

Project Design Phase-II
Technology Architecture (Architecture & Stack)

Date	17 October 2022
Team ID	PNT2022TMID04130
Project Name	Project - Signs With Smart Connectivity For Better Road Safety

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2



5.3User St

Project Planning Phase (Milestone and Activity List)

Date	29 October 2022
Team ID	PNT2022TMID04130
Project Name	Signs with smart connectivity for better roadsafety
Maximum Marks	4 Marks

MILESTONE AND ACTIVITY LIST (4 Marks)

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	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M
Sprint-1	Checking the simulation with conditions	USN-1	Simulating the circuits and experimenting	2	High	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M

Sprint-2	Software	USN-2	- IBM Watson Iot - NodeRed integration	2	High	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M
Sprint-2	Software	USN-2	Test the device and workflow.	2	High	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M
Sprint-3	Application Development	USN-3	Using MIT App Inventor create an App	2	High	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M
Sprint-3	Testing	USN-3	Testing the Application.	2	High	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M

Sprint-4	WEB UI	USN-4	User interface with the Software	2	High	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M

6.PROJECT PLANNING & SCHEDULING

6.1Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Project Planning Phase

Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

Date	27 October2022
Team ID	PNT2022TMID04130
Project Name	Signs with Smart Connectivity for Better Road Safety
Maximum Marks	8 Marks

Product Backlog, Sprint Schedule and Estimation(4Marks)

Use the below template to create product backlog and sprint scheme

Sprint	Functional Requirement (Epic)	User Story/Task	Story Points	Priority	Team Members
Sprint-1	Resources Initialization	Create and initialize accounts in various public APIs like OpenWeatherMap API.	1	LOW	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M
Sprint-1	Local Server/Software Run	Write a Python program that outputs results given the inputs like weather and location	1	MEDIUM	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M
Sprint-2	Push the server/software to cloud	Push the code from Sprint1 to cloud so it can be accessed from anywhere	2	MEDIUM	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M
Sprint-3	Hardware initialization	Integrate the hardware to be able to access the cloud functions and provide inputs to the same	2	HIGH	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M

Sprint-4	UI/UX Optimization & Debugging	Optimize all the short comings and provide better user experience	2	LOW	Sri Vignesh G Surya Prakash K Thamizharasan T Hari Shankhar M

Project Tracker, Velocity & Burndown Chart:(4Marks)

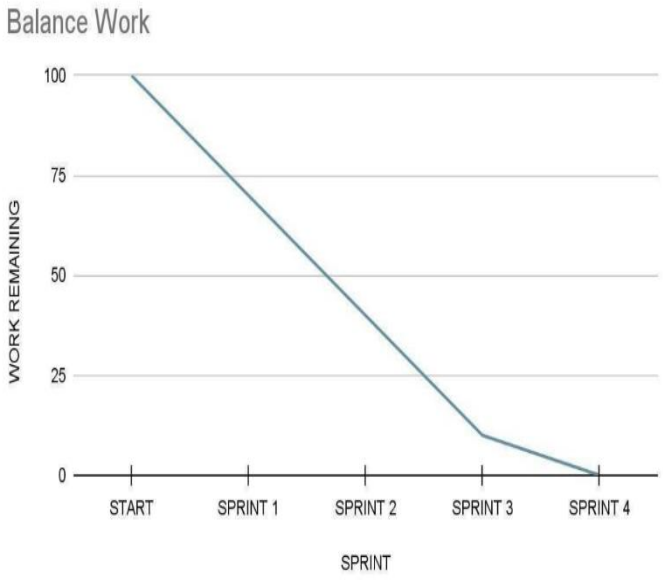
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date(Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6Days	24Oct2022	29Oct2022	20	29Oct2022
Sprint-2	20	6Days	31Oct2022	05Nov2022	20	31Oct2022
Sprint-3	20	6Days	07Nov2022	12Nov2022	20	07Nov2022
Sprint-4	20	6Days	14Nov2022	19Nov2022	20	14Nov2022

Velocity:

Imagine we have a 10-days print 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)

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

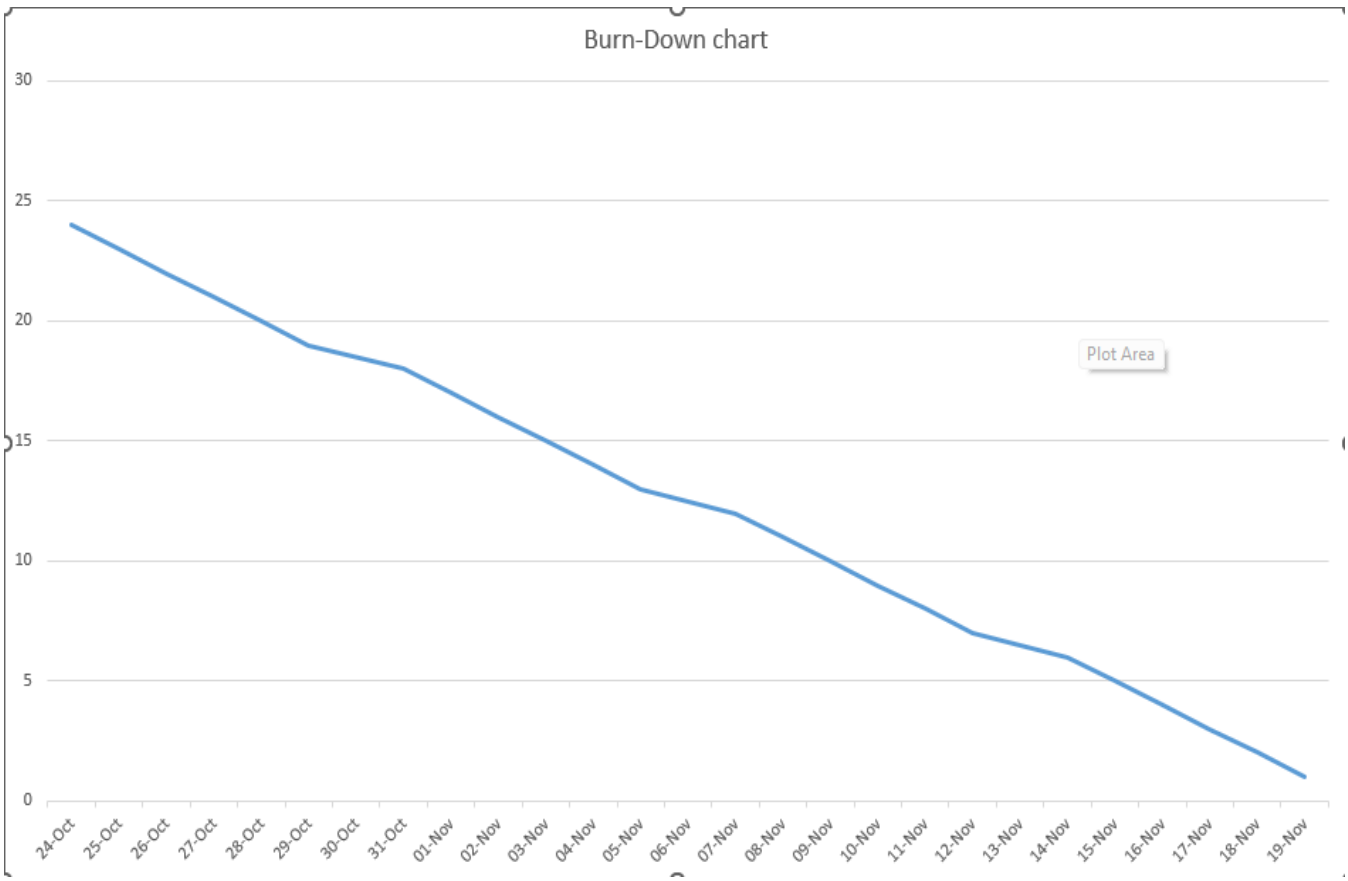
Burndown Chart:



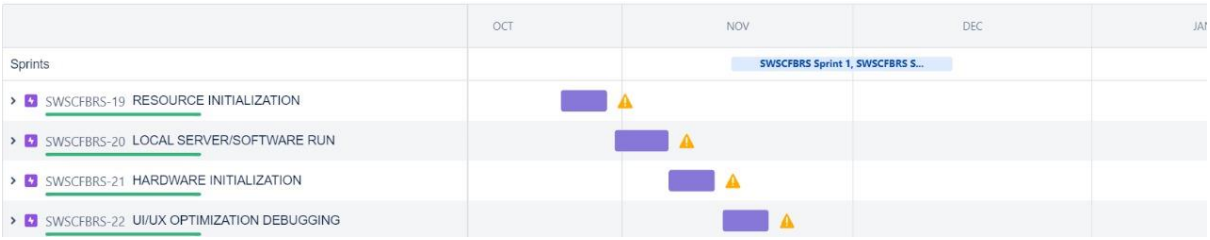
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

6.3Reports from JIRA

Burn down chart:



Road Map:



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

7.1Feature 1

```
import weather
from datetime import datetime as dt
 def
processConditions(myLocation,APIKEY,localityInfo):
      weatherData = weather.get(myLocation,APIKEY)

      finalSpeed = localityInfo["usualSpeedLimit"] if "rain" not in weatherData else
localityInfo["usualSpeedLimit"]/2
      finalSpeed = finalSpeed if weatherData["visibility"]>35 else finalSpeed/2

if(localityInfo["hospitalsNearby"]):
          # hospital zone                  doNotHonk = True
else:
if(localityInfo["schools"]["schoolZone"]==False):
                # neither school nor hospital zone
doNotHonk = False                else:
                # school zone
                now = [dt.now().hour,dt.now().minute]
activeTime = [list(map(int,_.split(":"))) for _ in
localityInfo["schools"]["activeTime"]]
                doNotHonk = activeTime[0][0]<=now[0]<=activeTime[1][0] and
activeTime[0][1]<=now[1]<=activeTime[1][1]

      return({
          "speed" : finalSpeed,
          "doNotHonk" : doNotHonk
      })

[DEBUG ON]
[DEBUG OFF]
```

```
import requests as reqs

def get(myLocation,APIKEY):
    apiURL =
f"https://api.openweathermap.org/data/2.5/weather?q={myLocation}&appid={AP
IKE Y}"
    responseJSON = (reqs.get(apiURL)).json()
    returnObject = {
        "temperature" : responseJSON['main']['temp'] - 273.15,
        "weather" : [responseJSON['weather'][_]['main'].lower() for _ in
range(len(responseJSON['weather']))],
        "visibility" : responseJSON['visibility']/100, # visibility in
percentage where 10km is 100% and 0km is 0%
    }
    if("rain" in responseJSON):
        returnObject["rain"] = [responseJSON["rain"][key] for key in
responseJSON["rain"]]
    return(returnObject)
```

7.2 Feature 2

CODE:

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include
<BlynkSimpleEsp8266.h>
 char
auth[]="q6FAQIggdIxznS2kMIbxAPn8E6nnv116";
char ssid[] = "hellow";
char pass[] = "12345678";
String str; void setup() {
Serial.begin(9600);
Blynk.begin(auth, ssid,
pass);
}
void loop() { Blynk.run(); if
(Serial.available()>0)  str  =
Serial.readStringUntil('/');  //
Serial.print(str);
// Blynk.notify("location:
");Blynk.notify(str);
}
}
```

7.3Database Schema (if Applicable)
Not Aplicable

8.TESTING

8.1Test Cases

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

Section	Total cases	Not tested	Pass	Fail
Print Engine	9	0	9	0
Client Application	45	0	45	0
Security	2	0	2	0
Outsource Shipping	3	0	3	0
Exception Reporting	9	0	9	0
Final Report Output	4	0	4	0
Version Control	2	0	2	0

8.2User Acceptance Testing

8.2User Acceptance Testing

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	5	4	2	3	14
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	9	2	4	15	30
Not Reproduced	0	0	1	1	2
Skipped	0	0	1	1	2

9.RESULTS

9.1Performance Metrics

10.ADVANTAGES & DISADVANTAGES

Now let's take a look at the disadvantages.

Capital intensive:

It costs significant amounts of money to implement smart road technologies on a large scale, which can make governments drag their feet when it comes to implementation. A good way to combat this is to start with smaller implementations that bring immediate value to the cities that use them

11.CONCLUSION.

In addition, other technologies like 5G internet have to be available throughout the country to take advantage of the fast communication between smart vehicles and smart roads. Until we have adequate infrastructure and the backing of the public, we'll struggle to build smart roads at scaleThe smart road concept, namely the highway of the Smart Age, extends road infrastructures improving their operational capability to respond to the modern needs of road users with intelligent mobility solutions.

The paper aim was to offer an overview of the smart approach in road engineering by proposing a broad discussion about the current state of the art in smart road developments. Actually, the paper presented a general discussion on what "smart road" and "smart highway" really mean and what they

can be. The use of functional definitions in the literature has allowed us to highlight the key functions of the smart road: self-awareness; information and connection; self-adaptability; energy harvesting. By examining each of these key functions, the paper offered a bird's eye view of the most modern technologies based on Information and Communications Technologies, such as end-user Internet service system, Internet of Things, Connection and Cooperation Services, Big Data, Augmented Reality, Artificial Intelligence, Edge Computing. Alongside these, other innovative technologies were reviewed, which concern the use of Intelligent Materials or the exploitation of clean and renewable energy sources.
Starting from the definition of the functions of the smart road and more generally of mobility in a smart city context, the paper proposed a discussion on the actual ability of these innovations to achieve the objectives underlying a vision of the smart road, in a perspective of environmental and social sustainability. The solutions reviewed showed an excellent degree of compliance with the criteria that were identified starting from this vision. Some points of attention emerged from the discussion, highlighting some strengths and criticalities of current innovations in the market for infrastructures and services for the road mobility in the Smart Age and especially of their future developments. These may concern, with greater attention, issues such as: security of data flow and storage; privacy and personal responsibility; traffic safety and protection of weaker users; any new forms of pollution, to the detriment of human health and the environment.
Actually, it is a rapidly expanding sector with very broad market prospects in the coming years, oriented to win the major challenge to connect users, vehicles and infrastructures in an intelligent, efficient, safe and sustainable manner. Even though these innovations still represent a small slice of the present, they are destined to enrich themselves and constitute a large slice of the future in the panorama of mobility, both for people and goods.

12.FUTURE SCOPE

"One's destination is never a place but rather a new way of seeing things" **– Henry Miller**

Not long ago, road technology experienced a permanent transformation. It was the early twentieth century and the mass adoption of the automobile encompassed the world. And to help the automobile achieve its full potential, highways were built to link together towns, cities, and states.

Through this investment, we saw a better way to live with the emergence of suburbia, city decongestion and big brand malls springing up across the country.

As time went on, these changes started to pose challenges the world had never experienced before. Thanks to tarred roads and the rise of urban living, we now experience an increase in environmental pollution, traffic congestion, long commutes, and fatal accidents.

Yet again, we're at the crossroads between status quo and innovation. And with the emergence of…

- **5G high speed internet across the globe**
- **Electric vehicles**
- **Autonomous driving software.**

13.APPENDIX

Source Code

GitHub & Project Demo Link: https://github.com/IBM-EPBL/IBM-Project-22006-1659800916