

# **SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY**

## **PROJECT REPORT**

**Submitted by**

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## **1.Introduction**

### **1.1 Project Overview**

This goal of this project is to replace the static signboards with smart connected

sign boards to get the speed limitations from a web app using weather API and update with automatically based on the weather conditions , set diversions through API and warn drivers for school zones and hospital zones.

## **1.2 Purpose**

To replace the static signboards , smart connected sign boards are used.

- These smart connected sign boards get the speed limitations from a web app using weather API and update automatically.
- Based on the weather changes the speed may increase or decrease .
- Traffic diversion signs are displayed.
- Messages indicating school , hospital , police station zones are also displayed.

## **2. Literature Survey.**

### **2.1 Existing problem**

A phenomenon in transportation known as traffic congestion may involve large crowds ,slowed vehicle speeds ,and even longer vehicle lengths . when there is a high demand for traffic ,the interaction of the moving cars slows down the of traffic which eventually leads to the congestion. Smart traffic management systems can be implemented in the correct situation to address these issues ,and we are now researching ways to create cities with no traffic .this system aids in traffic monitoring.

### **2.2 References**

<b>S.No</b>	<b>Paper Title</b>	<b>AUTHOR NAME</b>	<b>PUBLICATION YEAR</b>

<b>1.</b>	<b>European road assessment program(Euro Rap)</b>	<b>European Road safety Atlas</b>	<b>2020</b>
<b>2.</b>	<b>Save LIVES-A road safety technical package</b>	<b>World Health Organization</b>	<b>2017</b>
<b>3.</b>	<b>Global Status report on Road safety</b>	<b>World Health Organization</b>	<b>2015</b>

## **2.3 Problem Statement Definition**

Many factors increase both the risk of road traffic crashes and the risk of death or injury they result in. Driving at speed significantly increases both the likelihood of a crash occurring, and the severity of it's consequences. For every 1% increase in mean speed there is a 4% increase in fatal crash risk.

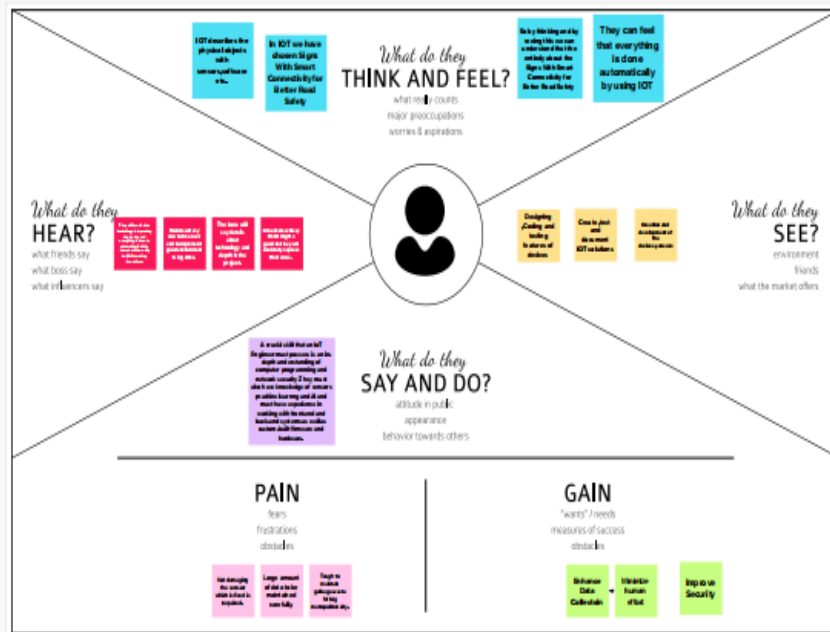
## **3. Ideation and Proposed Solution**

### **3.1 Empathy Map Canvas**

# Empathy Map Canvas

Gain insight and understanding on solving customer problems.

**1**  
Build empathy and keep your focus on the user by putting yourself in their shoes.



## 3.2 Ideation & Brainstorming

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



## Brainstorm & idea prioritization

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

- 10 minutes for prep work
- 1 hour for ideation
- 2-3 hours for prioritization

When completed, click on the link to view the results.

00

### Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

1. Team gathering

Customize the template and prepare to discuss the session's objectives and goals. There are several ideas within the template to help you.

2. Set the stage

There is a lot of preparation to do before the session. Make sure you have the right tools and resources to help you.

3. Learn how to use the tool

Use the 'Facilitator' role to guide the session. Use the 'Participant' role to help you understand the tool.

Open in full screen

01

### Define your problem statement

What problem are you trying to solve? Frame your problem as a how might we statement. This will be the focus of your brainstorm.

10 minutes

#### PROBLEM

Many factors increase both the risk of road traffic crashes and the risk of death or injury the result is. Driving at speed significantly increases both the likelihood of a crash occurring, and the severity of its consequences. For every 1% increase in mean speed there is a 4% increase in fatal crash risk.



#### Key rules of brainstorming

To ensure you get the most out of your brainstorming session

- 1. No criticism
- 2. No judgement
- 3. No veto
- 4. No idea is too small
- 5. No idea is too big
- 6. No idea is too late
- 7. No idea is too early
- 8. No idea is too simple
- 9. No idea is too complex
- 10. No idea is too obvious

02

### Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

#### M. Kowalski

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#### S. Novitski

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What's next?  
Now that you've completed the template, it's time to start brainstorming ideas.

Open in full screen



3

### Group ideas

Take turns sharing your ideas while discussing similar or related ones as you go. Once all sticky notes have been grouped, give each cluster a sentence to describe it. If a cluster is bigger than six sticky notes, try subdividing it up into smaller subgroups.

120 seconds



Use your knowledge to help others to think in a new way. When you give your suggestions, consider how a leader might put them to use.

4

### Prioritize

Your team should agree on the same page about what's important moving forward. Place your ideas on the grid to determine which ideas are important and which are feasible.

30 minutes



5

### After you collaborate

You can export the mind as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

#### Share the mind

Share a dashboard for the mind with collaborators. Invite them to the help about the mind as often as you want.

#### Export the mind

Export a copy of the mind as a PDF or CSV to share with others. It can be used in spreadsheets, presentations, or other documents.

Keep moving forward

#### Strategic planning

Use the mind map to create a strategic plan.

[Open the template](#)

#### Customer experience journey map

Use the mind map to create a customer experience journey map.

[Open the template](#)

#### Strategic, tactical, operational & financial

Use the mind map to create a strategic, tactical, operational, and financial plan.

[Open the template](#)

[View a template feedback](#)

### 3.3 Proposed Solution

SI.NO	Parameters	Description
1.	Problem Statement (problem to be solved)	Many factors increase both the risk of road traffic crashes and the risk of death or injury they result in. Driving at speed significantly increases both the likelihood of a crash occurring. People failure to understand signs and violation of rules. Traffic management is an essential part of modern mobility, and traffic signals help optimize the existing network in the best possible way. It monitors and controls various modes of traffic in order to avoid congestion and to improve traffic flow.
2.	Idea/Solution description	Smart traffic lights can also be synced to the movement of larger vehicles or conditioned to respond appropriately to situations like gridlock or blockage. Simple programming modes of traffic in



		<p>order to avoid congestion and to improve traffic Smart programming and digitization can be used to control traffic light operations in both larger and small urban areas When traffic lights co-ordinate ideally and respond to demand in real-time, Road capacity can be maximized quickly. All of this programming can be done with expert knowledge.</p>
3.	Novelty/Uniqueness	<p>A display via smart phone is also possible. This improves convenience for drivers and leads to better traffic flow and less air pollution.</p> <p>Dynamic of sign board.</p> <p>Gives more detailed information to the road drivers.</p>
4.	Social Impact/Customer Satisfaction	<p>Reduced accident rates.</p> <p>Increase travel speeds.</p> <p>Increase operational efficiency. Real time information management. Create a platform for sharing traffic to other systems.</p> <p>Environment friendly.</p>

5.	<b>Business Model(Revenue Model)</b>	<b>LED signal lamp which compiles the European standards EN12368 and IP65 grade with 5 years performance warranty. Selling project to the highway departments. It will provide service where the accidents avoid is play vital role in road.</b>
6.	Scalability of the Solution	Adaptive traffic control system (ATCS) considers developing countries traffic scenarios, vehicular movements and responds in real time. It uses downstream detection and provides user friendly interface to.

### 3.4 Problem solution fit

**Project design phase -1- solution fit template**

**Project Title:** Signs with Smart Connectivity for Better Road Safety  
**Team ID:** PNT2022TMD33212

<b>1. CUSTOMER SEGMENTS</b> People say road kills one person every 24 seconds	<b>6. CUSTOMER CONSTRAINTS</b> Identify accidents because over 50% fatal crashes on roadways with speed limit 55mph.	<b>5. AVAILABLE SOLUTIONS</b> Speed limit to be displayed automatically according to the weather condition.  In fatal solutions the diversion signs are displayed automatically.
<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> Determine the speed limit for the road on the vehicles with auto break system.	<b>9. PROBLEM ROOT CAUSE</b> The higher speed, the higher accident risk and the more severe the accident consequences.	<b>7. BEHAVIOUR</b> Protect the persons from accidents.

<b>3. TRIGGER</b> Causes on road traffic: Travel time, mobility, accessibility, impacts on environment.	<b>10. YOUR SOLUTION</b> Simple programming, modes of traffic in order to avoid congestion and to improve traffic smart programming and digitization can be used to control traffic light operations in both larger and smaller urban areas.	<b>8. CHANNELS of BEHAVIOUR</b>  <b>8.1 ONLINE</b> The speed limitation & diversion signs must be updated in whatsapp web  <b>8.2 OFFLINE</b> Strict enforcement and implementation of law on equality basis plays a vital role in road safety.
<b>4. EMOTIONS: BEFORE / AFTER</b> <b>Before</b> For every 1% increase in mean speed there is a 4% increase in fatal crash <b>After</b> Use new technology such as smart light traffic system and traffic control system are implemented		

## 4. Requirement Analysis

### 4.1 Functional Requirements

FR No.	Functional Requirement (Epic)	Sub Requirement (Story/Sub-Task)
FR-1	User tracking	Speed Limit To be displayed automatically according to the weather

		condition. In fatal situations the diversion signs are displayed automatically.
FR-2	Weather	Using open weather Map
FR-3	User interface	Open API (application programming interface) Keys
FR-4	Data processing	The speed limitation & diversion sign must be updated in a web App.
FR-5	Sensor	Stand -alone-safety sensor GPS Sensor

## 4.2 Non-functional Requirements

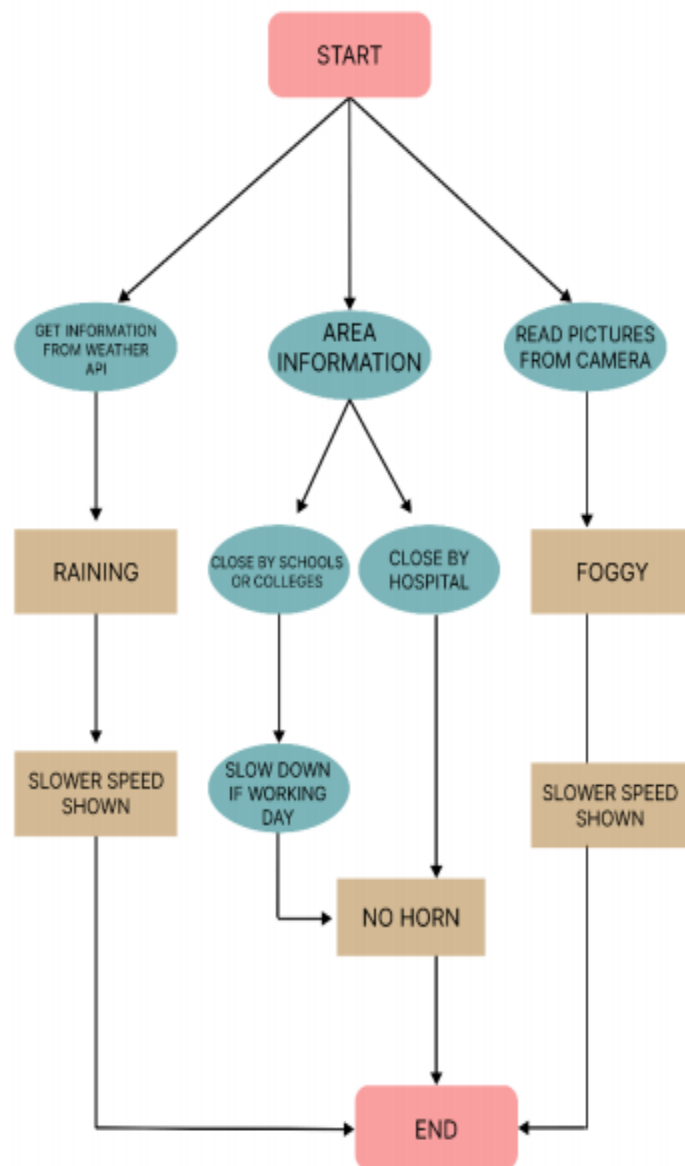
FR NO.	Non-Functional Requirement	Description
NFR-1	Usability	Indicates how framework should operate for the Customer or end-user
NFR-2	Security	Focuses on how the framework is kept secure, store information and react to the attacks
NFR-3	Reliability	Characterizes the frameworks accessibility

		<b>and the tolerance for disappointment.</b>
<b>NFR-4</b>	<b>Performance</b>	<b>Focuses on the system speed, efficiency and workload.</b>
<b>NFR-5</b>	<b>Availability</b>	<b>It could be a metric that measures the probability that a framework is not failed or experiencing a repair activity when it should be utilized.</b>
<b>NFR-6</b>	<b>Scalability</b>	<b>Ensures the framework can react to changes in request.</b>

## **5. Project Design**

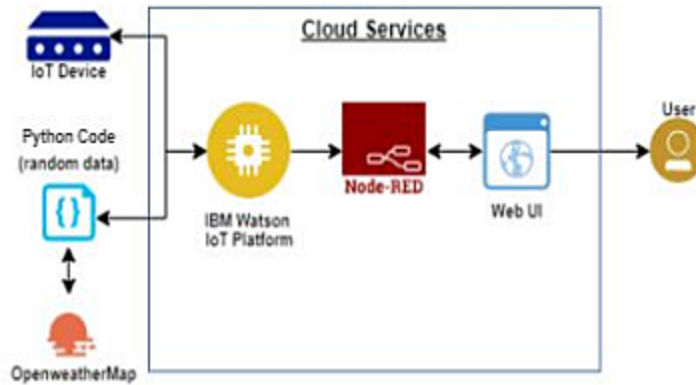
### **5.1 Data-Flow Diagrams**

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



## 5.2 Solution & Technical Architecture

## Components & Technologies



## 5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story/Task	Acceptance criteria	Priority
Customer (Mobile User)	Registration	USN-1	I can get my speed imperative using climate application	I can get speed limitations.	High
		USN-2	As a client, I can enlist for the application by entering my e-mail,	I can get to my account/dash board	Medium

			mystery phrase and affirming my mystery phrase		
		USN-3	As a client, I can increment or lessening my speed as demonstrated by the climate conditions change	I can increase or decrease my speed	High
		USN-4	As a client, I may I at any point get my activity redirection signs depending upon the activity and deadly circumstances	I can get to my traffic status ahead in my development	Medium
	Login	USN-5	As a client, I can sign out from the dim climate	I can get to the application through my Gmail	High



			outline by entering e-mail and mystery key	login	
	Interface	USN-6	As a client the association point got to be straight forward and succeefully open	I can get to the point interaction without any issue	High
Customer (Web User)	Data generation	USN-7	As a client I use open climate application to get to the data in respects	I can get to the data concerning through the application	High
Director	Problem solving Fault Clearance	USN-8	As an in specialist charge for the authentic working of the sign sheets have to be keep up with it through periodic watching	Specialist can screen the sign sheets for genuine working	Medium

## **6. Project planning & scheduling**

### **6.1 Sprint planning & Estimation**

<b>Sprint</b>	<b>Functional Requireme</b>	<b>User Story/Task</b>	<b>Story Points</b>	<b>priority</b>
Sprint-1	Initializing the resources	Create an account in Open Weather API	5	LOW
Sprint-1	Code in Software is written	Write a python script using the inputs given from Open Weather API	5	MEDIUM
Sprint-2	Sending the software to cloud	The python code from sprint 1 should be sent to cloud so that it is easily accessible	5	MEDIUM
Sprint-3	Initializing the connection between hardware and cloud	The hardware should be integrated for the easy access of the cloud functions	5	HIGH
Sprint-4	User input? output optimization and error	Rectify all the shortcomings/ errors and initiate the	5	HIGH

	identification and rectification	optimization for better usage		
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## 6.2 Sprint Delivery Schedule

Sprint	Total story points	Duration	Story points completed
Sprint-1	20	4 Days	20
Sprint-2	20	4 Days	20
Sprint-3	20	4 Days	20
Sprint-4	20	4 Days	20

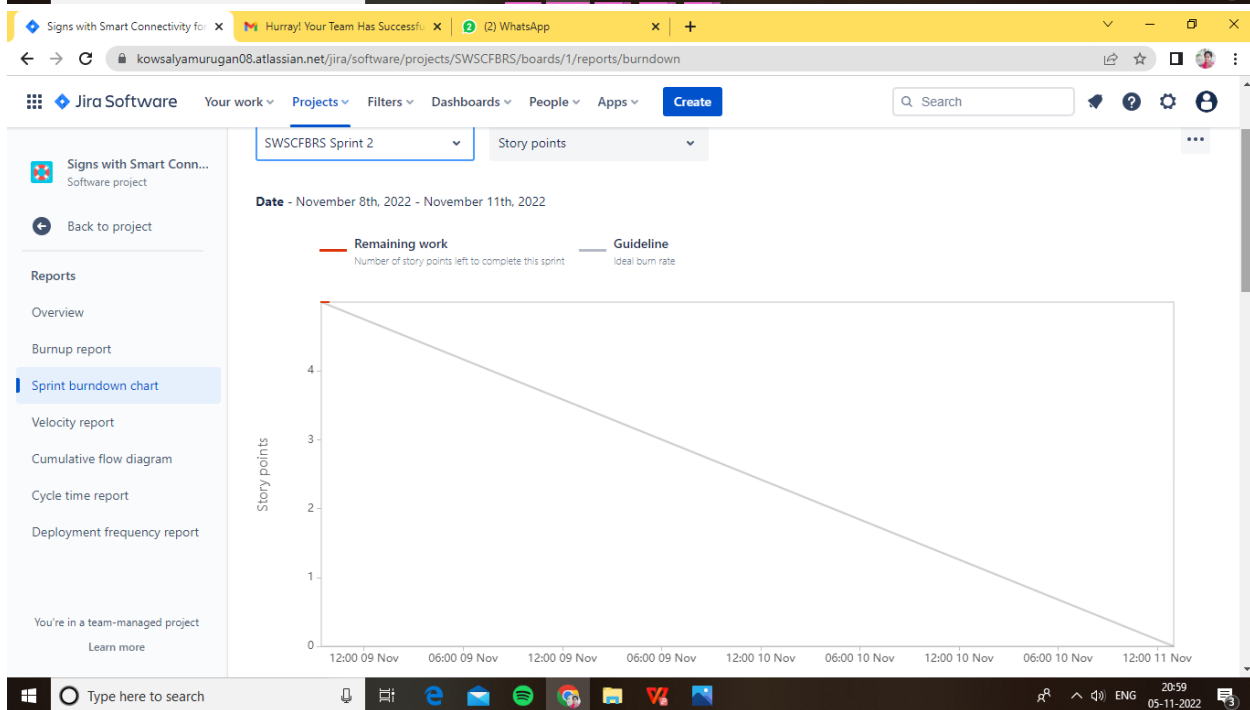
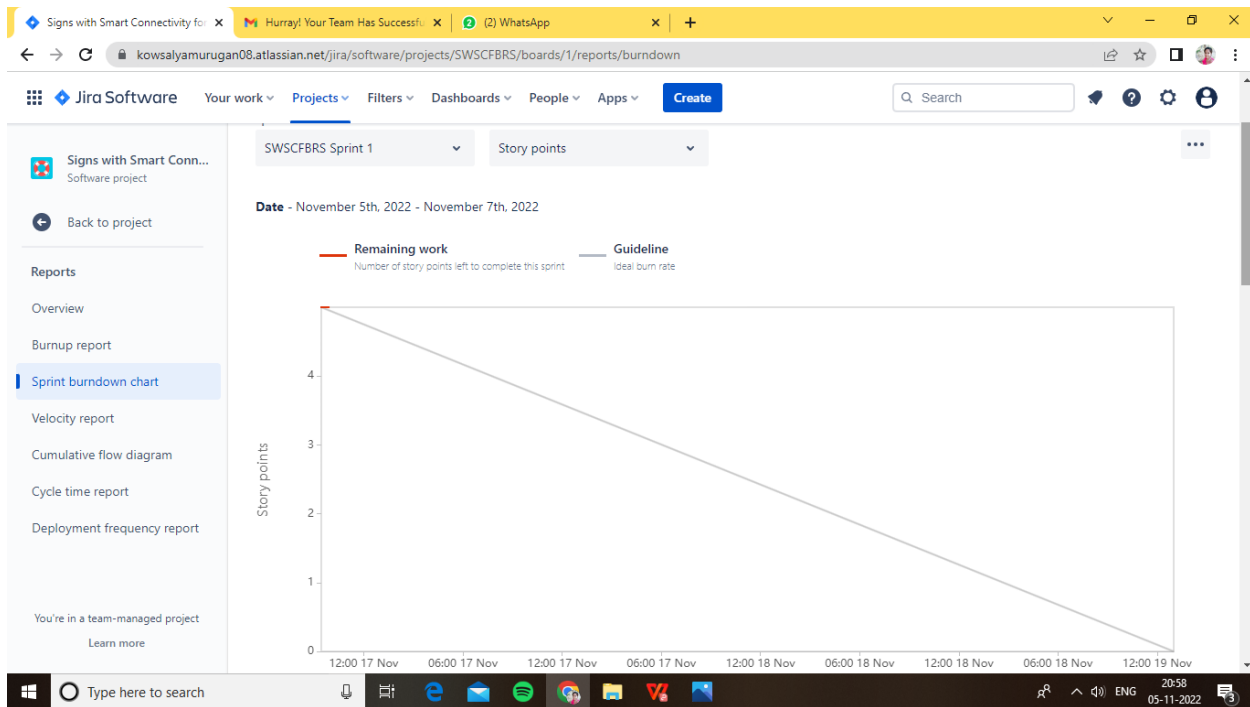
### Velocity:

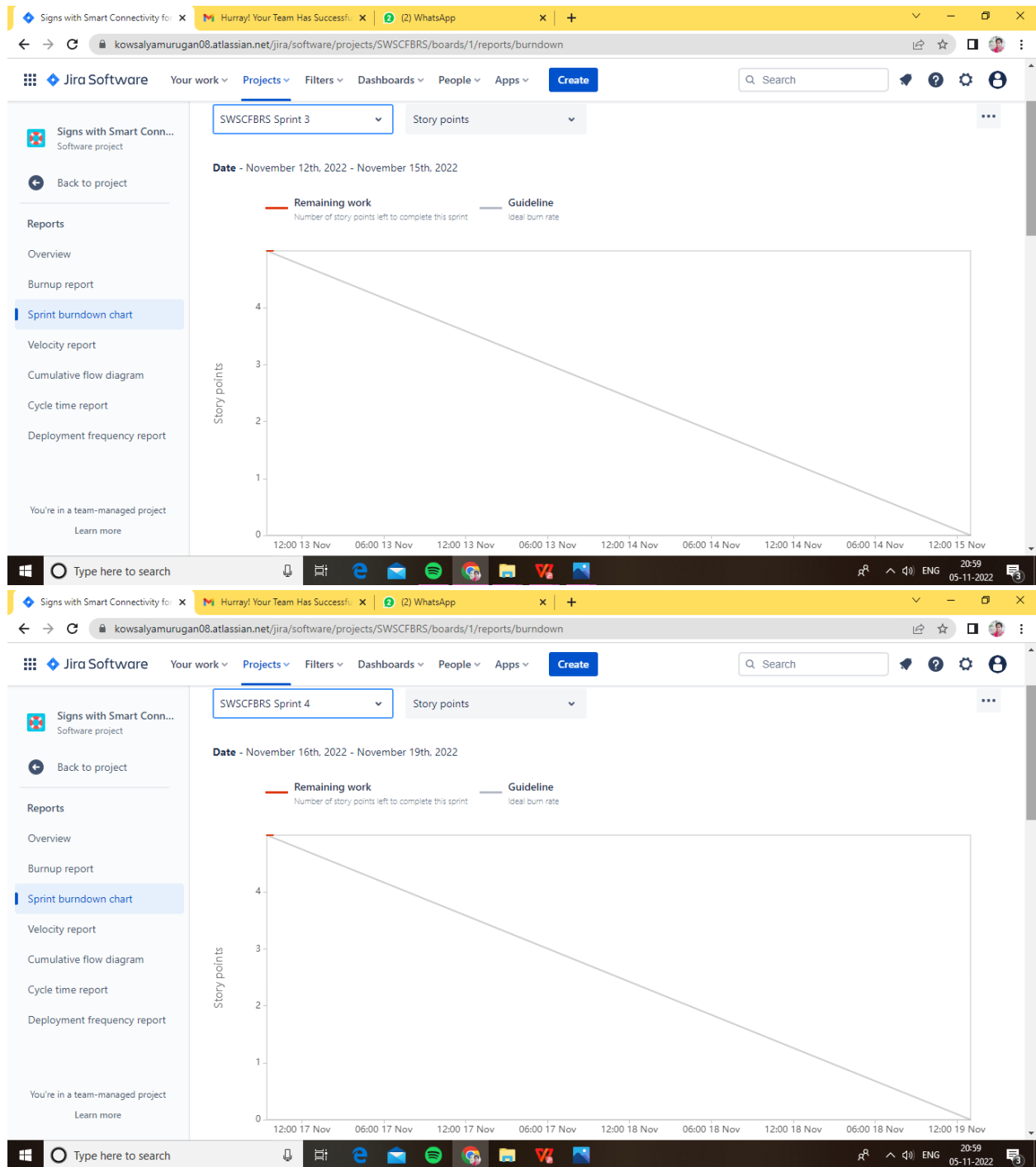
We have a 4 day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \text{Sprint duration} / \text{Velocity} = 20 / 4 = 5$$

### Burndown Chart:

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

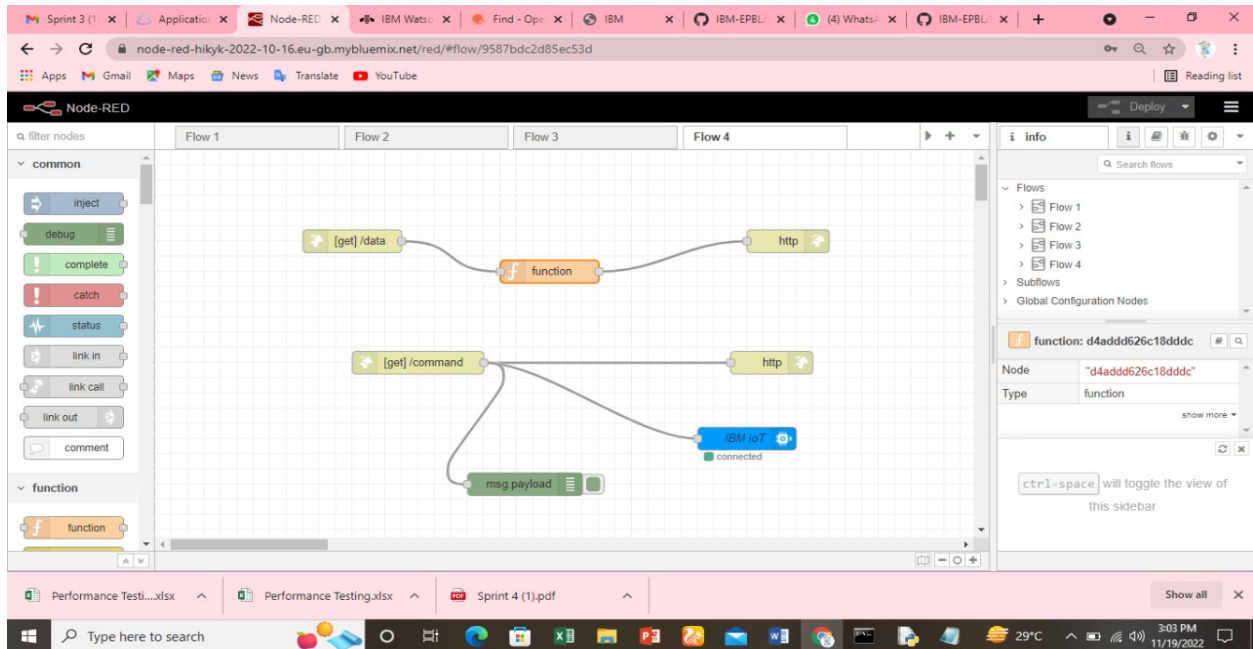




## 7. Coding and Solutioning

### 7.1 Feature 1

GET WEATHER DETAILS FOR GIVEN LOCATION



## 8. Testing

### 8.1 Test cases

#### TEST CASE 1

Temperature': 303.03, 'Humidity': 51, 'Pressure': 1010, 'Message': 'SLOW DOWN , SCHOOL IS NEAR', 'Sign': ', 'Speed': ', 'Visibility': 'Clear Weather'

#### • TEST CASE 2

Temperature': 303.03, 'Humidity': 51, 'Pressure': 1010, 'Message': ', 'Sign': 'Left Diversion <-', 'Speed': 'SLOW DOWN , Speed Limit Exceeded', 'Visibility': 'Clear Weather'

#### • TEST CASE 3

Temperature': 303.03, 'Humidity': 51, 'Pressure': 1010, 'Message': 'SLOW DOWN , HOSPITAL NEARBY', 'Sign': 'Left Diversion <-', 'Speed': ', 'Visibility': 'Clear Weather'

#### • TEST CASE 4

Temperature': 303.03, 'Humidity': 51, 'Pressure': 1010, 'Message': 'NEED HELP, POLICE STATION NEARBY', 'Sign': 'U Turn', 'Speed': 'Moderate Speed', 'Visibility': 'Clear Weather'.

### 8.2 User Acceptance Testing

Dynamic speed & diversion variations based on the weather and traffic helps user to avoid traffic and have a safe journey home. The users would welcome this idea to be implemented everywhere.

## **9. Results**

### **9.1 Performance Metrics**

The performance of the website varies based on the software chosen for implementation .

Built upon NodeJS, a light and high performance engine, NodeRED is capable of handling upto 10,000 requests per second. Moreover, since the system is horizontally scalable, a even higher demand of customers can be served.

## **10. Advantages and Disadvantages**

### **Advantages**

- Lower battery consumption since processing is done mostly by Node RED servers in the cloud.
- Cheaper and low requirement micro controllers can be used since processing requirements are reduced.
- Longer lasting systems.
- Dynamic Sign updation.
- School/Hospital Zone alerts

### **Disadvantages**

- The size of the display determines the requirement of the micro controller.
- Dependent on OpenWeatherAPI and hence the speed reduction is same for a large area in the scale .

## **11. Conclusion**

Our project is capable of serving as a replacement for static signs for comparatively lower cost and can be implemented in the very near future. This will help reduce a lot of accidents, traffics and maintain a peaceful environment.

## **12. Future Scope**

Introduction of intelligent road sign groups in real life scenarios could have great impact on increasing the driving safety by providing the end-user with the most accurate information regarding the current road and traffic conditions. Even displaying the information of a suggested driving speed and road surface condition (temperature, icy, wet or dry surface) could result in smoother traffic flows and, what is more important, in increasing a driver's awareness of the road situation.

## **13. Appendix**

**Github Link :** <https://github.com/IBM-EPBL/IBM-Project-2366-1658470402>

**Project Demonstration Link:**

[https://drive.google.com/file/d/1ZOKnA9yvLOqV4AP8BWEA-2WjZv3UzNI7/view?usp=share\\_link](https://drive.google.com/file/d/1ZOKnA9yvLOqV4AP8BWEA-2WjZv3UzNI7/view?usp=share_link)