SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY.

PROJECT REPORT

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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

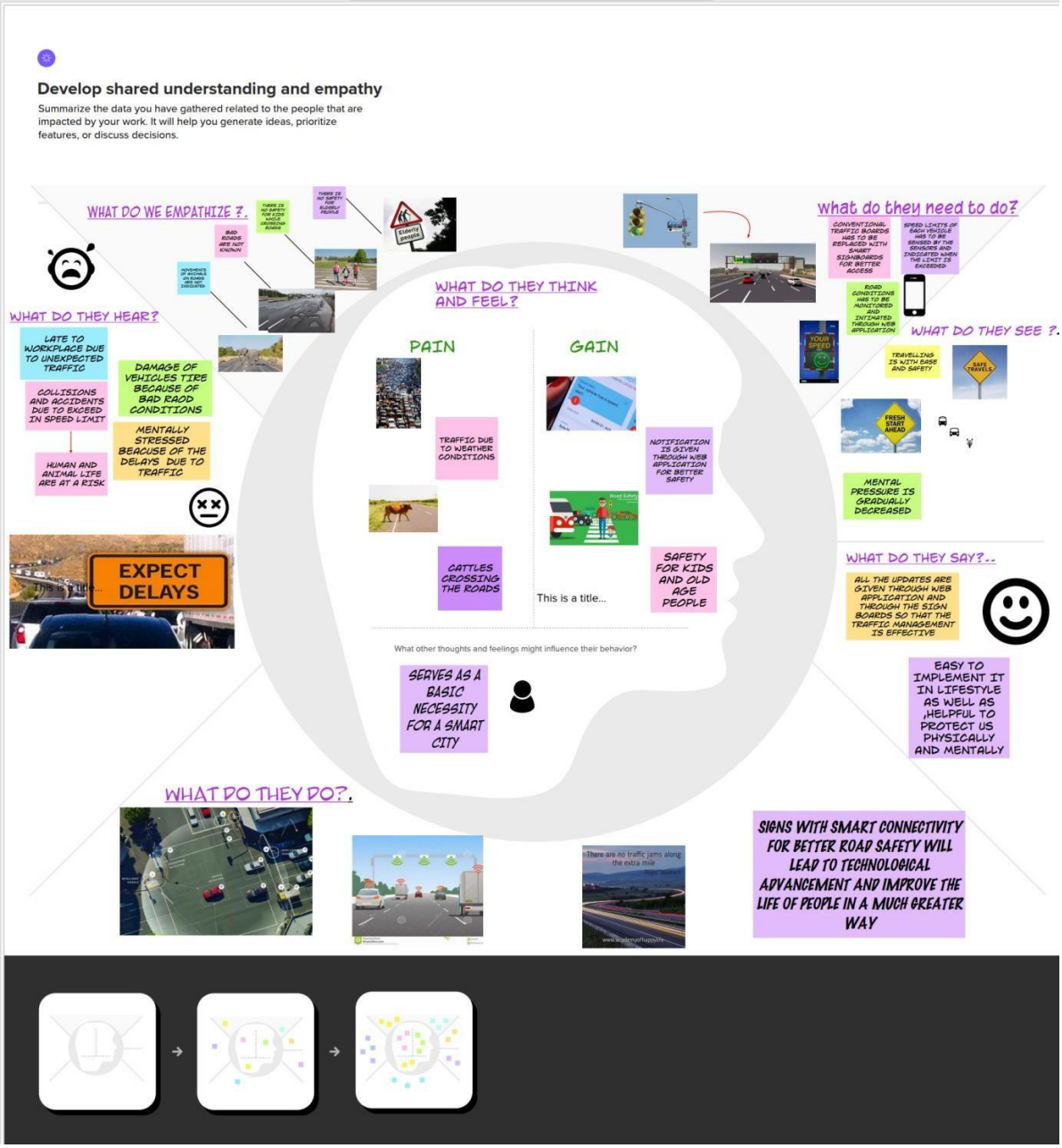
S. NO	PAPER TITLE	AUTHOR NAME	PUBLICATION YEAR
1.	European road assement program(Euro Rap)	European Road safety Atlas	2020
2.	Save LIVES-A road safety technical package	World Health Oraganization	2017
3.	Global Status report on Road safety	World Health Oraganization	2015

2.3 Problem Statement Definition

The speed limits and road signage in use today is static .However, under specific circumstances ,the signs may be modified. If the signs are digitalized, we may take into account situations when there are detours due to traffic congestion or accidents and adjust the signs accordingly. This proposal suggests a system that uses digital signs boards with constantly changing signs. Rainfalls causes the roads to become slick ,and the speed restrictions is lowered .There is a web application that allows you to enter the information about road detours ,accident -prone regions, and informational sign boards.

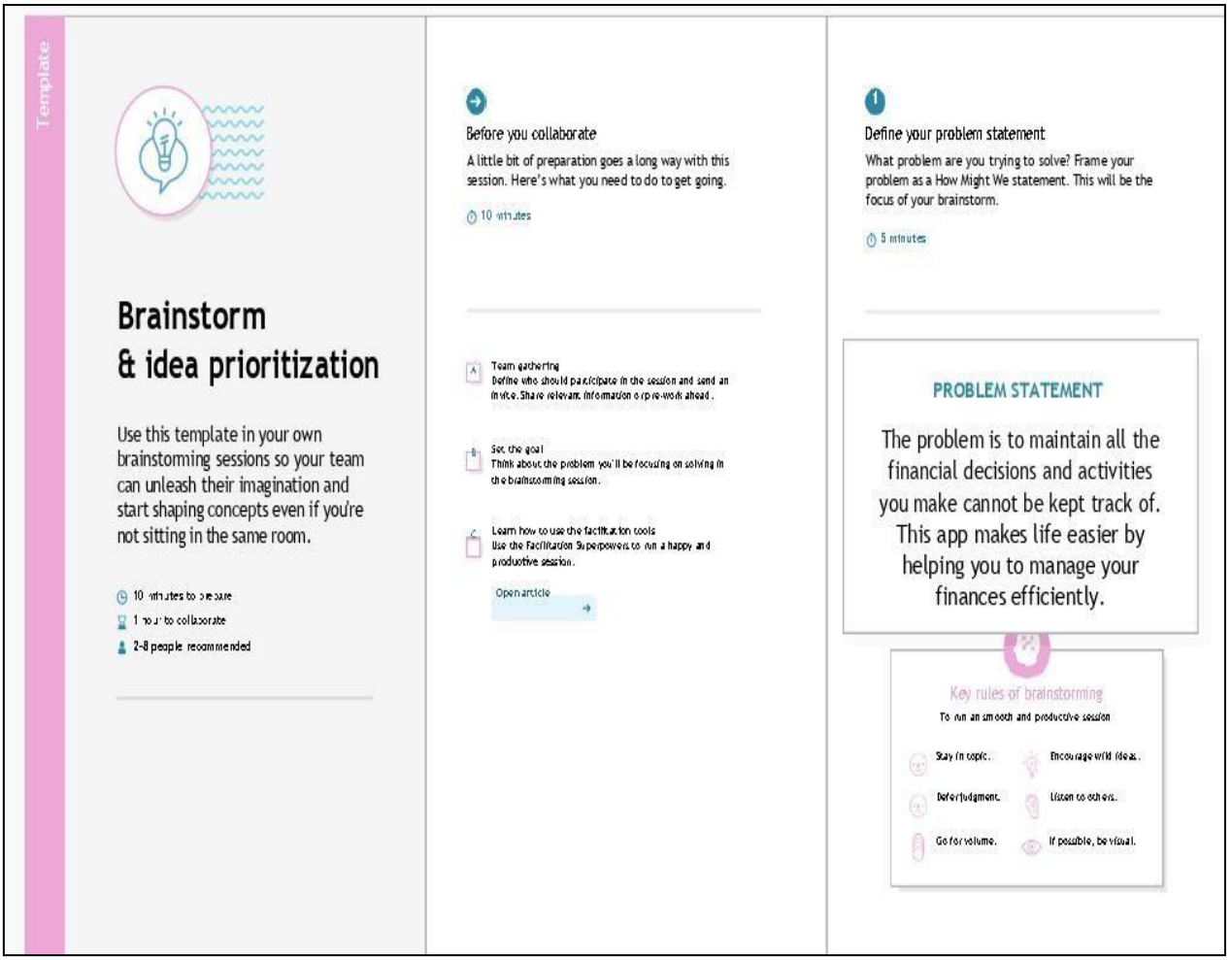
3. Ideation and Proposed Solution

3.1 Empathy Map Canvas



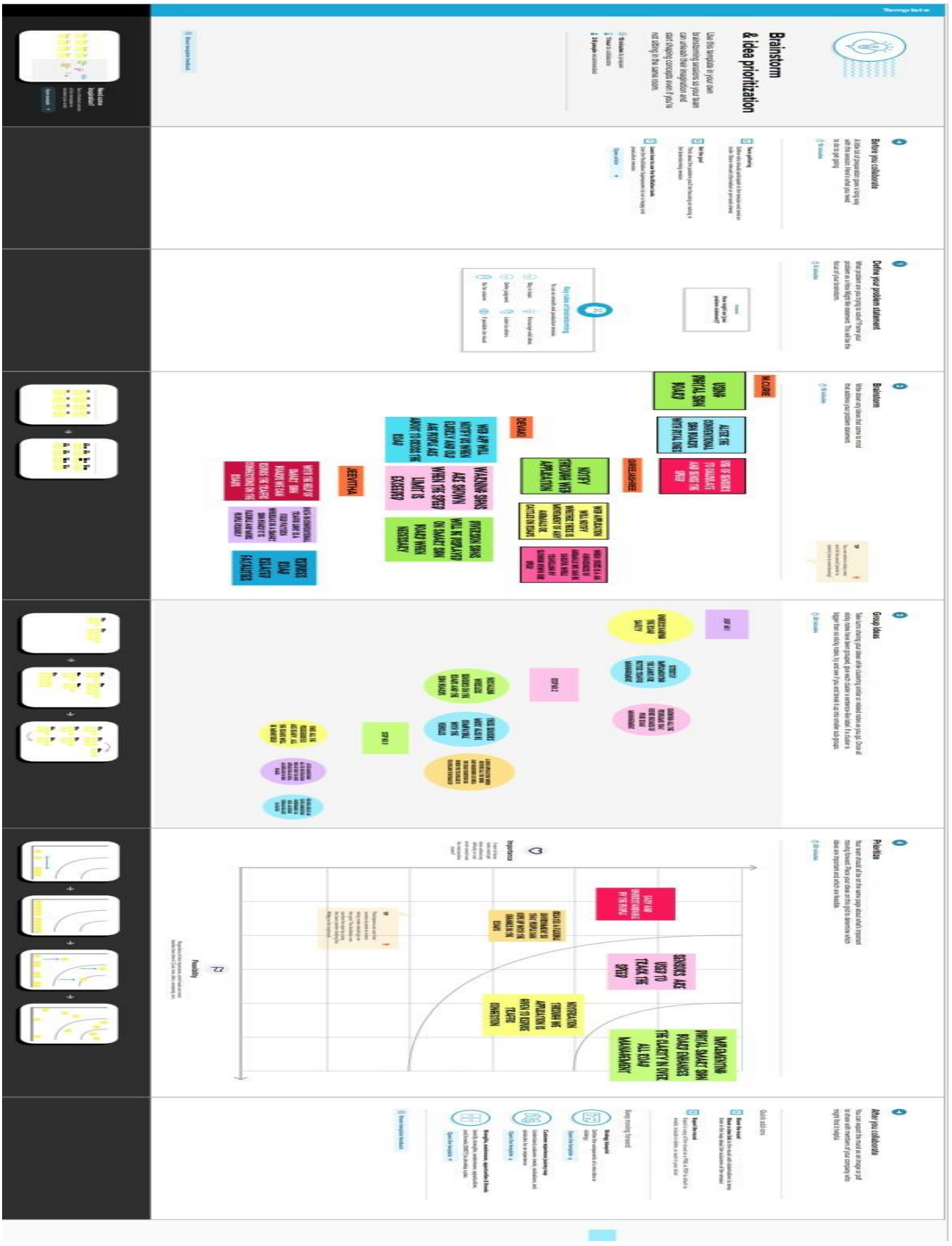
3.2 Ideation & Brainstorming

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



Step-2: Brainstorm, Idea Listing

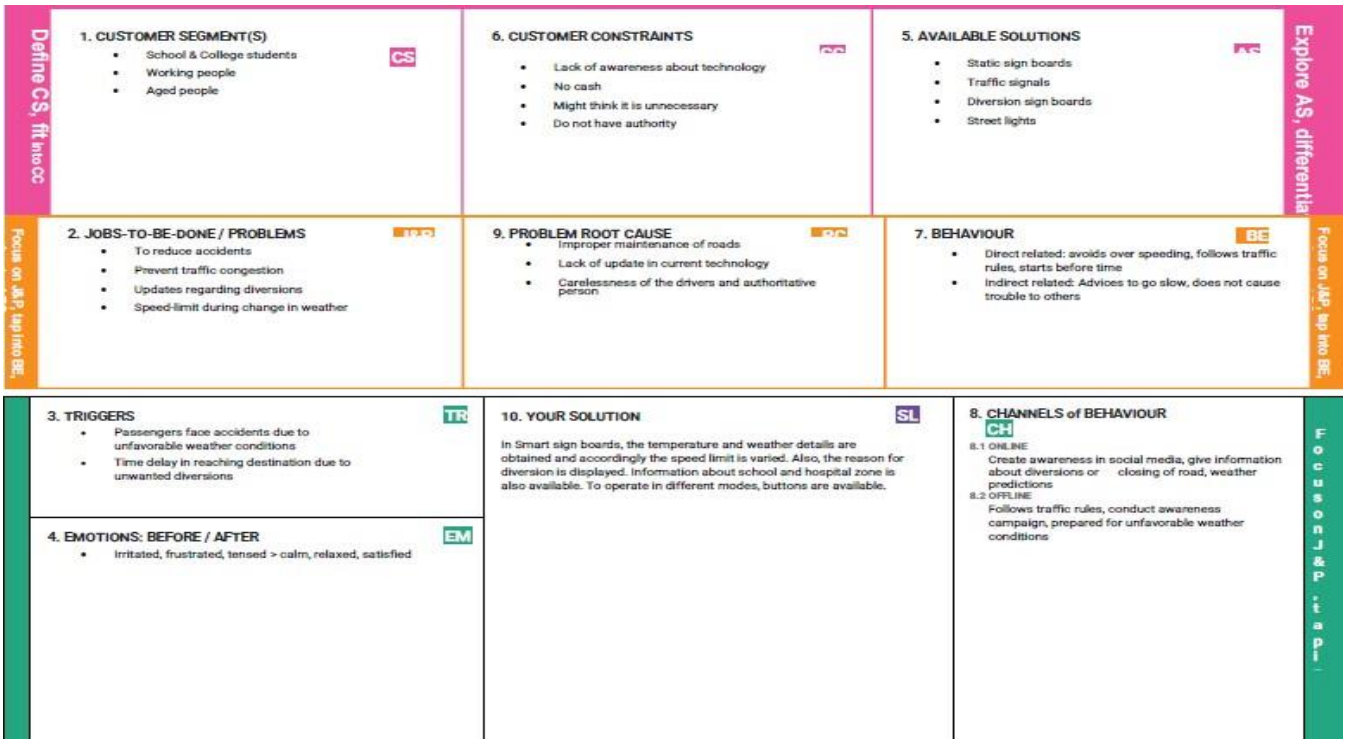
Step-3: Idea Grouping



3.3 Proposed solution

S.NO	Parameter	Description
1.	Problem statement (problem to be solved)	Enhancing the road safety management , which results in the huge decrease and reduction of road related fatalities, collisons and unwanted delays due to traffic which inturn results in the peace of mind for our society.
2.	Idea/solution description	Conventional traffic lights are replaced with smart sign boards as well as web application is used to send warnings , notification about the road conditions with the help of sensors.
3.	Uniqueness/novelty	The uniqueness of iot based smart connectivity for better road safety is its flexibility to the present and current situations of the roads on which the customer is travelling ,which guides the user to make best decision in ease, whereas the conventional traffic light follows the same pattern .
4.	Social impact / customersatisfaction	When clarity is given through signs on smart boards as well through web notification , customer will know what should be done .this iot based smart connectivity for road safety provides safety and peace of mind for the customers by avoiding unnecessary anxious scenarios.
5.	Business model (revenuemodel)	This is an important model which will help the country to increase its productivity as well the individual’s productivity by avoiding unwanted delays while travelling to the workplace or any other emergency situations.this scheme also values and ensures the safety of each and every living being.
6.	Scalability of the solution	A highly populated country the scalability of this particular project will be a great acheivement as it will create much more awareness and clarity amongst the people.

3.4 Problem solution fit



4. Requirement Analysis

4.1 Functional Requirements

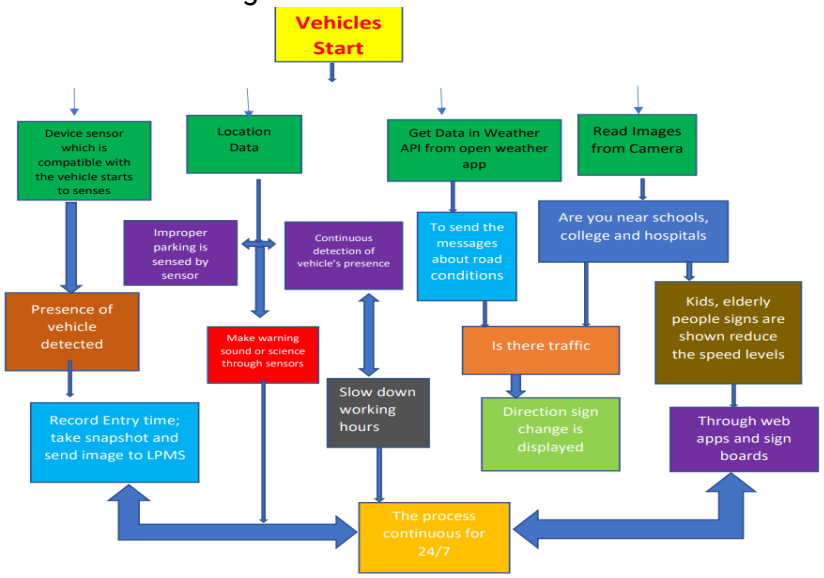
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation viaEmailConfirmation via OTP
FR-3	User Access / Login	Login through e-mail ID & Password
FR-4	User Data	Adding user expenses through input field & categories
FR-5	User Alert	Alerting user through registered e-mail ID

4.2 Non-functional Requirements

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	User friendly interface
NFR-2	Security	Strong security system
NFR-3	Reliability	Highly reliable for the old age people to track theexpenses
NFR-4	Performance	Low data usage, instant email alerts while exceedinglimits.
NFR-5	Availability	Available for all platforms (Mobile User, Web User)
NFR-6	Scalability	Access Anywhere Anytime

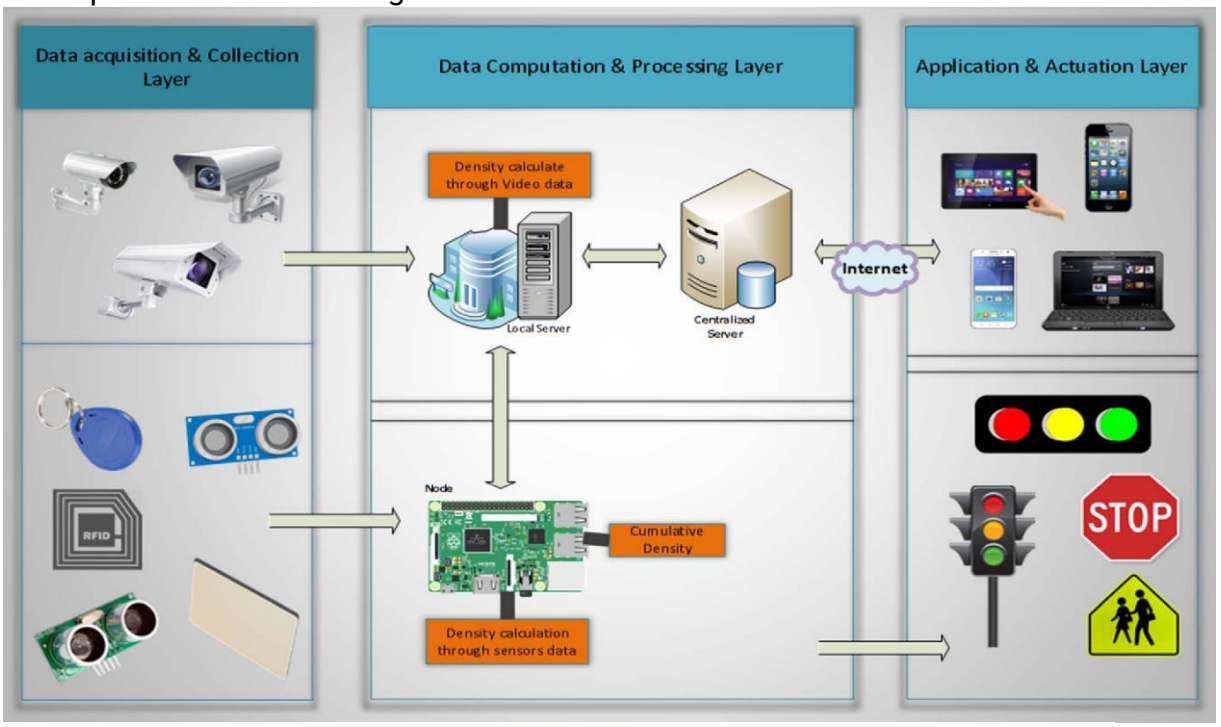
5. Project Design

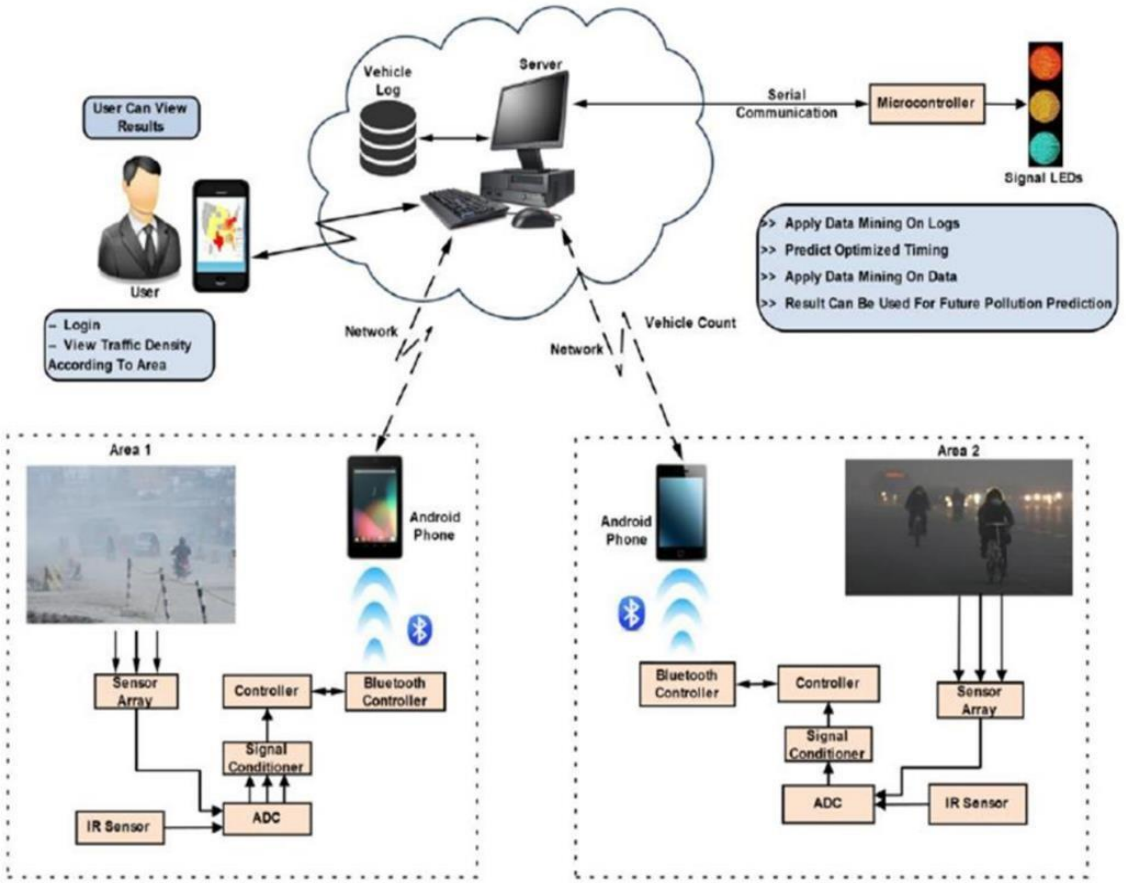
5.1 Data-Flow Diagrams



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 & web user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirmingmy password.	I can access my account / dashboard	High
		USN-2	As a user, I will receive confirmation emailonce I have registered for the application	I can receive confirmation email & click confirm	High
		USN- 3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low
	Login	USN - 4	As a user, I can log into the application by entering email & password	I can access theapplication	High
	Dashboard	USN - 5	As a user I can enter to the main dashboard	I can view the direction	High
Customer Care Executive		USN – 6	As a customer care executive I can solve thelog in issues and other issues of the application.	I can provide support or solution at any time 24*7	Medium
Administr ator	Application	USN - 7	As a administrator I can upgrade or update the application.	I can fix the bug which arises for the customersand users of the application	Medium

6. Project planning & scheduling

6.1 Sprint planning & Estimation

Sprint	Functional Requirement (Epic)	User Story / Task	Story Points	Priority
1	Intializing the Resources	Create an account in Open Weather API	1	LOW
1	code in Software is written	Write a python script using the inputs given from OpenWeather API	2	MEDIUM
2	Sending the software to cloud	The python code from sprint 1 should be sent to cloud so that it is easily accessible	1	MEDIUM
3	Initialising the connection between hardware and cloud	The hardware should be intergrated for the easy access of the cloud functions	2	HIGH
4	User input-output optimisation and error identification and rectification	Rectify all the shortcomings/errors and initiate the optimisation for better	3	HIGH

6.2 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Story Points Completed
Sprint-1	8	6 Days	20
Sprint-2	6	6 Days	20
Sprint-3	4	6 Days	20
Sprint-4	4	6 Days	20

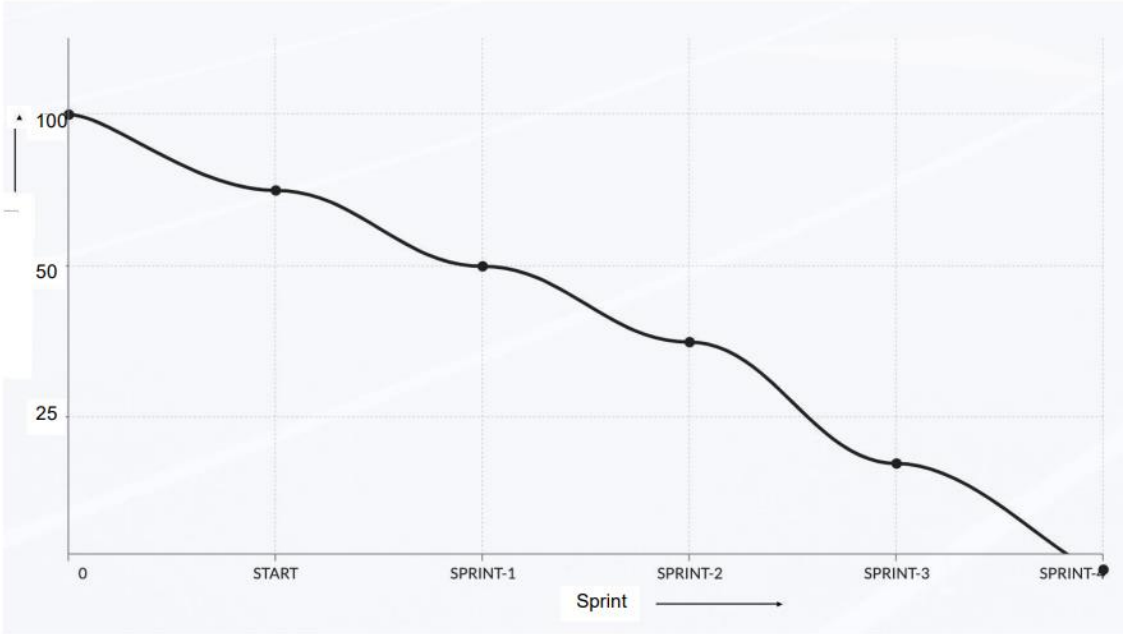
Velocity

Velocity is a metric that predicts how much work an Agile software development team can successfully complete within a two-week sprint (or similar time-boxed period). Velocity is a useful planning tool for estimating how fast work can be completed and how long it will take to complete a project

Average velocity = Total story points/ No. of iterations = 6/20 = 0.3

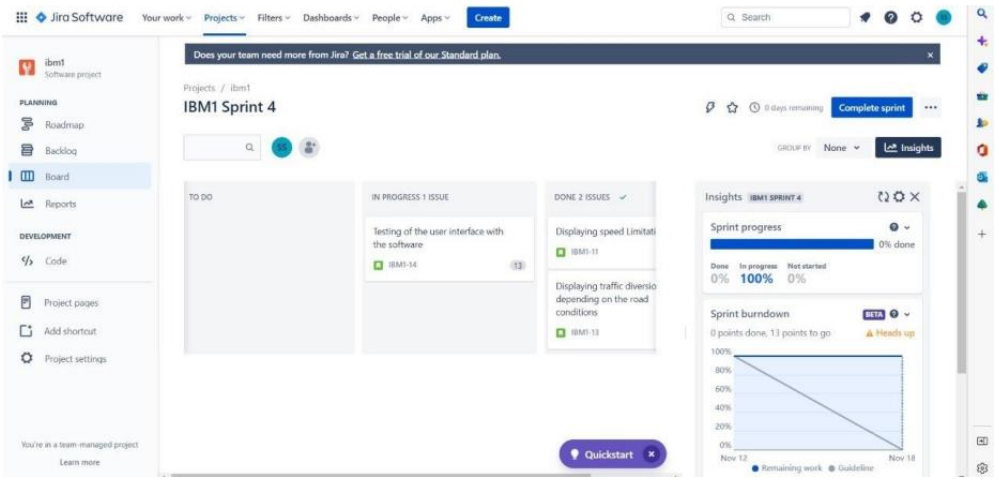
Burndown Chart:

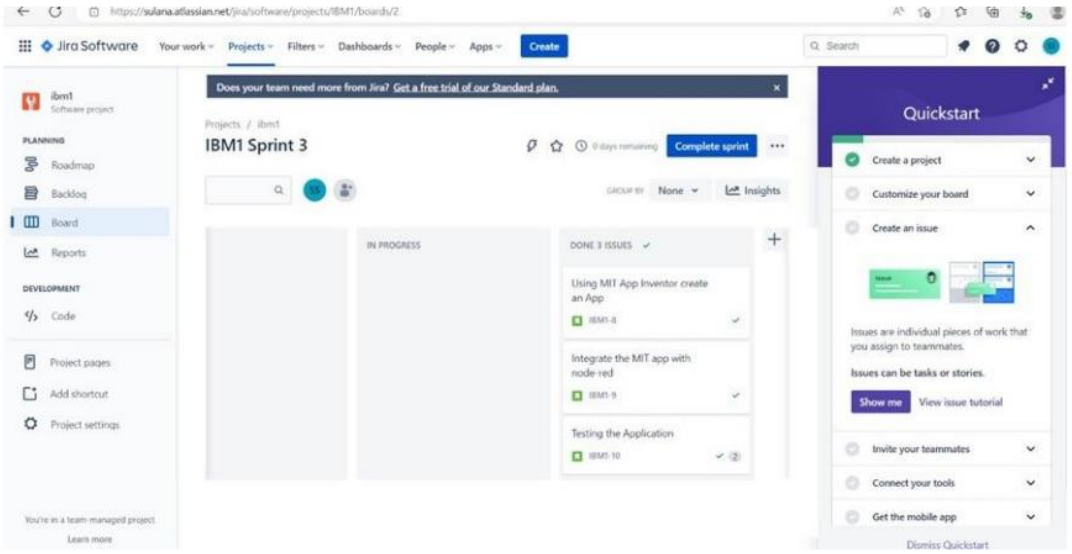
A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



6.3 Reports from JIRA

Sprint - 4 :

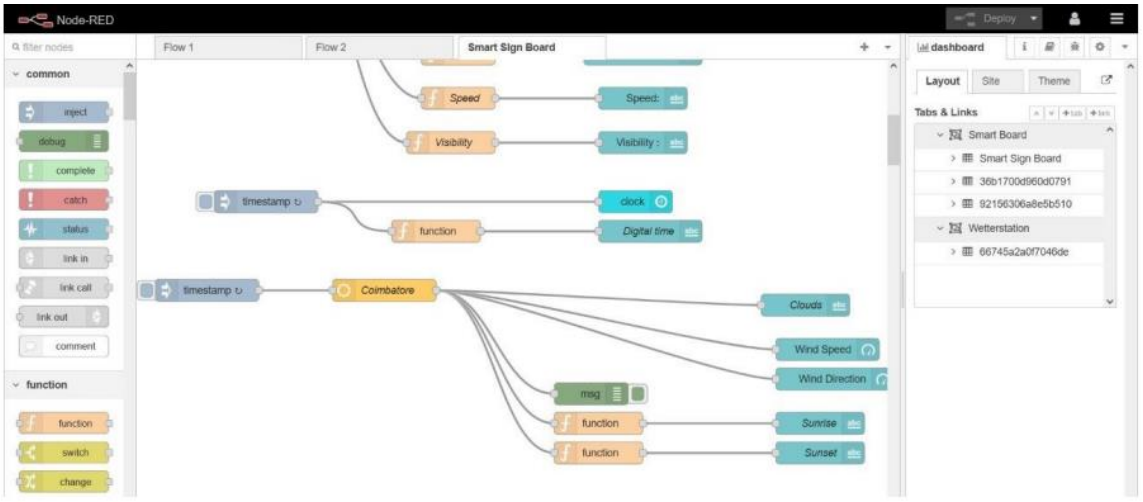




7. Coding and Solutioning

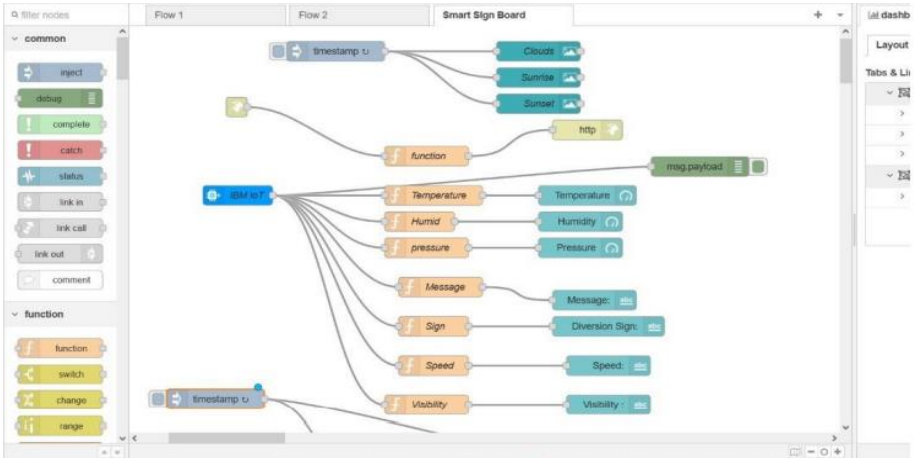
7.1 Feature 1

GET WEATHER DETAILS FOR GIVEN LOCATION



7.2 Feature 2

GET SPEED LIMITATIONS, MESSAGES, SIGNS



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 & divertion 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

9.1Performance 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 a 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-23733-1659922281

Project Demonstration Link : https://vimeo.com/772696082