SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

PROJECT REPORT

IBM NALAIYA THIRAN

Submitted By

TEAM ID: PNT2022TMID40472

TEAM MEMBERS:

Team Leader	**:**	**VINOTH E**
Team member 1	**:**	**HARIHARAN C**
Team member 2	**:**	**THIYAGU E**
Team member 3	**:**	**LOGESHVARAN T**

In partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

In

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

University College of Engineering Kancheepuram

(Village and Post, NH 4, Bengaluru - Chennai Hwy, Ponnerikkarai, Karaipettai, Tamil Nadu 631552)

NOVEMBER 2022

INDEX

1. INTRODUCTION

1.1Project Overview:

Connected vehicle technology aim to solve some of the biggest challenges in the transportation in the areas of safety, mobility and environment. The safety application for Intelligent Transport System(ITS) is one of the main objectives in this project. Safety application is research and industrial initiative which aim to contribute to the global advancement of automobile industry. In this project we focus on V2V communication, once cars are connected which is able to share data with other cars on the road and which help to reduce Highway accidents. Ultimately, vehicles are connect via multiple complementary technologies of vehicle to-vehicle (V2V) and vehicle-to-infrastructure (V2I) connectivity based on Wi-Fi, GPS, Dedicated Short Range Communication (DSRC).

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.
- Based on the traffc and fatal situations the diversion signs are displayed.
- Guide(Schools), Warning and Service(Hospitals, Restaurant) signs are also displayed accordingly.
- *Different modes of operations can be selected with the help of buttons.*

2. LITERATURE SURVEY:

2.1 Existing problem:

One of the main causes of accidents in sensitive public areas like schools, colleges, hospitals, etc. and sharp turning points in the over speed of vehicles avoiding the speed limit indicated in the traffic sign board. Road accidents have now become a national catastrophe for overpopulated developing countries. By not reducing their vehicle speed in these delicate public areas, drivers put the lives of passengers, pedestrians, and other drivers at danger. The suggested system's primary goal is to run the vehicles at a safe speed in vital areas while reducing the potential danger of unintentional accidents and casualties. This project establishes a mechanism to notify drivers of speed limitations in particular locations and to slow down vehicles in sensitive public areas.

2.2 References:

1. [2] J. Kotus, A. Czyżewski, Counting and tracking vehicles using acoustic vector sensors, 176th Meeting of the Acoustical Society of America and 2018 Acoustics Week in Canada, Victoria, Canada.

DESCRIPTION:

A method is presented for counting vehicles and for determining their movement direction by means of acoustic vector sensor application. The assumptions of the method employing spatial distribution of sound intensity determined with the help of an integrated 3D intensity probe are discussed. The intensity probe developed by the authors was used for the experiments. The mode of operation of the algorithm is presented in conjunction with noise characteristics produced by moving vehicles. The optimization of the algorithm is based on measurements of intensity of sound emitted by the vehicle under controlled conditions. A test setup was built for this purpose with the use of measuring devices installed along a road with varying traffic flow. Reference data on the number of vehicles and traffic directions were prepared employing a recorded video and a reference traffic analyzer operating in lidar technology. It is shown that the developed acoustic method may contribute to an increase of effectiveness of commonly used vehicle counting systems employing inductive loops or Doppler radars. [Project financed by the by the Polish National Centre for Research and Development (NCBR) from the European Regional Development Fund under the Operational Programme Innovative Economy No. POIR.04.01.04-00-0089/16 “INZNAK —Intelligent road signs...”.]

2. K. Marciniuk, M. Blaszke, B. Kostek, Acoustic Road Monitoring, 12th International Road Safety Conference GAMBIT 2018 Road Innovations for Safety National and regional perspective, Gdańsk,

DESCRIPTION:

The subject of this research is showing the performance of an automatic acoustic road monitoring system proposed by the authors. The main goal of the study is describing road traffic by means of an acoustic representation and testing effectiveness of traffic flow sensors. Evaluation metrics of the road conditions such as velocity of the traffic flow, its structure and weather condition are presented along with acoustic descriptors derived from the audio signal analysis. Accuracy of emergency vehicles pass by detection based on acoustic monitoring is also briefly described

3 .van Flandern, T. C.; Pulkkinen, K. F. Low-precision formulas for planetary positions, Astrophysical Journal Supplement Series, vol. 41

DESCRIPTION:

Numerous modern applications have created a demand for lowprecision (1 arc min) formulas for the positions of the sun, moon, and planets. With the power of a computerized formula manipulator which can handle algebraic and trigonometric expressions, the development of simple expressions for coordinates and elements from the existing analytic theories is now feasible. The paper presents the results of such developments in a form suitable for use with hand calculators, minicomputers, or microprocessors. The outputs are always in the form of series. The series are also available on punched cards or in the form of FORTRAN subroutines. The full-precision (1 arc sec or better) formulas with unlimited time validity are being developed. Several tables are included

4. Muhammed O. Sayin; Chung-Wei Lin; Eunsuk Kang; Shinichi Shiraishi; Tamer Başar

DESCRIPTION:

A game theoretical adversarial intervention detection mechanism for reliable smart road signs. A future trend in intelligent transportation systems is “smart road signs” that incorporate smart codes (e.g., visible at infrared) on their surface to provide more detailed information to smart vehicles. Such smart codes make road sign classification problem aligned with communication settings more than conventional classifcation. This enables us to integrate well-established results in communication theory, e.g., error-correction methods, into road sign classifcation problem. Recently, vision-based road sign classifcation algorithms have been shown to be vulnerable against (even) small scale adversarial interventions that are imperceptible for humans. On the other hand, smart codes constructed via error-correction methods can lead to robustness against small scale intelligent or random perturbations on them. In the recognition of smart road signs, however, humans are out of the loop since they cannot see or interpret them. Therefore, there is no equivalent concept of imperceptible perturbations in order to achieve a comparable performance with humans. Robustness against small scale perturbations would not be sufcient since the attacker can attack more aggressively without such a constraint. Under a game theoretical solution concept, we seek to ensure certain measure of guarantees against even the worst case (intelligent) attackers that can perturb the signal even at large scale. We provide a randomized detection strategy based on the distance between the decoder output and the received input, i.e., error rate.Finally, we examine the performance of the proposed scheme over various scenarios.

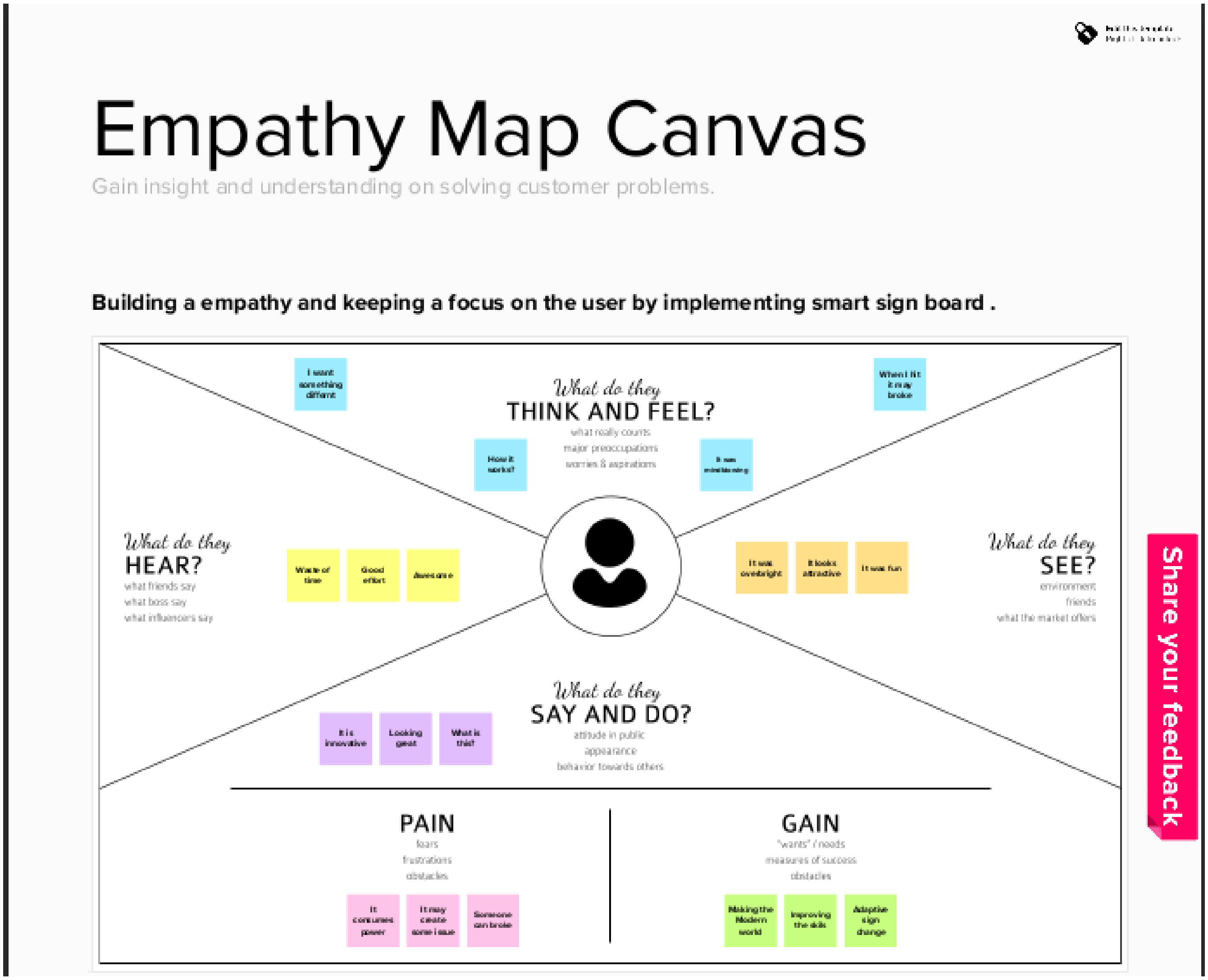
2.3 Problem Statement Defnition

Problem Statement (PS)	**I am (Customer)**	**I'm trying to**	**But**	**Because**	**Which makes me feel**
PS-1	A tourist	Explore the place	I don't know about the place	There is no proper sign boards	confused
PS-2	A driver	Deliver the product on tme	I can't able to make it on tme	There is a heavy trafc	frustrated
PS-3	people	Cross the road on zebra crossing	Occurred more accidents	Not following the trafc rules	Fear

PS-4	Passengers	To reach the destnaton	Delay to reach the destnaton	Trafc is too heavy to move on	My precious tme was wasted

3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



Empathy Map Canvas

Gain insight and understanding on solving customer problems.

Building a empathy and keeping a focus on the user by implementing smart sign board .

What do they THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations

I want something differnt

When I hit it may broke

How it works?

It was mindblowing

What do they HEAR?
what friends say
what boss say
what influencers say

Waste of time

Good effort

Awesome

What do they SEE?
environment
friends
what the market offers

It was overbright

It looks attractive

It was fun

What do they SAY AND DO?
attitude in public
appearance
behavior towards others

It is innovative

Looking great

What is this?

PAIN
fears
frustrations
obstacles

It consumes power

It may create some issue

Someone can broke

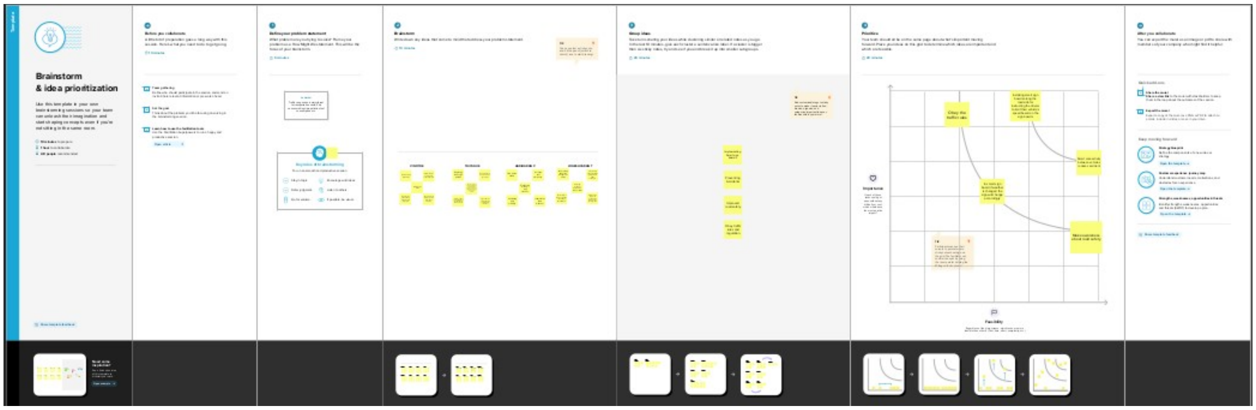
GAIN
"wants" / needs
measures of success
obstacles

Making the Modern world

Improving the skils

Adaptive sign change

3.2 Ideation & Brainstorming

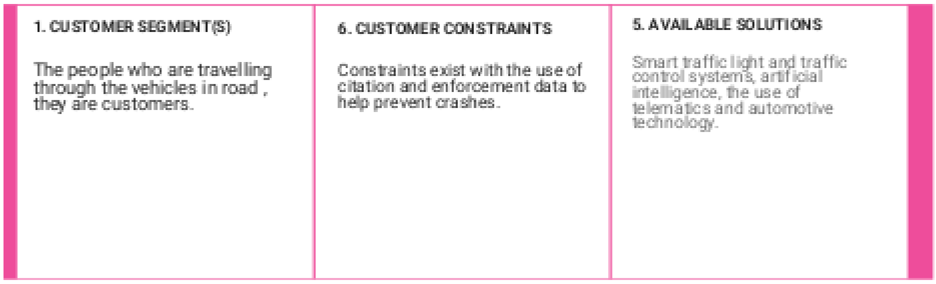


3.3 Proposed Solution

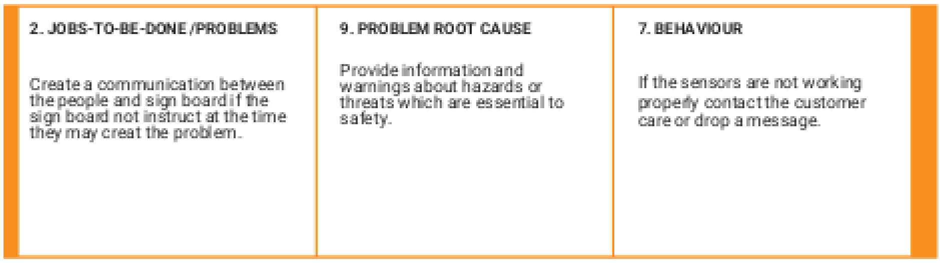
S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To prevent and reduce the number of road related accidents and improve road safety.
2.	Idea / Solution description	Replace static sign boards and Make Smart Travel.
3.	Novelty / Uniqueness	Create a undeviating communication between the people and sign board
4.	Social Impact / Customer Satisfaction	• Accident less environment • Fell easy and people being more aware.
5.	Business Model	Fee-for-service model

6.	Scalability of the Solution	As Heavy Traffics drive our idea rise

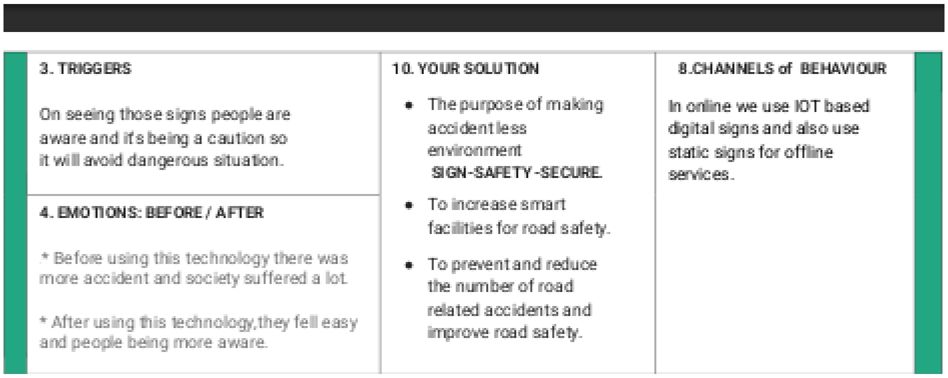
3.3 Problem solution Fit:



1. CUSTOMER SEGMENT(S)	6. CUSTOMER CONSTRAINTS	5. AVAILABLE SOLUTIONS
The people who are travelling through the vehicles in road , they are customers.	Constraints exist with the use of citation and enforcement data to help prevent crashes.	Smart traffic light and traffic control systems, artificial intelligence, the use of telematics and automotive technology.



2. JOBS-TO-BE-DONE /PROBLEMS	9. PROBLEM ROOT CAUSE	7. BEHAVIOUR
Create a communication between the people and sign board if the sign board not instruct at the time they may creat the problem.	Provide information and warnings about hazards or threats which are essential to safety.	If the sensors are not working properly contact the customer care or drop a message.



3. TRIGGERS	10. YOUR SOLUTION	8.CHANNELS of BEHAVIOUR
On seeing those signs people are aware and it's being a caution so it will avoid dangerous situation.	• The purpose of making accident less environment SIGN-SAFETY-SECURE. • To increase smart facilities for road safety. • To prevent and reduce the number of road related accidents and improve road safety.	In online we use IOT based digital signs and also use static signs for offline services.
4. EMOTIONS: BEFORE / AFTER * Before using this technology there was more accident and society suffered a lot. * After using this technology,they fell easy and people being more aware.		

4. REQUIREMENT ANALYSIS

4.1 Funtional Requirement:

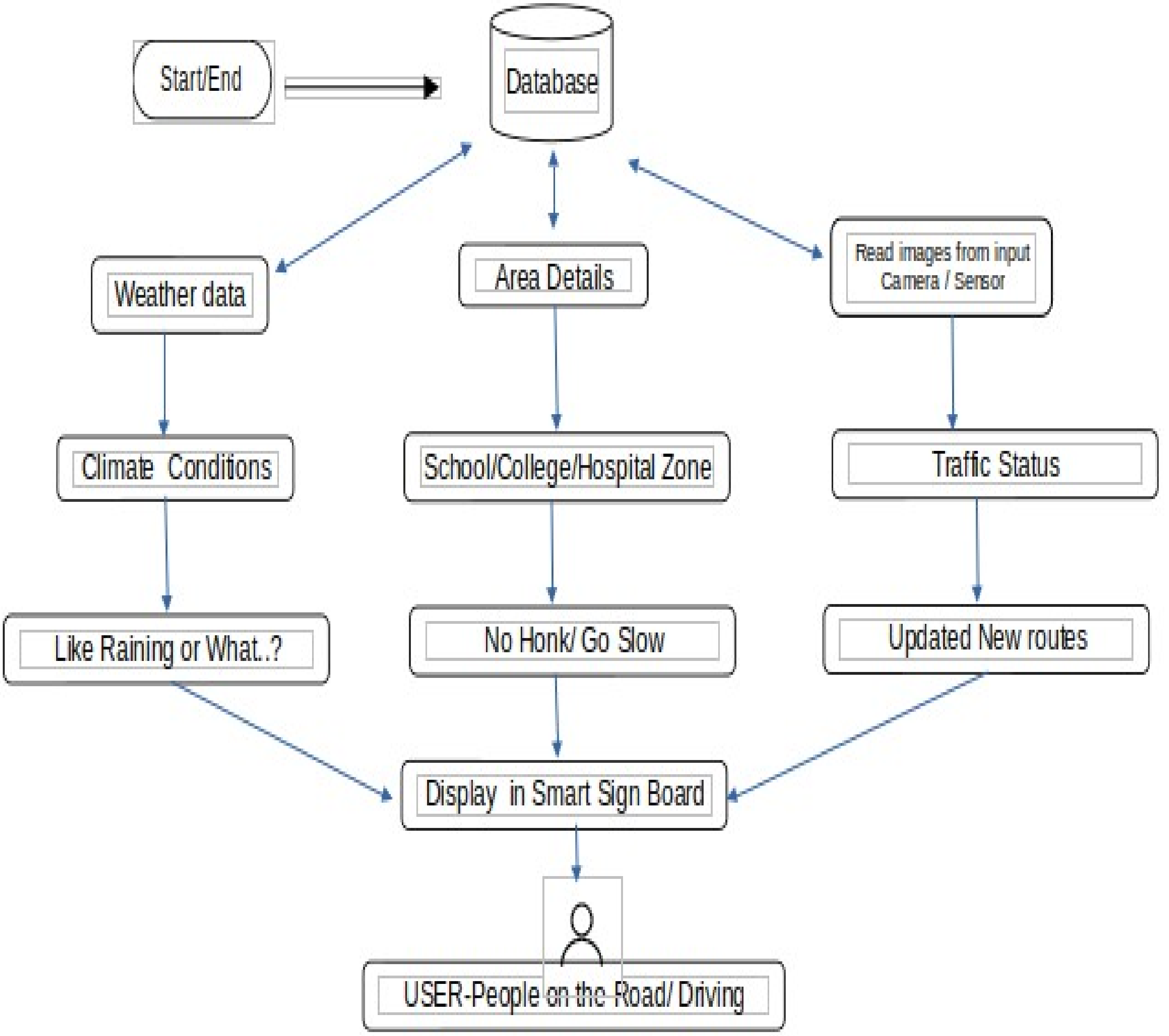
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Requirements	Static signboards will be replaced with smart linked sign boards that meet all criteria.
FR-2	User Visibility	Sign Board will have and clear and interactive UI so that it will be clearly visible to all the userr.
FR-3	User Registration	User Registration can be done through a Website
FR-4	Product Delivery and installation	The installation will be depend upon the length of the road.
FR-5	Product Feedback	Will be shared through a website via Gmail

4.2 Non-functional Requirements:

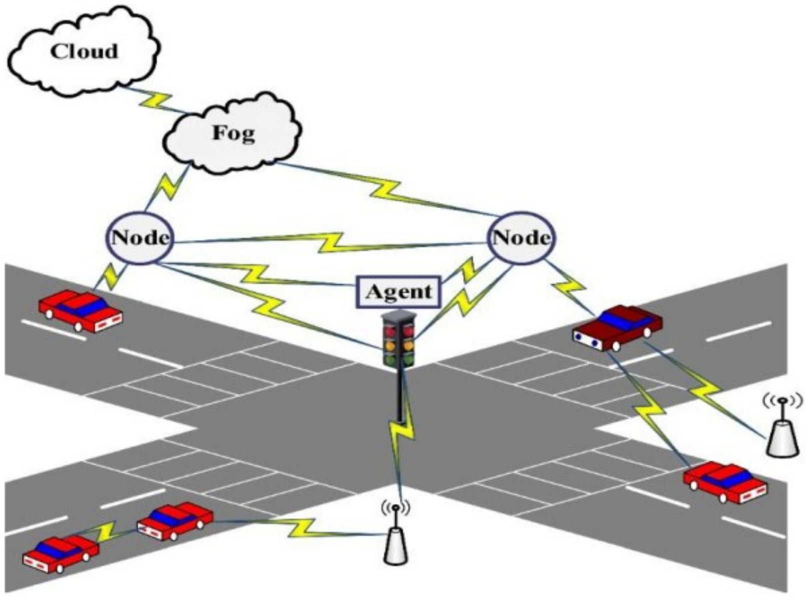
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Multiple sign display will automatic and dynamically changeable. No need for manual operations.
NFR-2	**Security**	Cloud data must be contained within the network, so there is no chance of security susceptibility.
NFR-3	**Reliability**	More reliable than the existing system.
NFR-4	**Performance**	Acceptable performance with dynamic updation of data regarding weather, traffic, etc..
NFR-5	**Availability**	All the time 24/7 avalialbe
NFR-6	**Scalability**	The product is based on road safety and reduces the traffic so our product Scalability is high.

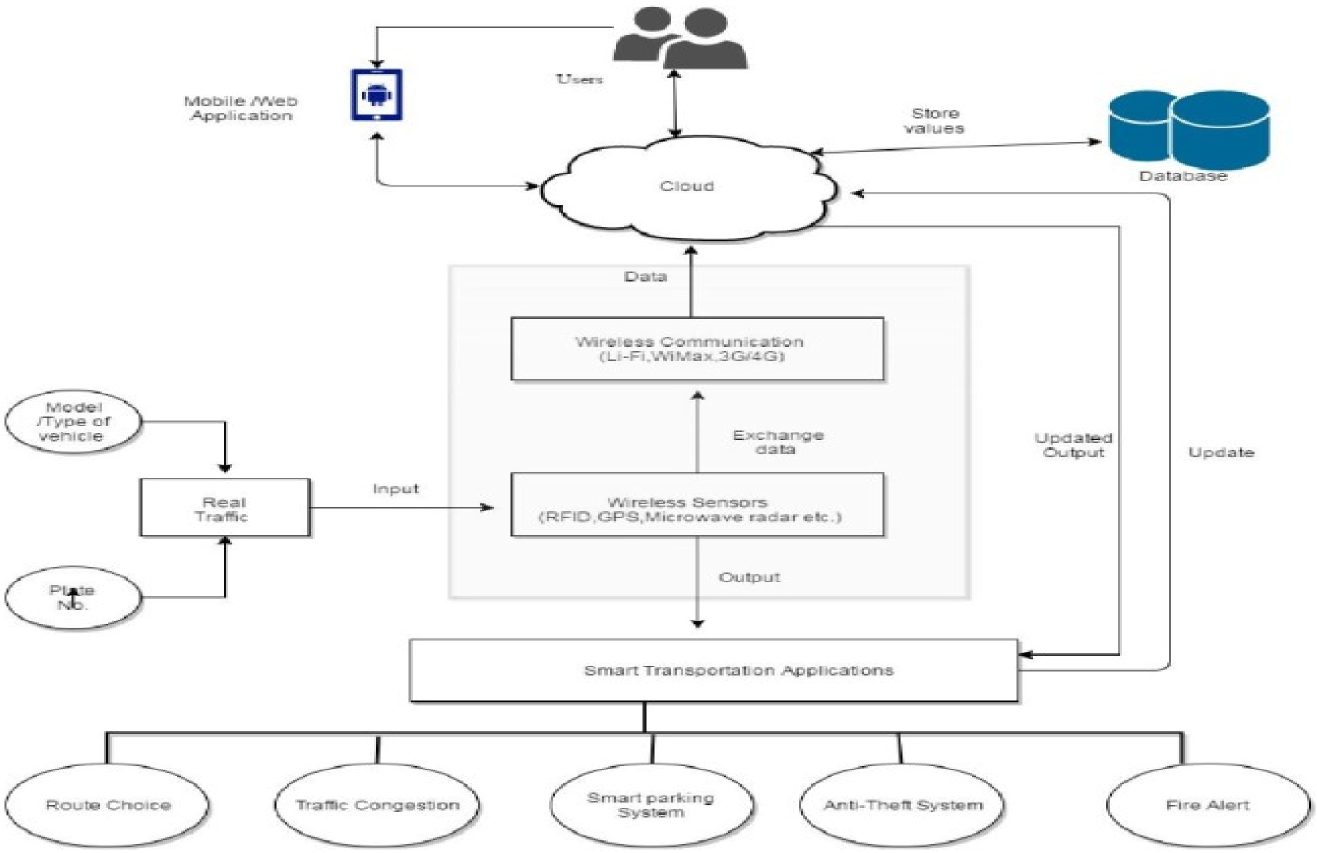
5.PROJECT DESIGN

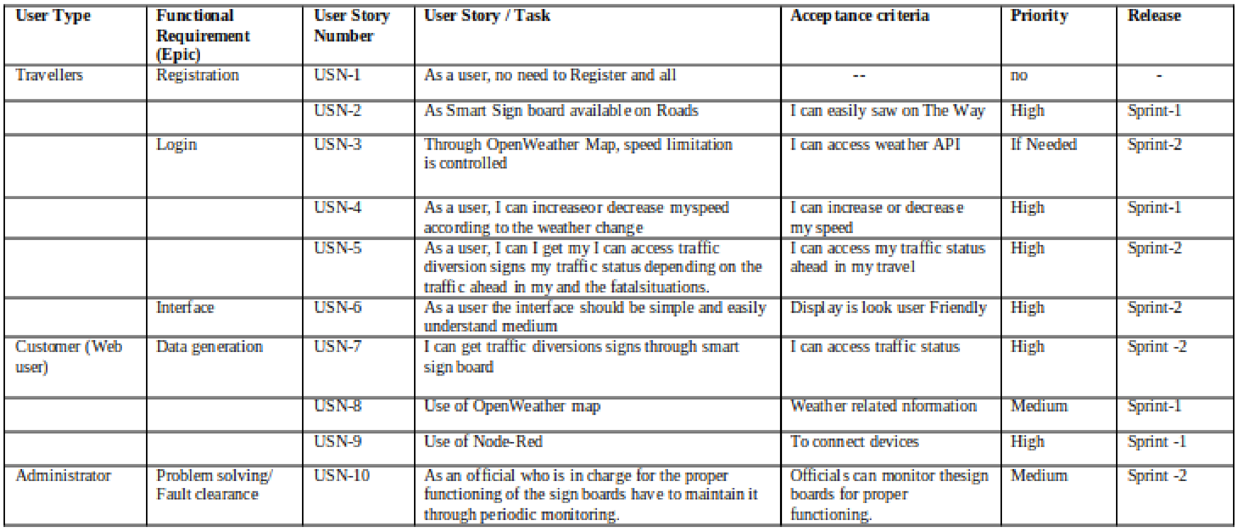
5.1Data Flow Diagrams:



5.2 Solution & Technical Architecture:





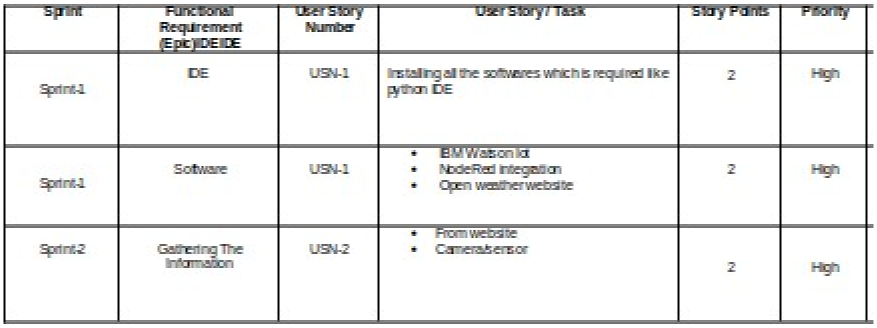


User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Travellers	Registration	USN-1	As a user, no need to Register and all	--	no	-
		USN-2	As Smart Sign board available on Roads	I can easily saw on The Way	High	Sprint-1
	Login	USN-3	Through OpenWeather Map, speed limitation is controlled	I can access weather API	If Needed	Sprint-2
		USN-4	As a user, I can increaseor decrease myspeed according to the weather change	I can increase or decrease my speed	High	Sprint-1
		USN-5	As a user, I can I get my I can access traffic diversion signs my traffic status depending on the traffic ahead in my and the fatalsituations.	I can access my traffic status ahead in my travel	High	Sprint-2
	Interface	USN-6	As a user the interface should be simple and easily understand medium	Display is look user Friendly	High	Sprint-2
Customer (Web user)	Data generation	USN-7	I can get traffic diversions signs through smart sign board	I can access traffic status	High	Sprint -2
		USN-8	Use of OpenWeather map	Weather related nformation	Medium	Sprint-1
		USN-9	Use of Node-Red	To connect devices	High	Sprint -1
Administrator	Problem solving/ Fault clearance	USN-10	As an official who is in charge for the proper functioning of the sign boards have to maintain it through periodic monitoring.	Officials can monitor thesign boards for proper functioning.	Medium	Sprint -2

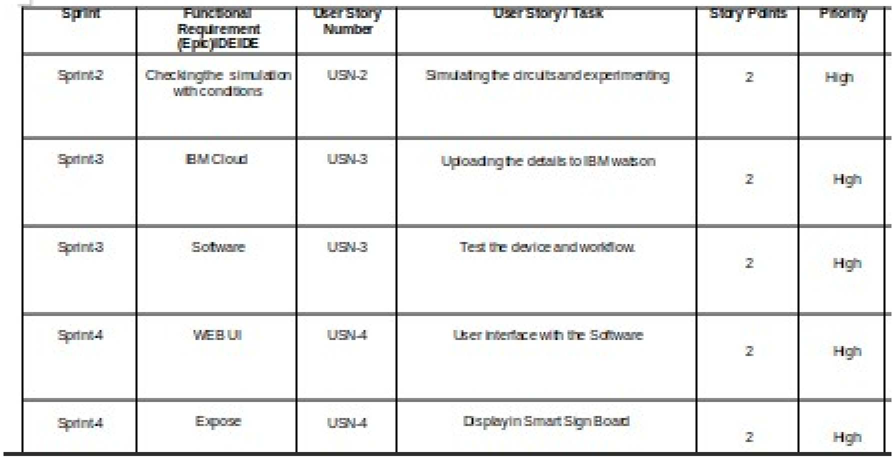
5.3 User Stories:

6. PROJECT PLANNING & SCHEDULING:

6.1 Sprint Planning & Estimation:

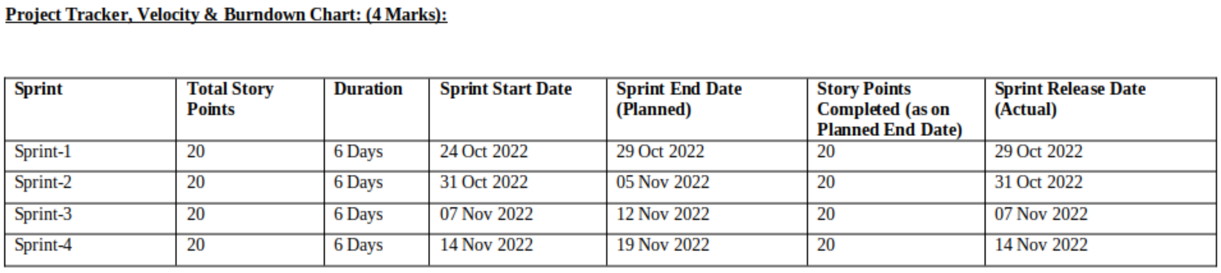


Sprint	Functional Requirement (Epic)IDEIDE	User Story Number	User Story / Task	Story Points	Priority
Sprint-1	IDE	USN-1	Installing all the softwares which is required like python IDE	2	High
Sprint-1	Software	USN-1	• IBM Watson Iot • NodeRed integration • Open weather website	2	High
Sprint-2	Gathering The Information	USN-2	• From website • Camera/sensor	2	High



Sprint	Functional Requirement (Epic)IDEIDE	User Story Number	User Story / Task	Story Points	Priority
Sprint-2	Checkingthe simulation with conditions	USN-2	Simulating the circuitsand experimenting	2	High
Sprint-3	IBM Cloud	USN-3	Uploading the details to IBM watson	2	High
Sprint-3	Software	USN-3	Test the device and workflow.	2	High
Sprint-4	WEB UI	USN-4	User interface with the Software	2	High
Sprint-4	Expose	USN-4	Displayin Smart Sign Board	2	High

6.2 Sprint Delivery Schedule:



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

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	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

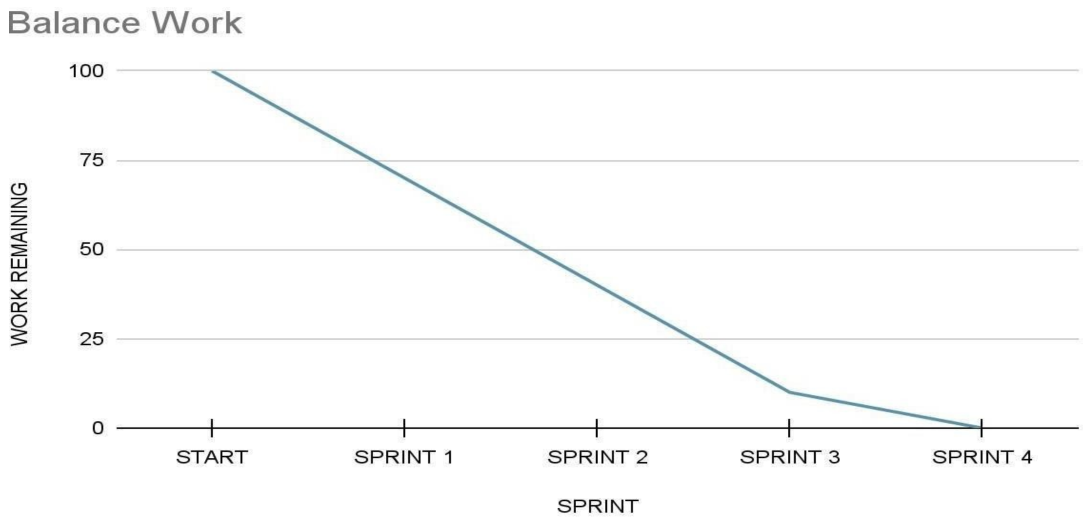
Velocity:

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)

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

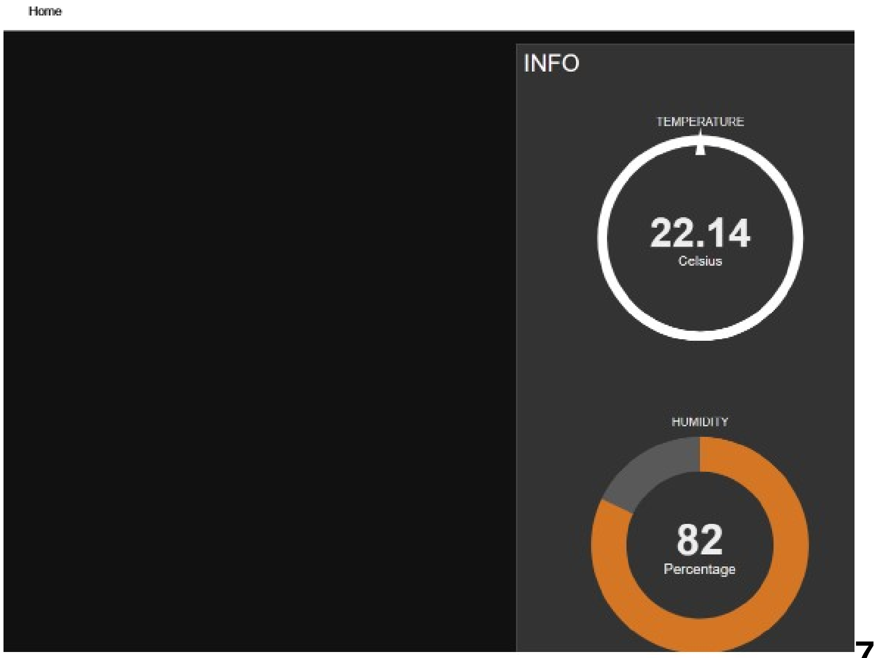
6.33 Rwports from JIRA:

Burndown Chart:



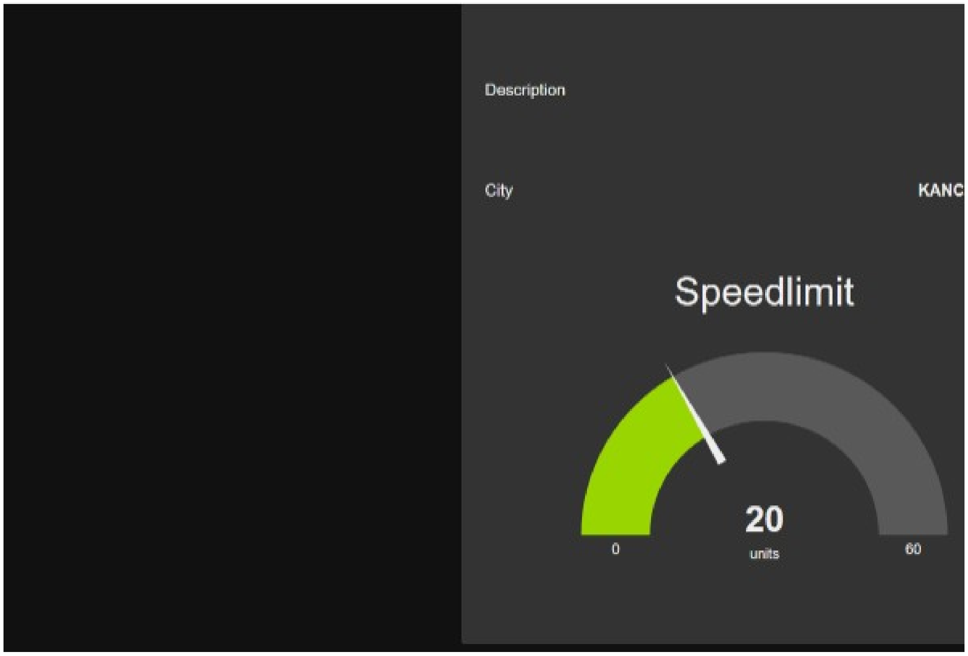
7.CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1:



7.1

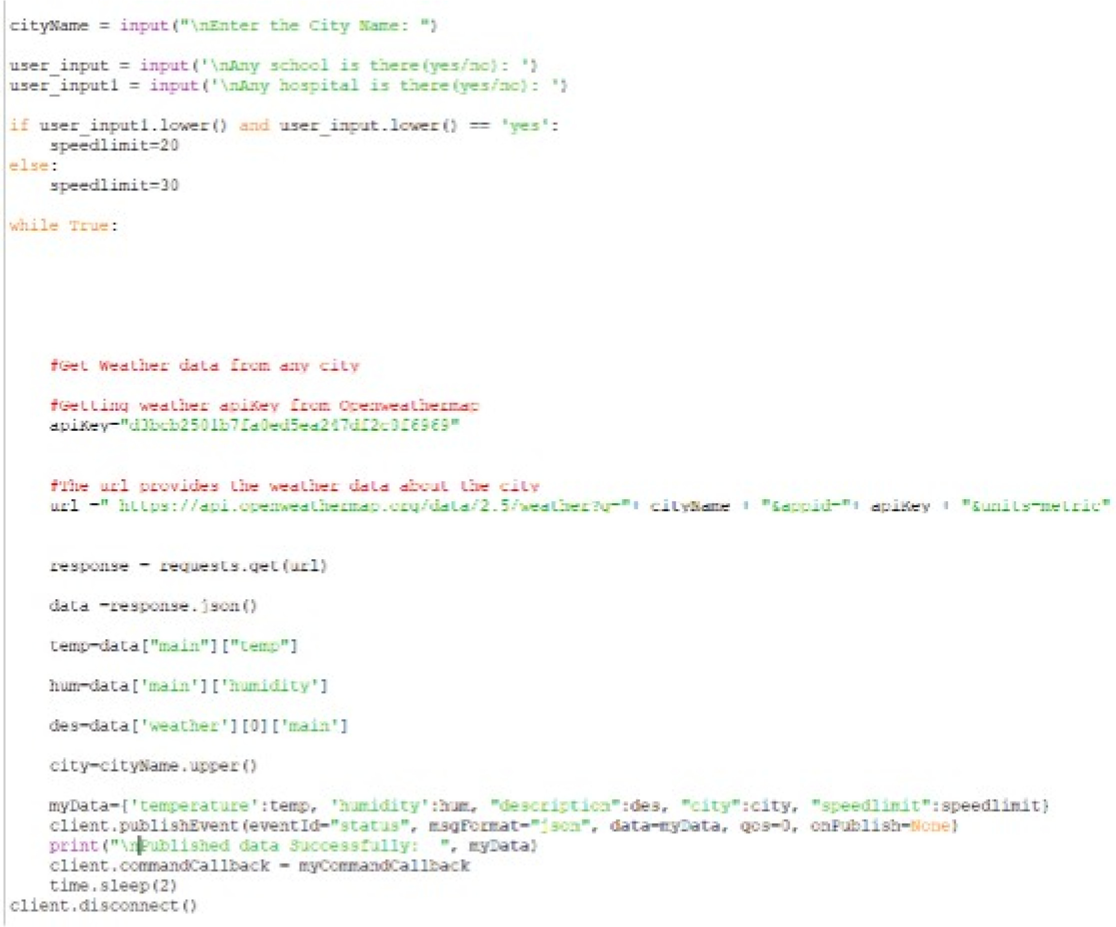
Feature 2:


Description

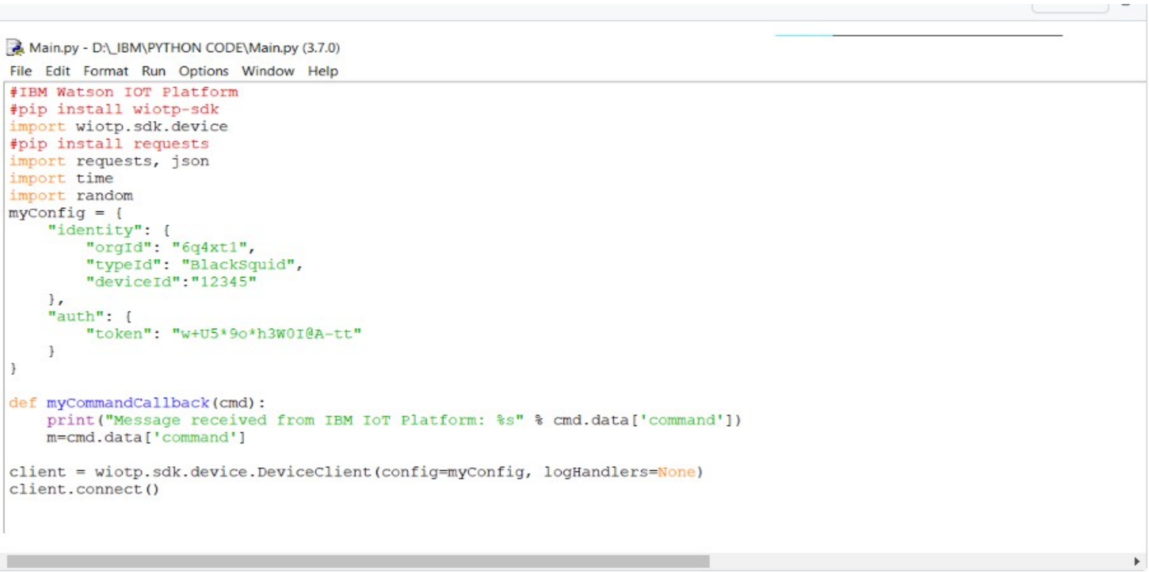
City KANC

8. TESTING:

8.1. Testing case



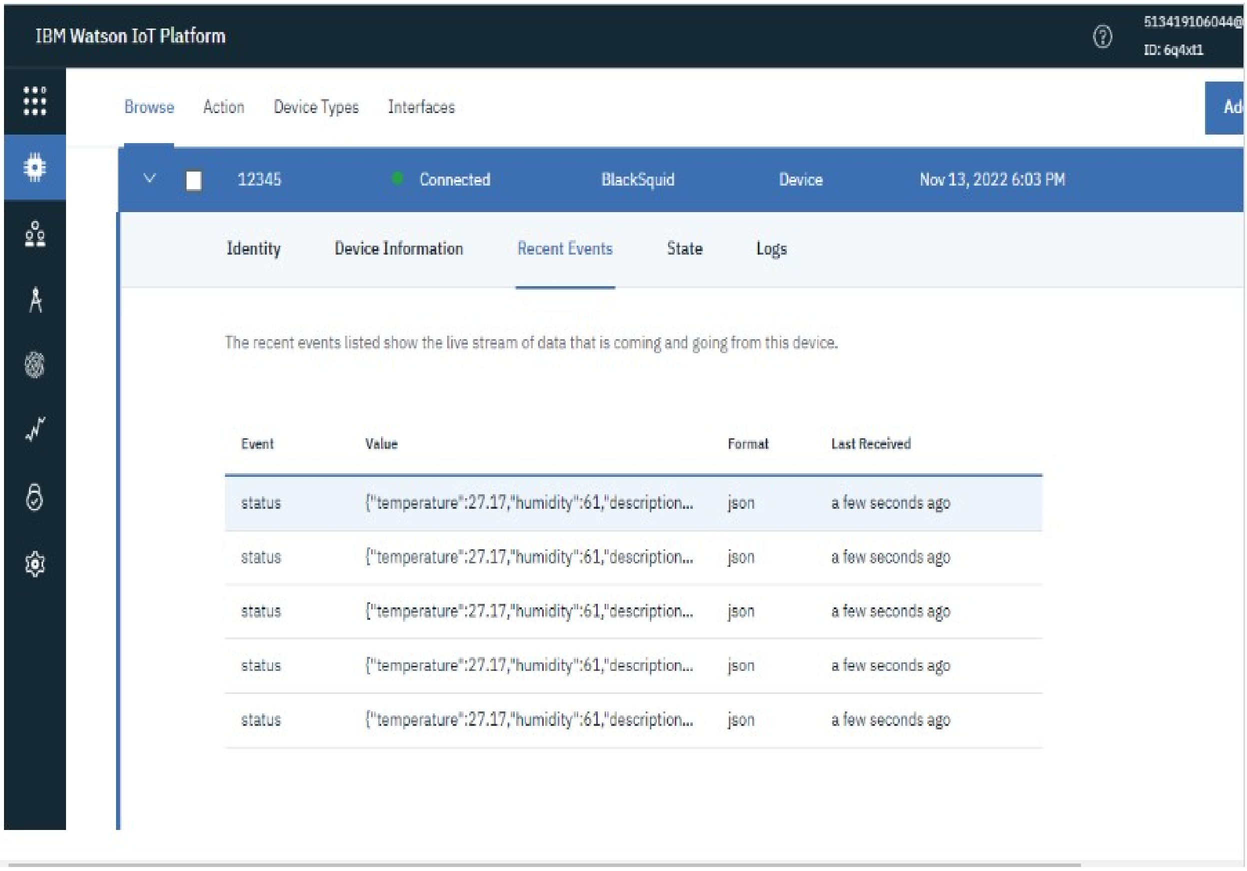
```
cityName = input("\nEnter the City Name: ")

user_input = input('\nAny school is there(yes/no): ')
user_input1 = input('\nAny hospital is there(yes/no): ')

if user_input1.lower() and user_input.lower() == 'yes':
    speedlimit=20
else:
    speedlimit=30

while True:




    #Get Weather data from any city

    #Getting weather apiKey from Openweathermap
    apiKey="d3bcb2501b7fa0ed5ea247df2c0f6969"


    #The url provides the weather data about the city
    url =" https://api.openweathermap.org/data/2.5/weather?q="+ cityName + "&appid="+ apiKey + "&units=metric"


    response = requests.get(url)

    data =response.json()

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

    hum=data['main']['humidity']

    des=data['weather'][0]['main']

    city=cityName.upper()

    myData={'temperature':temp, 'humidity':hum, "description":des, "city":city, "speedlimit":speedlimit}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("\nPublished data Successfully:  ", myData)
    client.commandCallback = myCommandCallback
    time.sleep(2)
client.disconnect()
```



Main.py - D:_IBM\PYTHON CODE\Main.py (3.7.0)

```
#IBM Watson IOT Platform
#pip install wiotp-sdk
import wiotp.sdk.device
#pip install requests
import requests, json
import time
import random
myConfig = {
    "identity": {
        "orgId": "6q4xt1",
        "typeId": "BlackSquid",
        "deviceId":"12345"
    },
    "auth": {
        "token": "w+U5*9o*h3W0I@A-tt"
    }
}

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()
```

8.2 User Acceptance:



12345 Connected BlackSquid Device Nov 13, 2022 6:03 PM

The recent events listed show the live stream of data that is coming and going from this device.

Event	Value	Format	Last Received
status	{"temperature":27.17,"humidity":61,"description...	json	a few seconds ago
status	{"temperature":27.17,"humidity":61,"description...	json	a few seconds ago
status	{"temperature":27.17,"humidity":61,"description...	json	a few seconds ago
status	{"temperature":27.17,"humidity":61,"description...	json	a few seconds ago
status	{"temperature":27.17,"humidity":61,"description...	json	a few seconds ago

9. RESULTS:

- We have presented a system, to alert the driver about the speed limits in specific areas and reduce the speed of the vehicles in sensitive public zones without any interference of the drivers where controls are taken automatically by the use of a wireless local area network.

- In the initial phase, we designed the basic block and circuit diagram for the system.

- In the implementation phase, we executed the hardware with the help of IoT connecting technologies such as Blynk app. Extensive experiments conducted on IoT and other connecting technologies.

10. ADVANTAGES & DISADVANTAGES:

ADVANTAGES:

- Enable a better way for drivers to access the information.
- Smart intersection help to address increasing traffic density and improve road safety.
- Can also help cities adapt for long term sustainable tranportation needs.
- It enables you to control traffic, catch lawbreakers, and provide road safety.
- Fullfls duty by enabling the smooth movement of vehicles.

DISADVANTAGES:

- May give faulty results.
- Not the best option for long distance.
- Not practical for all roads.

11.CONCLUSION:

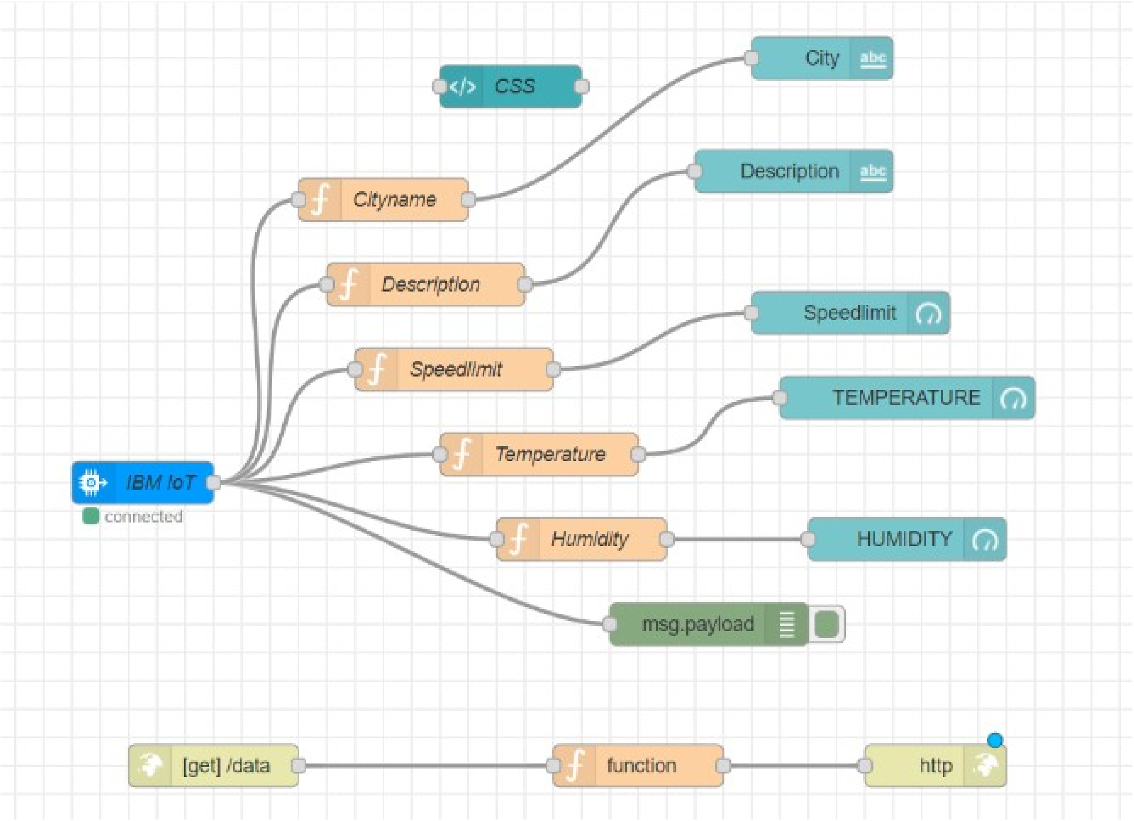
This work illustrates the viability of an economic road safety monitoring and assessment solution through exploiting advances in the Internet of Things (IoT) within the context of smart cities. The introduced architecture facilitates robust and dynamic road safety assessment that complements the Safe System approach motivated by the World Health Organization (WHO), which has been increasingly adopted worldwide. An application of the dynamic assessment framework for route planning is also demonstrated.

Future work involves exploring further applications, especially in the context of raising driver awareness of the road safety conditions during their trips.

12. FUTURE SCOPE:

- To create traffic free city
- To maintain zero accidents
- Spread all the road rules to all road users

13. APPENDIX:


CSS
City
Cityname
Description
Description
Speedlimit
Speedlimit
TEMPERATURE
Temperature
IBM IoT
connected
Humidity
HUMIDITY
msg.payload
[get] /data
function
http

SOURCE CODE

```
#IBM Watson IOT Platform
#pip install wiotp-sdk
import wiotp.sdk.device
#pip install requests
import requests, json
import time
import random
myConfig = {
    "identity": {
        "orgId": "6q4xt1",
        "typeId": "BlackSquid",
        "deviceId":"12345"
    },
    "auth": {
        "token": "w+U5*9o*h3W0I@A-tt"
    }
}

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()



cityName = input("\nEnter the City Name: ")

while True:
    #Get Weather data from any city

    #Getting weather apiKey from Openweathermap
    apiKey="d3bcb2501b7fa0ed5ea247df2c8f6969"


    #The url provides the weather data about the city
    url =" https://api.openweathermap.org/data/2.5/weather?q="+ cityName +
"&appid="+ apiKey + "&units=metric"
```

```
    response = requests.get(url)

    data =response.json()



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

    hum=data['main']['humidity']
    myData={'temperature':temp, 'humidity':hum}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully:  ", myData)
    client.commandCallback = myCommandCallback
    time.sleep(2)
client.disconnect()
```

GITHUB LINK

https://github.com/IBM-EPBL/IBM-Project-2150-1658463985

DEMO LINK:

https://vimeo.com/772823761