SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

1.INTRODUCTION

1.1 PROJECT OVERVIEW

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.

Road traffic accidents (RTA) are defined as accidents that occurred or originated on a way or street open to public traffic. These collisions result in injury or death between automobiles or humans. According to World Health Organization road safety report of 2018, the number of road traffic deaths increased to 1.35 million in 2016. According to the report, 93% of global road accidents occurred in low and middle- income countries, which accounts for 60% of the world's vehicles.

Road signs provide information to drivers to help them operate their vehicles safely. To be effective, road signs must be visible and legible at a sufficient distance to allow drivers to take appropriate actions. However, static road signs are frequently missed by drivers making it difficult for them to respond in time. Despite the presence of road signs on most highways, currently there is no information and communication technology (ICT) based system in place to alert drivers in advance and real time about the location of those road signs. As a result, drivers encounter road signs at a short distance, making them unable to take the necessary precautions in time. This could lead them to apply the brakes abruptly, an action that may cause an accident.

1.2 PURPOSE

- They improve vehicle safety by providing real-time traffic information to the driver. Road signs play an important role in road safety. Road signs

must be visible at a distance that enables drivers to take the necessary actions.

- Smart intersections help to address increasing traffic density and improve road safety. By leveraging data from infrastructure sensors, and combining and supplying those data to road users. Their perception can be improved. This aids in protecting vulnerable road users (VRUs) and acts as a crucial building block for enabling automated and autonomous driving.
- Increasing volumes of traffic are using municipal road infrastructure, with severe consequences for traffic efficiency and the safety of road users. Vulnerable road users such as pedestrians or cyclists are involved in 46% of lethal accidents.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM & 2.2 REFERENCES

1.Internet-of-Things-Based Smart Transportation Systems for Safer Roads:

Author: Mohammad Derawi, Yaser Dalveren, Faouzi Alaya Cheikh.

Date of Conference: 02-06-2020.

Conference Location: New Orleans, LA, USA .

From the beginning of civilizations, transportation has been one of the most important requirements for humans. Over the years, it has been evolved to modern transportation systems such as road, train, and air transportation. With the development of technology, intelligent transportation systems have been enriched with Information and Communications Technology (ICT). Nowadays, smart city concept that integrates ICT and Internet-of-Things (IoT) have been appeared to optimize the efficiency of city operations and services. Recently, several IoT-based smart applications for smart cities have been developed. Among these applications, smart services for transportation are highly required to ease the issues especially regarding to road safety. In this context, this study presents a literature review that elaborates the existing IoT-based smart transportation systems especially in terms of road safety. In this way, the current state of IoT-based smart transportation

systems for safer roads are provided. Then, the current research efforts undertaken by the authors to provide an IoT-based safe smart traffic system are briefly introduced. It is emphasized that road safety can be improved using Vehicle-to- Infrastructure (V2I) communication technologies via the cloud (Infrastructure-to-Cloud – I2C). Therefore, it is believed that this study offers useful information to researchers for developing safer roads in smart cities.

2.Reliable Smart Road Signs:

Author: Muhammed O. Sayin, Chung-Wei Lin, Eunsuk Kang, Shinichi Shiraishi, Tamer Basar.

Date of conference: 16 October 2019.

Conference Location: IEEE Transactions on Intelligent Transportation Systems.

In this paper, they propose 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 classification. This enables us to integrate well-established results in communication theory, e.g., error-correction methods, into road sign classification problem. Recently, vision-based road sign classification 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 sufficient since the attacker can attack more aggressively without such a constraint. Under a game theoretical solution concept, they seek to ensure certain measure of guarantees against even the worst case

(intelligent) attackers that can perturb the signal even at large scale. they provide a randomized detection strategy based on the distance between the decoder output and the received input, i.e., error rate. Finally, they examine the performance of the proposed scheme over various scenarios.

3.Smart Road Accident Detection and communication System:

Author: Nagarjuna R. Vatti,Prasanna Lakshmi Vatti, Rambabu Vatti,Chandrashekhar Garde.

Date of conference: 01 March 2018.

Conference Location:2018 International Conference on Current Trends towards Converging Technologies (ICCTCT).

In this paper they proposed that, the number of fatal and disabling road accident are increasing day by day and is a real public health challenge. Many times, in the road accidents, human lives will be lost due to delayed medical assistance. Hence road accident deaths are more prominent. There exist many accident prevention systems which can prevent the accidents to certain extent, but they do not have any facility to communicate to the relatives in case accident happens. In this paper, the authors made an attempt to develop a car accident detection and communication system which will inform the relatives, nearest hospitals and police along with the location of the accident. In the last they concluded that, Smart Road accident and communication system has been developed. Experiments have been conducted by implementing the system in a toy car. It is observed that the system is working properly. The system sends the message to the stored emergency numbers successfully when the car is collided and toppled or tilted by more than 30 degrees and if the reset button is not pressed in the stipulated time interval. Future scope: An android app can be developed for this in which instead of just receiving the co-ordinates of the location, it can be exactly pin pointed on the map. The heart rate can also be continuously monitored by the app to determine the driver's condition till the medical help arrives.

4.Telematics and Road Safety:

Author: Sivaramalingam Kirushanth, Boniface Kabaso.

Date of conference:24 July 2018.

Conference Location:2018 2nd International Conference on Telematics and Future Generation Networks (TAFGEN).

In this they proposed that, Road Safety is a major concern around the world. Telematic solutions have been available for more than a decade, and several studies have been done in the use of telematics data in road safety. However, these studies are scattered on different topics. There is a need to find the best possible ways of using telematics data for safe driving. This paper presents the review made with the aim of finding the evidence on the effective use of telematics data for road safety. Summary of the data collection devices, sensors, features, algorithms, feedback types used are discussed in this paper. In the last they conclude that, more studies on presenting effective feedback techniques are needed. An efficient way of detecting who is using the phone while driving is a challenging task to be further studied. Only a few studies on total road safety monitoring, which covered driver, vehicle, and road anomaly, has been done so far. Since there are different types of features used in each study, performing a meta-analysis is challenging task.

5.Enhancing V2V network connectivity for road safety by platoon based VANETs:

Author: Chunxiao li, Dawei he, Anran zhen, Jn sun, Xuelong hu.

Date of conference: 08 January 2017.

Conference Location:2017 IEEE International Conference on Consumer Electronics (ICCE).

In this paper they proposed that vehicular ad-hoc networks (VANETs), road services related messages are propagated by vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communications. So, the connectivity of VANETs is one key factor to ensure the successfully message dissemination. However, due to the dynamic changing topology of VANETs, the lifetime of the links between vehicles is short. Therefore, it is necessary to enhance the network connectivity for efficient message dissemination. In this paper, we propose a connectivity probability enhancing scheme by platoons, which also

has considered the minimum safety distance between adjacent vehicles. The simulation results indicate the connectivity probability is always higher than those without platoons. In this paper, they have designed a connectivity probability enhancing scheme by the platoons, which also has considered the influences of the minimum safety distance between adjacent vehicles to ensure road safety. The simulation results indicate that the network connectivity probability can be enhanced when there are platoons in a network. Besides, the minimum safety distance cannot be ignored when design the network connectivity models for avoiding crashes.

6.IoT-driven road safety system:

Author:Dasari Vishal, H. Saliq Afaque, Harsh Bhardawaj, T. K. Ramesh.

Date of Conference: 15 December 2017.

Conference Location: Mysuru, India.

Roads are integral part of human civilization. They are the nervous system of any country; hence these are being laid on hill sides and narrow ridges which is a major hazard to human life. As roads play a crucial role in our daily routine these can be modelled in a smart manner to serve us with enhanced capabilities. The architecture of IoT is comprised of an ability to make things more coherent and effective. This paper synchronizes the concept of IoT with roads to make them smart. The paper talks about using the IoT technologies, with the onset of smart cities, to reduce the risk of run off road collisions. As every vehicle is IoT enabled and connected to the internet, we have an effective technique to guide emergency service vehicles through the road within least time. This IoT system is a combination of simple cost- effective antenna technology and internet platforms which works with complete automation. These abilities will make the system to serve us with better accuracy and delicacy.

7.Smart Vehicle Connectivity for Safety Applications:

Author: Usha Devi Gandhi, Arun Singh, Arnab Mukherjee and Atul Chandak.

Date of conference: 6 February 2014.

Conference Location: 2014 International Conference on Optimization, Reliability, and Information Technology (ICROIT), India.

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 connected 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). VA NETS are also considered as one of the most important Simulator for safety of intelligent transportation systems. The use of the DSRC technologies support low latency vehicle-to-vehicle (V2V) communication. In this paper, they proposed to design Vehicle communication management protocols using vehicle-to vehicle communication to address these core issues of safety. They believe that accidents can be diminished and endured altogether utilizing V2V technology. Since installation of wireless environment at every cross point would be costly. A V2V-based methodology appears to be more reasonable for implementing. They have depicted V2V-based conventions to be specific Stop-Sign, Traffic-Light, Throughput-Enhancement and Throughput-Enhancement with Agreement conventions. They stretched out VANET test system to backing these conventions. Even though they conventions are intended for independent vehicles that utilization V2V correspondence for co-agent driving additionally they might be adjusted to a driver-caution framework for manual vehicles at roadways.

Source:

1.Google scholar.

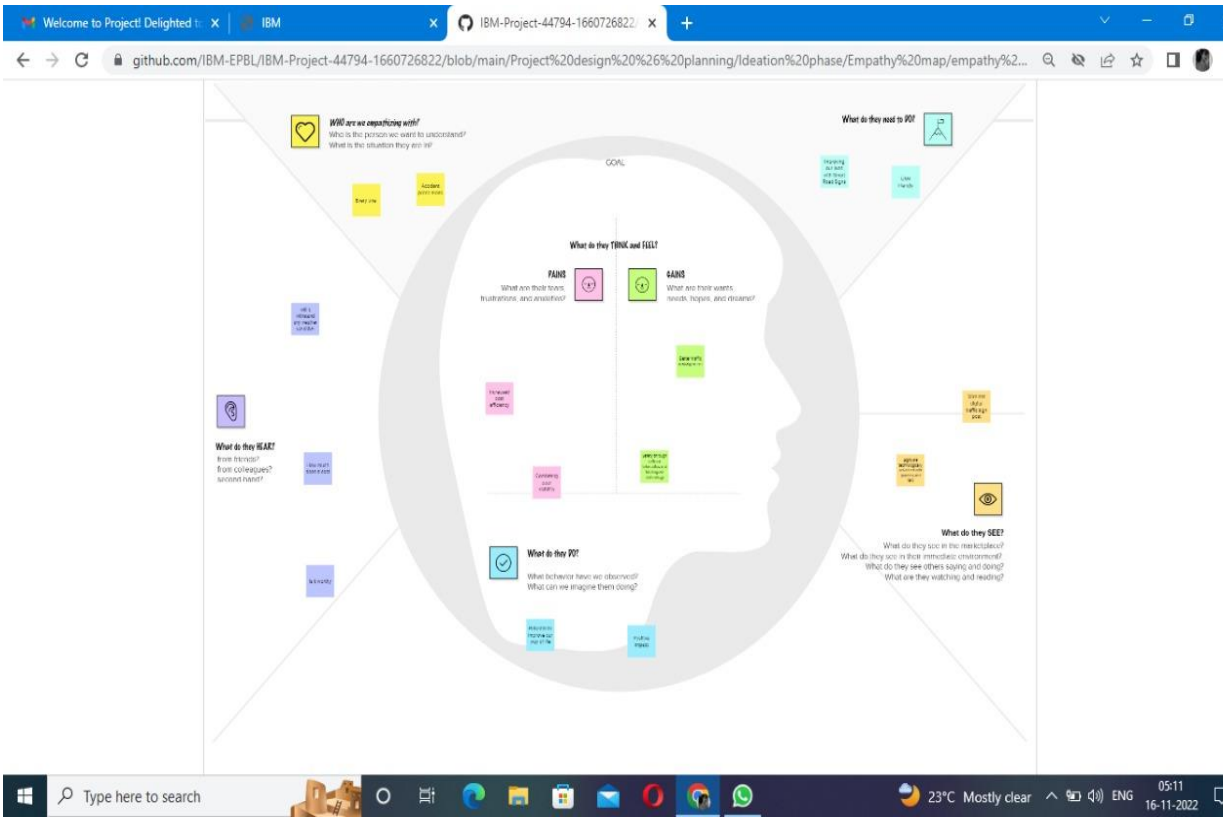
2.https://ieeexplore.ieee.org.

2.3 PROBLEM STATEMENT DEFINITION

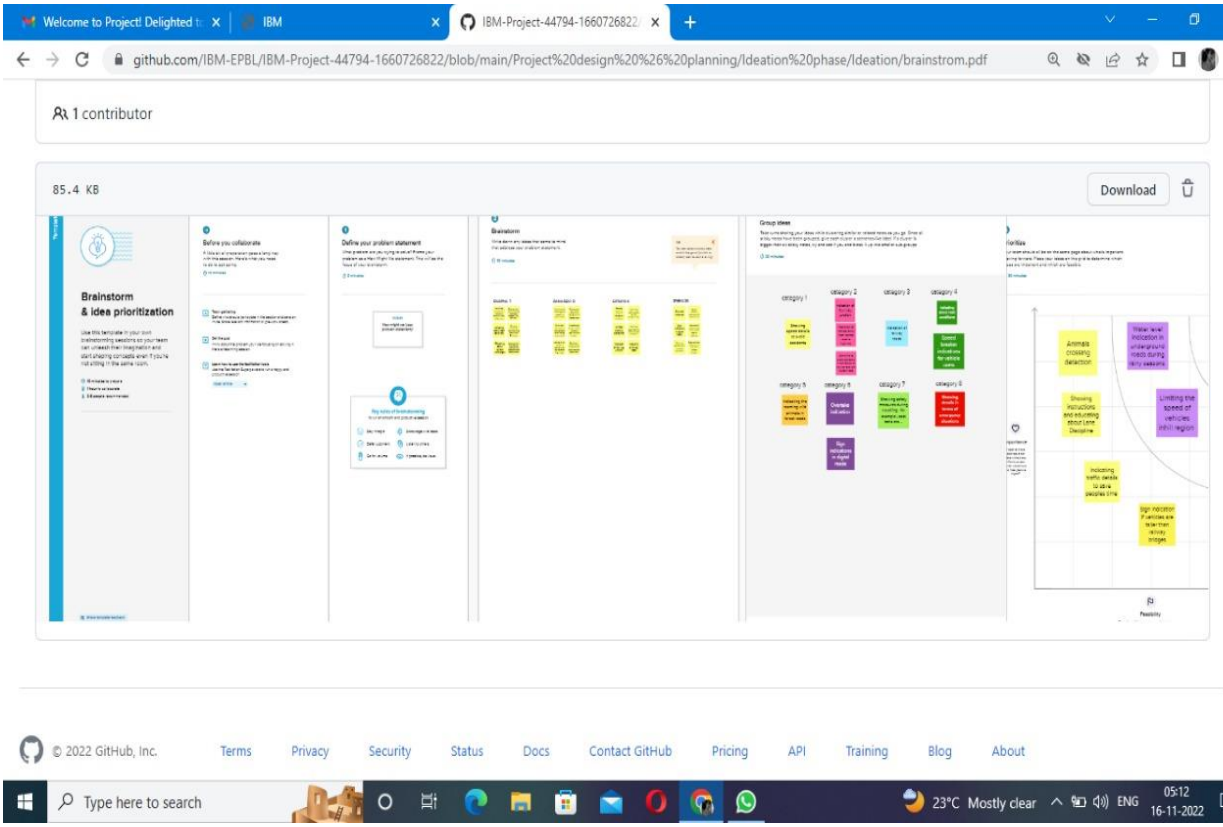
Nowadays road signs and speed limits are static, road signs and speed limits can’t be changed in some cases. If we replace static signs with dynamic signs, the signs can be changed at any time and anywhere, even we can change the signs during a sudden change in weather conditions or if any accidents happened we can change the signs & tell the people to have another route or direction. If we replace ordinary signs with smart signs a large number of happening accidents can be reduced and we can save a lot of time by reducing the traffic. Even this type of system is helpful for education and medical institutions.

3.IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAIN STROMING

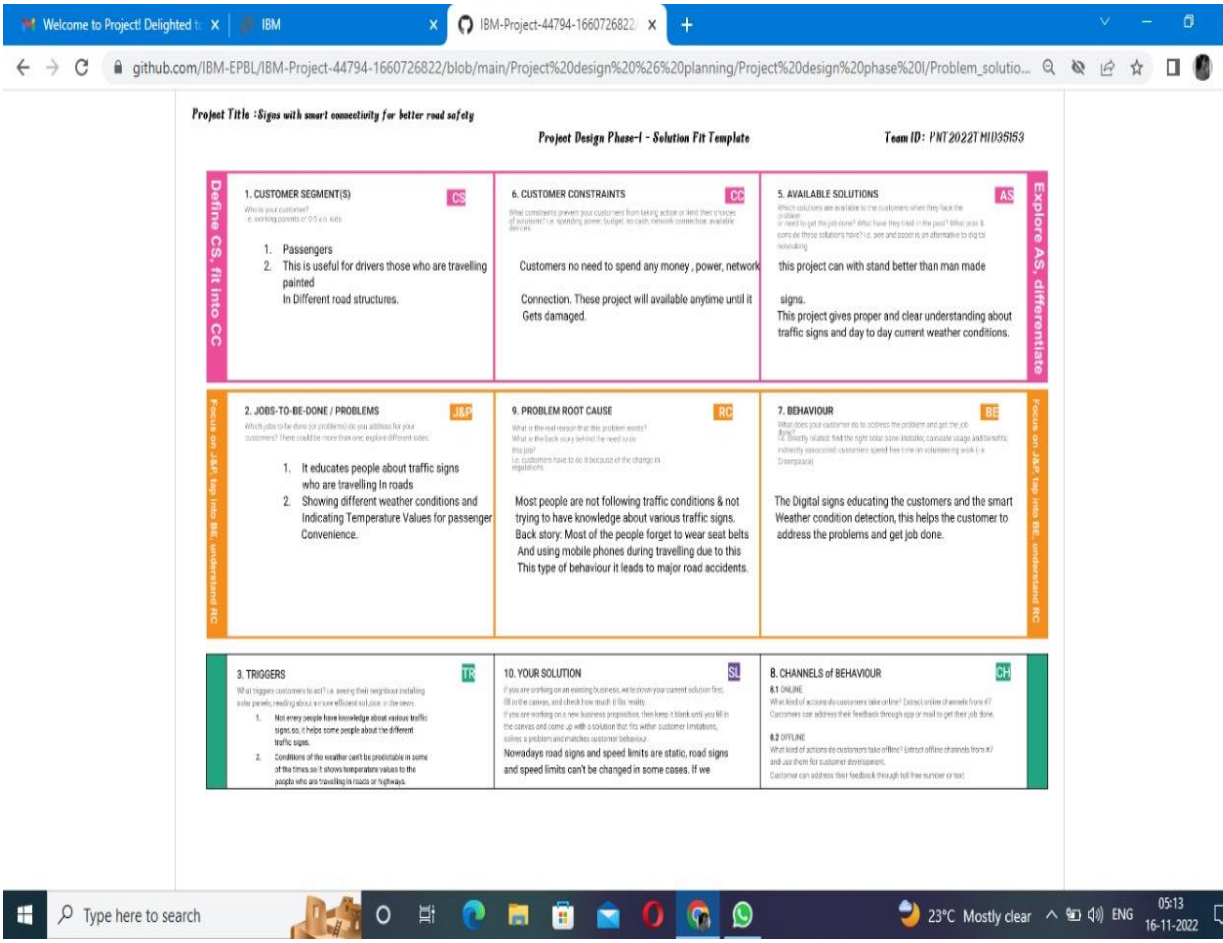


3.3 PROPOSED SOLUTION

SL.NO	PARAMETER	DESCRIPTION
1.	Problem Statement (Problem to be solved)	Project - Signs with Smart Connectivity for Better Road Safety is used to educate the drivers digitally using IOT who do not have knowledge about traffic signs and weather indication for the drivers and passengers convenience.
2.	Idea / Solution description	Replacing the man made painted signs into digital as well as their name which is more visible compared to current signs and also indicating weather in the same sign boards for

		driver where weather is not predictable.
3.	Novelty / Uniqueness	Weather indication on sign boards is unique which will help mostly the two wheelers from unfortunate heavy rains and winds. Digital traffic signs also educates the drivers to follow traffic rules easily
4.	Social Impact / Customer Satisfaction	It makes the people to know about traffic signs if they don't know, it shows signs digitally to avoid the accidents and weather indication based on IOT to avoid accidents and it helps mostly for two wheeler passengers.
5.	Business Model (Revenue Model)	This project can make revenue by selling many equipments to the government sector and also private sectors (educational &medical institutions). Maintain services are also taken by the company..
6.	Scalability of the Solution	It makes the daily life of drivers and passengers better. The product can be scalable by adding new features to the product makes more revenue.

3.4 PROBLEM SOLUTION FIT



Project Title :Signs with smart connectivity for better road safety

Project Design Phase-I - Solution Fit Template

Team ID: PNT2022TMID35153

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

1. Passengers
2. This is useful for drivers those who are travelling painted In Different road structures.

6. CUSTOMER CONSTRAINTS CC

Customers no need to spend any money , power, network Connection. These project will available anytime until it Gets damaged.

5. AVAILABLE SOLUTIONS AS

this project can with stand better than man made signs. This project gives proper and clear understanding about traffic signs and day to day current weather conditions.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

1. It educates people about traffic signs who are travelling In roads
2. Showing different weather conditions and Indicating Temperature Values for passenger Convenience.

9. PROBLEM ROOT CAUSE RC

Most people are not following traffic conditions & not trying to have knowledge about various traffic signs. Back story: Most of the people forget to wear seat belts And using mobile phones during travelling due to this This type of behaviour it leads to major road accidents.

7. BEHAVIOUR BE

The Digital signs educating the customers and the smart Weather condition detection, this helps the customer to address the problems and get job done.

Focus on J&P, tap into BE, understand RC

3. TRIGGERS TR

10. YOUR SOLUTION SL

Nowadays road signs and speed limits are static, road signs and speed limits can't be changed in some cases. If we

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE

8.2 OFFLINE

4.REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Following are the functional requirements of the proposed solution.

FR No. FR-1

- Functional Requirement (Epic) User Visibility.

FR-2

- User Understanding.
- **Sub Requirement (Story / Sub-Task)** Sign Boards should be made of bright coloured LEDs capable of attracting driver's attention Not too distracting to cause accidents Should display information through means like images/illustrations with text so that the user can understand the signs correctly Display should be big enough to display all the signs correctly so that it is visible even to far away drivers.

FR-3

- User Convenience.

4.2 NON-FUNCTIONAL REQUIREMENTS

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

FR No. NFR-1

- Non-Functional Requirement Usability
- Description Should be able to dynamically update with respect to time. Should be secure enough that only the intended messages are displayed in the display. Should convey the traffic information correctly.

NFR-2

- Security.

NFR-3

- Reliability.

NER-4

- Performance.
- Display should update dynamically whenever the weather or traffic values are updated Should be on service 24/7.

NFR-5

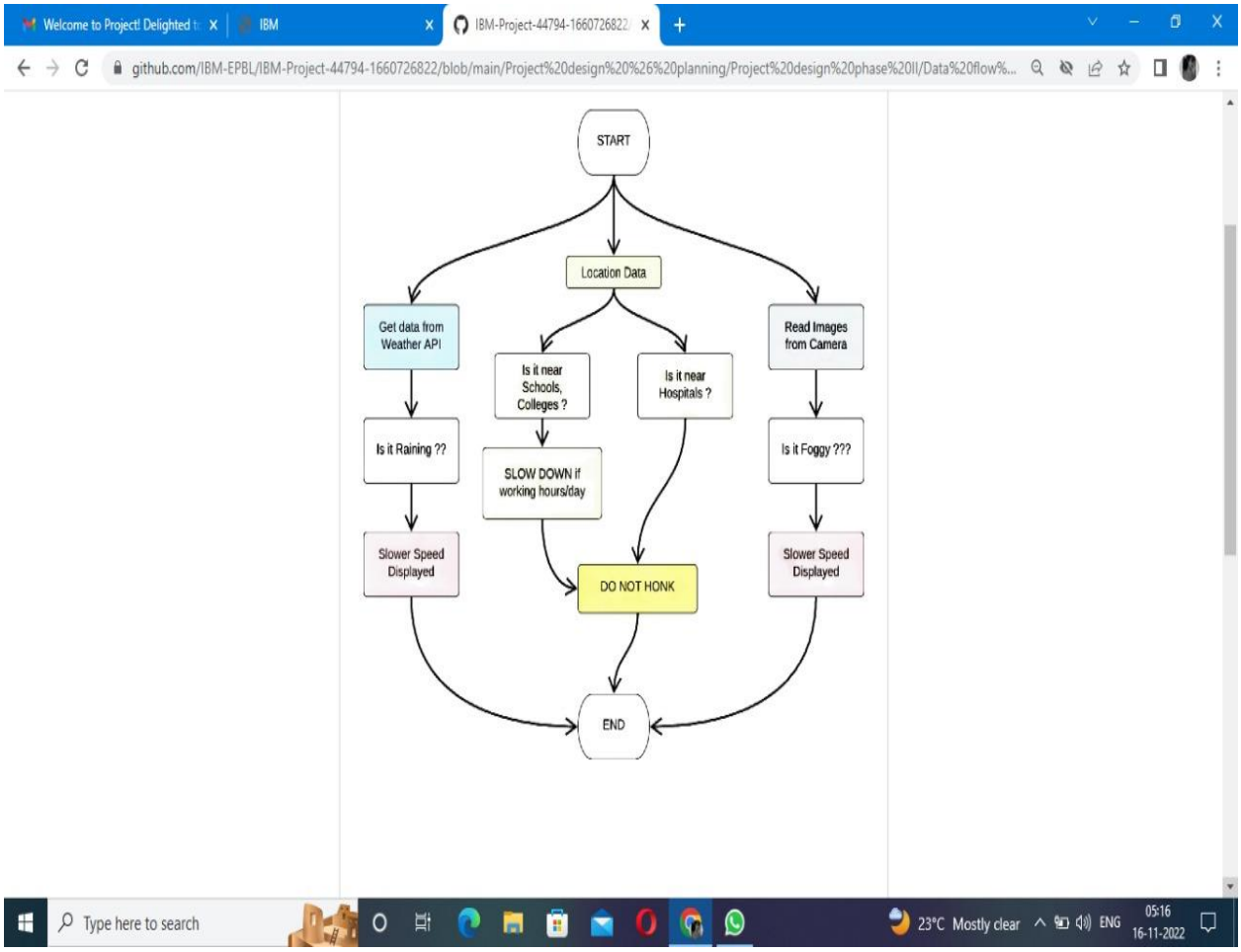
- Availability.

NER-6

- Scalability.
- Should be modular and hence able to scale on servers horizontally.

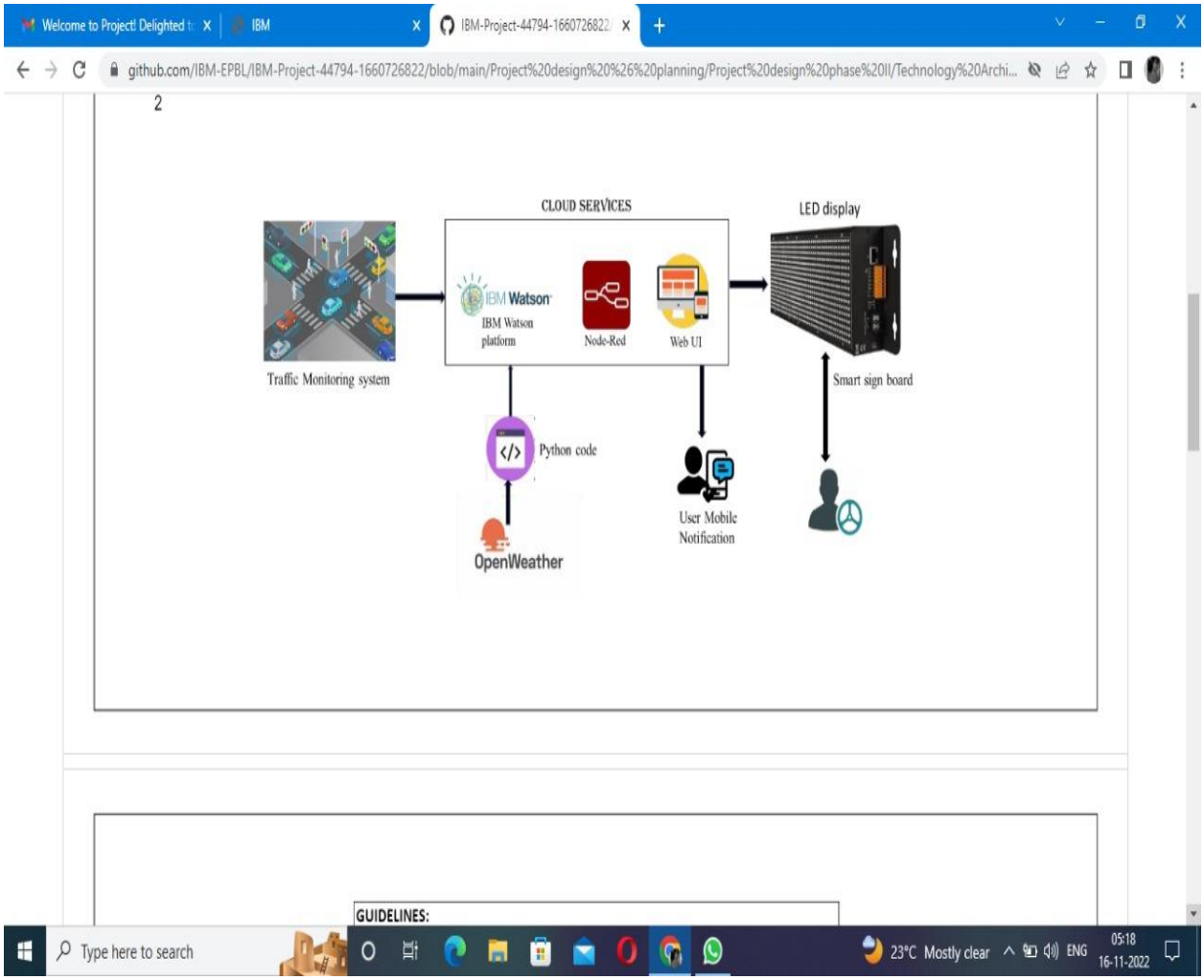
5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

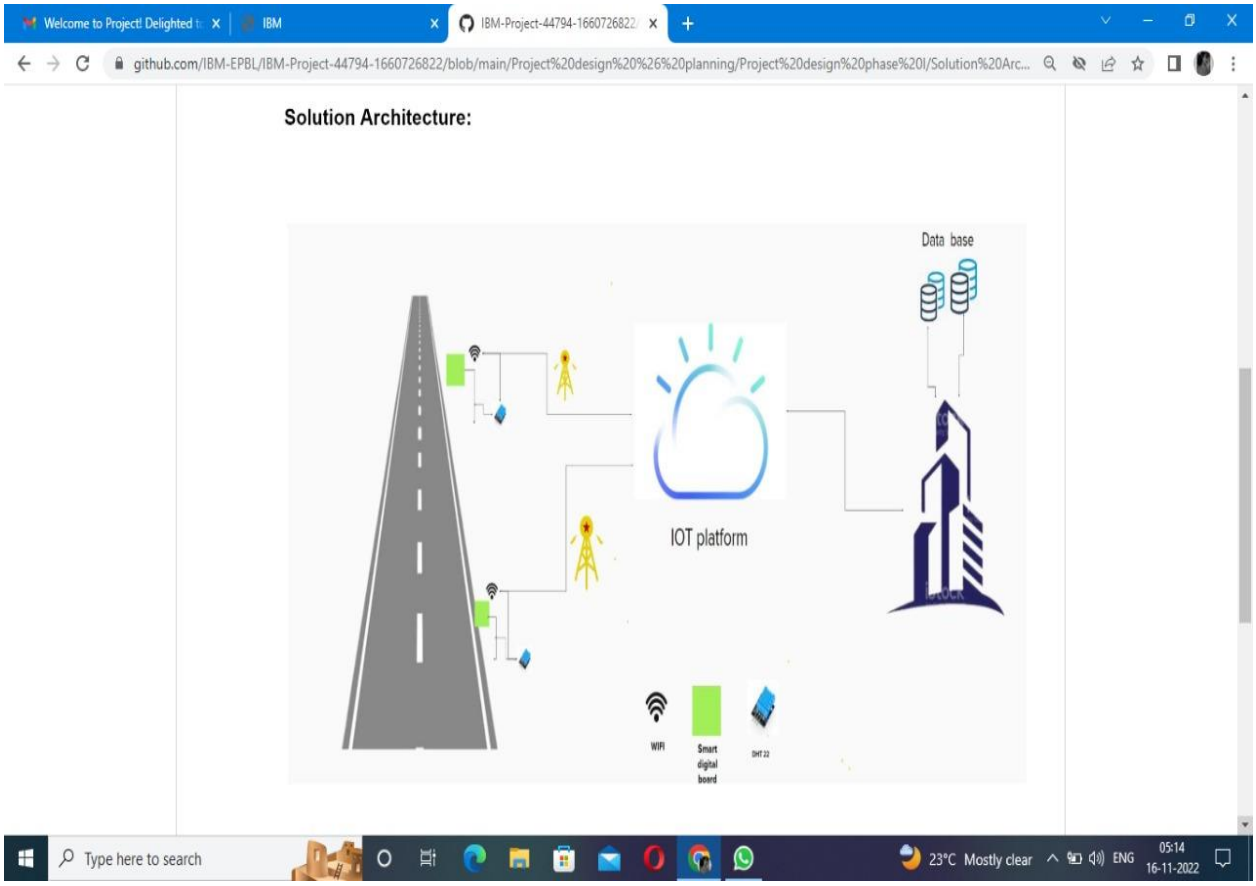


5.2 SOLUTION & TECHNICAL ARCHITECTURE

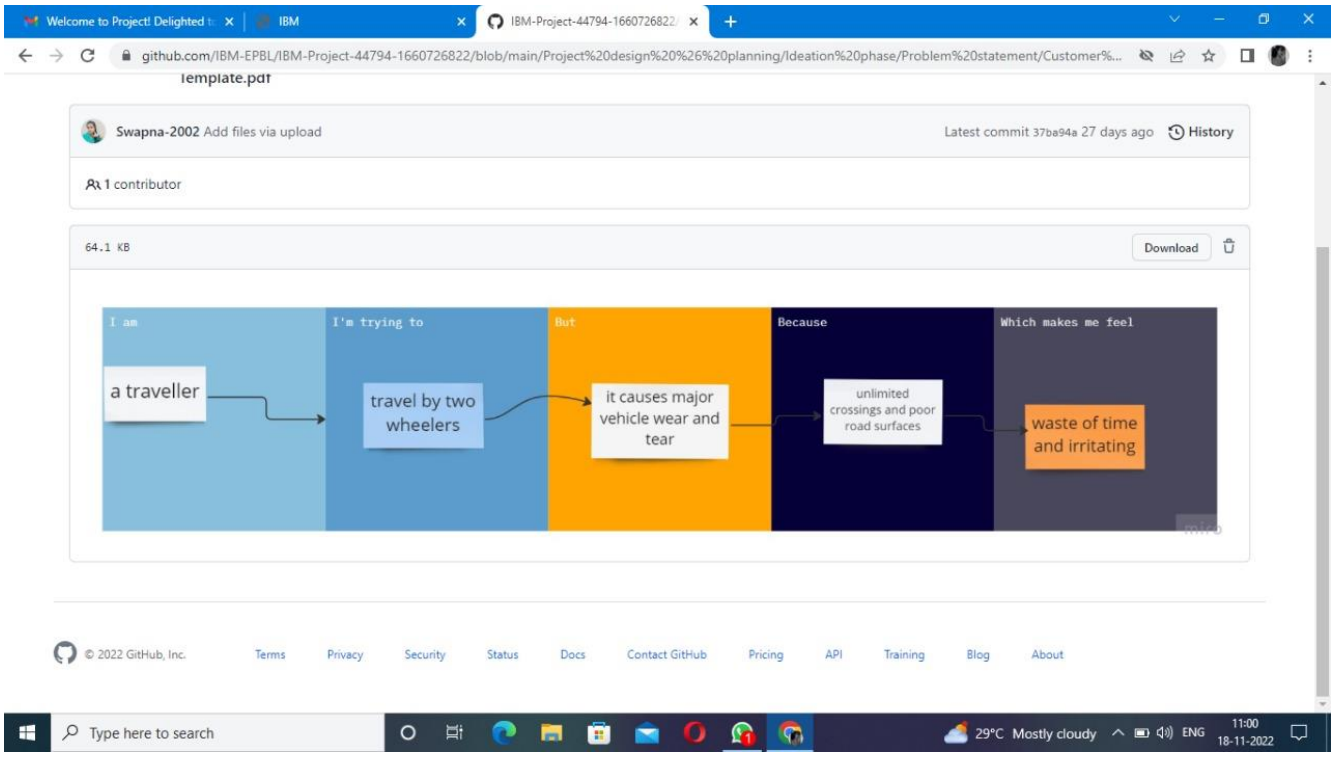
TECHNICAL ARCHITECTURE



SOLUTION ARCHITECTURE

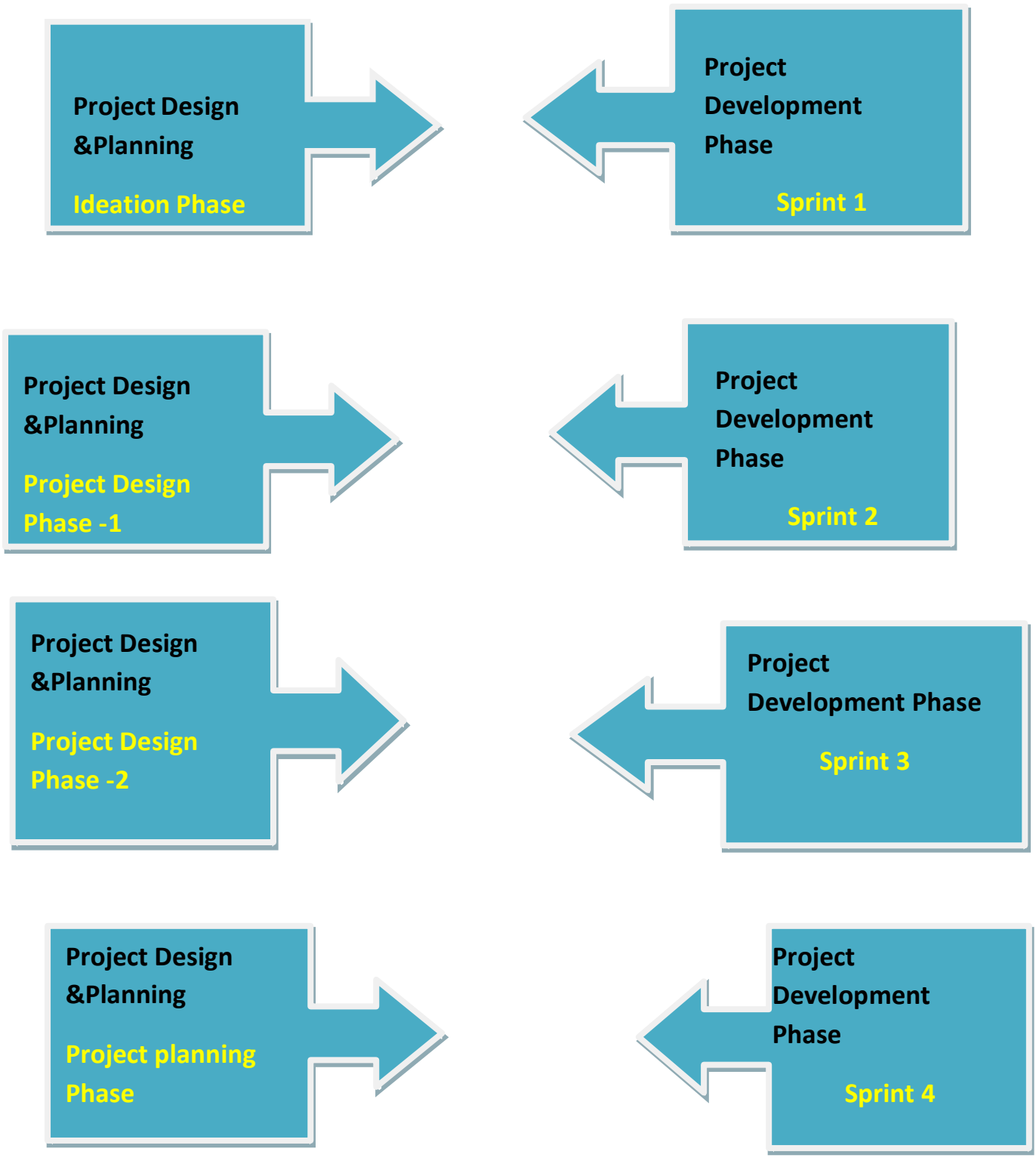


5.3.USER STORIES



6. PROJECT PLANNING & SCHEDULING

6.1. SPRINT PLANNING & ESTIMATION



6.2. SPRINT DELIVERY SCHEDULE

Sprint	Functional Requirement (Epic)	User Story / Task
Sprint-1	Resources Initialization	Create and initialize accounts in various public APIs like OpenWeatherMap API.
Sprint-1	Local Server/Software Run	Write a Python program that outputs results given the inputs like weather and location.
Sprint-2	Push the server/software to cloud	Push the code from Sprint 1 to cloud so it can be accessed from anywhere
Sprint-3	Hardware initialization	Integrate the hardware to be able to access the cloud functions and provide inputs to the same.
Sprint-4	UI/UX Optimization & Debugging	Optimize all the shortcomings and provide better user experience.

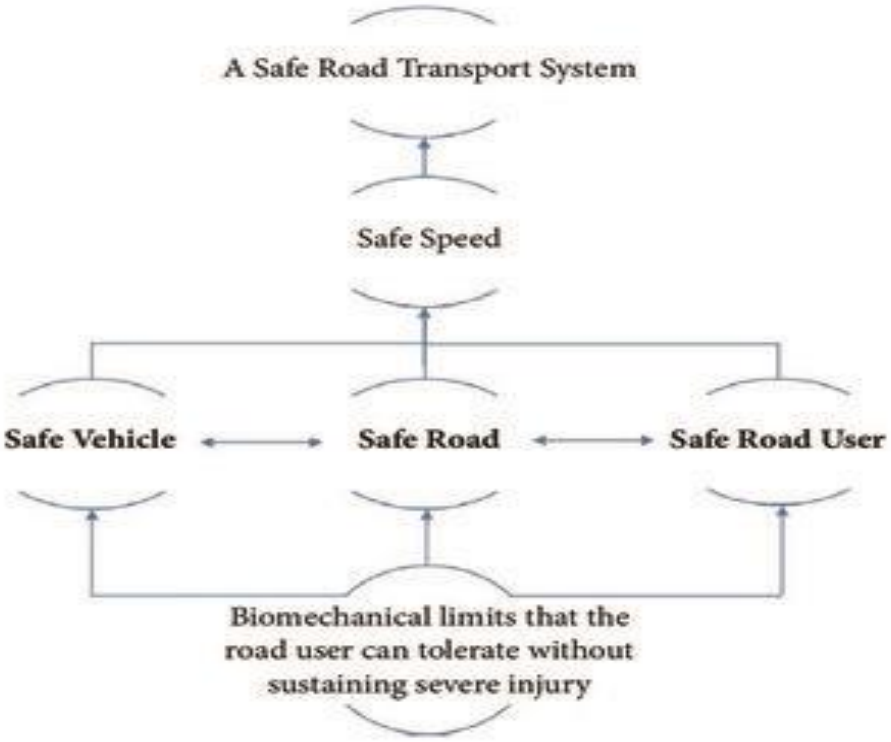
7.CODING & SOLUTIONING

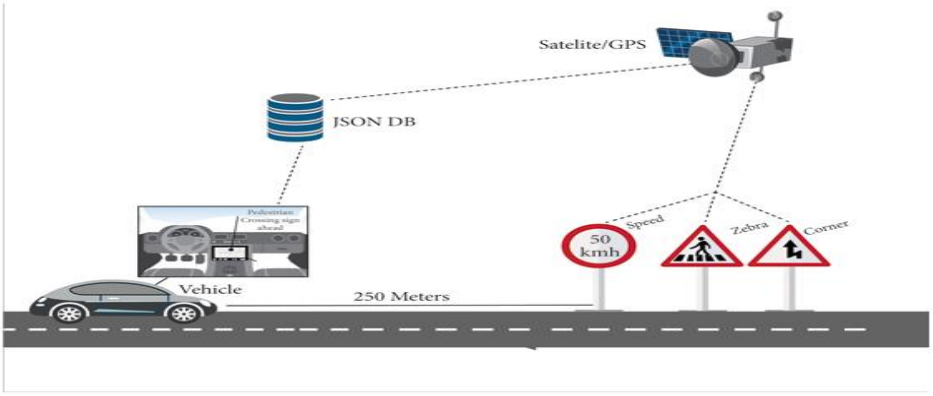
```
        # import required modules
        import requests, json

        # Enter your API key here
        api_key =
"73384f36faa9aed7acb0729eae8dd09
9"

        # base_url variable to store url
        base_url =
"http://api.openweathermap.org/data
/2.5/weather?"

        # Give city name
        city_name = input("Enter city
name : ")

        # complete_url variable to store
        # complete url address
        complete_url = base_url +
"appid=" + api_key + "&q=" +
city_name

        # get method of requests
module
        # return response object
        response =
requests.get(complete_url)

        # json method of response
object
        # convert json format data into
        # python format data
        x = response.json()

        # Now x contains list of nested
dictionaries
        # Check the value of "cod" key
is equal to
        # "404", means city is found
otherwise,
        # city is not found
        if x["cod"] != "404":

            # store the value of "main"
            # key in variable y
            y = x["main"]

            # store the value
corresponding
            # to the "temp" key of y
            current_temperature =
```

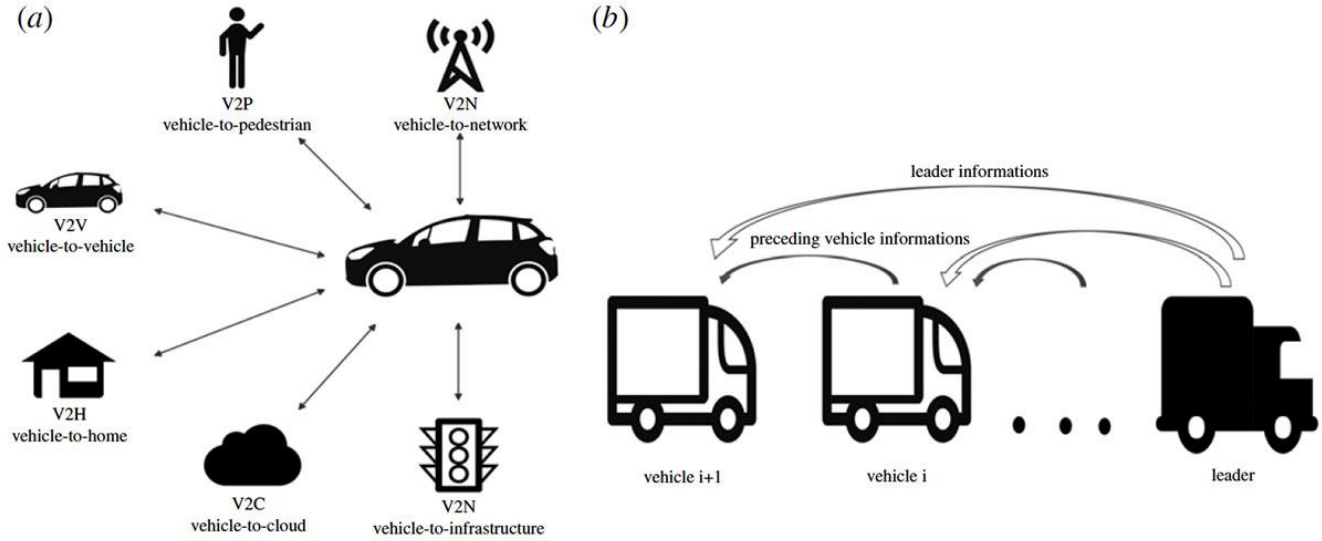
```
y["temp"]

            # store the value
corresponding
            # to the "pressure" key of y
            current_pressure =
y["pressure"]

            # store the value
corresponding
            # to the "humidity" key of y
            current_humidity =
y["humidity"]

            # store the value of
"weather"
            # key in variable z
            z = x["weather"]

            # store the value
corresponding
            # to the "description" key at
            # the 0th index of z
            weather_description =
z[0]["description"]

            # print following values
            print(" Temperature (in kelvin
unit) = " +

str(current_temperature) +
                "\n atmospheric pressure
(in hPa unit) = " +

str(current_pressure) +
                "\n humidity (in
percentage) = " +

str(current_humidity) +
                "\n description = " +

str(weather_description))
            if
current_temperature>287.05:

print(current_temperature,"Cannot
surpass")
            elif
current_temperature<287.05:

print(current_temperature,"Normal")
            if current_humidity<55:

print(current_humidity,"Normal")
            elif current_humidity>=55
and current_humidity<=65:

print(current_humidity,"Sticky with
```

```
mogged evening")
            else:

print(current_humidity,"Moisture")



        else:
            print(" City Not Found ")
```

7.3. DATABASE SCHEME







8.TESTING

8.1.TEST CASES

Test Plans

A test plan documents strategy that will be used to verify and ensure that a product or system meets its design specification and other requirements. A test plan is usually prepared by or with significant input from the engineer. This document describes the plans for testing the architectural prototype of System.

In this Project the system has to be tested to get the Desired Output . I use different speed for testing the system.

Unit testing

In computer programming, unit testing is a software testing method by which individual units of source code, sets of one or more computer program modules together with associated control data, usage procedures, and operating procedures, are tested to determine whether they are fit for use. In our system,

- Test to check whether block and circuit diagrams are well designed.
- Test to check whether hardware implementation work properly.
- Test to check whether the IoT connections are guaranteed.

Integration testing

Integration testing (sometimes called integration and testing) is the phase in software testing in which individual software modules are combined and tested as a group. It occurs after unit testing and before validation testing. Integration testing takes as its input modules that have been unit tested, groups them in larger aggregates, applies tests defined in an integration test plan to those aggregates, and delivers as its output the integrated system ready for system testing.

• Check whether the system limits the speed in specific areas.

• Check whether the system gives alerts.

• Check whether the controls are taken by a wireless local system.

System testing

System testing of software or hardware is testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements.

9.RESULT

9.1. PERFORMANCE MATRICES

Requirement Identification

- Functional Requirements
- Non-Functional Requirements

Implementation result

- System Implementation results
- Results of web application Implementation

Resource utilization results

- Foreground activities results
- Memory usage
- Energy usage
- Background activities results

10.ADVANTAGES AND DISADVANTAGES

Safety for pedestrians:

Smart roads have AI-powered traffic monitoring solutions that detect vehicles, pedestrians , and cyclists and enable safe riding practices. Smart device installed in smart roads are also able to alert first responders immediately incase of a crash or crime.

Advanced Communication:

Smart roads equipped with sensors can read weather conditions of the roads in real time and inform oncoming vehicles about how to optimally use the road.

Efficient Transportation:

All technology tools used in transportation are there to make moving from one place to another efficient. One example that smart roads use is e-trolling enhanced parking, where cars don't need to cause traffic congestion just to pay for road-related services.

Capital Intensive

It costs significant amounts of money to implement smart roads technologies on a large scale, which can make governments drag their feet when it comes to implementation.

Technological infrastructure and public acceptance

Autonomous self-driving cars would have to be widely adopted for smart roads to unlock many of its benefits to transportation . At the moment, the public is a bit skeptical about handling over the steering wheel to artificial intelligence .The gridlock in regulations and legislation is a reflection of public distributions and legislation is a reflection of public distrust at the moment.

CONCLUSION

While we come to an end , the IoT or Internet of Things has made the lives of the human being straight forward and comfortable. It has made the lives of the people very Convenient . 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.

FUTURE SCOPE

The concept of connectivity is going beyond laptop and smartphones as we see it moving towards smart cities, smart homes, smart retails , smart farming , connected cars ,connected wearable devices and connected healthcare. In short a connected life. We can be enhanced this system by implementing camera using Raspberri pi, GSM module in case of network unavailability and low RAM module/zigbee module for long range communication.

PROJECT DEMO LINK

https://youtu.be/uXb3IdUKIqo