

SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

**PROJECT REPORT
IBM NALAIYA THIRAN**

Submitted By

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1.INTRODUCTION

a. PROJECT OVERVIEW

Technology has brought fine changes into every portion of our life by making it smart and reliable. There are many situations in which technologies can be used to avoid accidents in roads which opens a wide window for the requirement of Smart Road System. With the dynamic changes in the models of the vehicles the roads need to have same ability to face them. Evolving towards the future, the roads needs to build with advanced sensors and antenna systems to have a pace with the new era. The design involves the road side units and vehicle side units as part of intelligent transport system involving Internet of things(IOT).This project has designed a system to alert the driver about the speed limits in specific areas by reducing the speed of the vehicle in sensitive public zones without any interference of the drivers where controls are taken automatically by the use of a wireless local area network. The main objective of the proposed system is to operate the vehicles in a safe speed at critical zones minimizing the possible risk of unwitting accidents and casualties. Besides, the system is capable of detecting the accidents and give notification to the control room. The system operates in such way that the accident information is passed to the vehicles entering the same zone to take diversion to avoid traffic congestion.

The basic steps of this system are:

- Block and circuit preparation
- Hardware Implementation
- Setting up IOT

1.2 PURPOSE:

The main purpose of our project is to alter the driver about the speed limits in particular areas especially in schools, colleges, hospital and reduce the speed of the vehicles.

2. LITERATURE SURVEY

2.1 Existing problem:

The early effects to prevent road accidents and to ensure road safety includes the use of speed detection devices, CCTVs, speed limiters and emergency accident units as the first phase. Despite achieving the state-of-the-art performance, the existing systems suffer from two main problems,

- Over Speed: These systems cannot control speed at some specific zones.
- Exact location of accident occurred: These systems cannot give the precise location of accident.

2.2 REFERENCES

Assistant Prof. Ankita Gandhi, Dhruvil Nanavati, Tushar Mandloi, Gaurav Sagar, Dhruv Sevak Students, Department of Computer Science and Engineering, Parul Institute of Engineering and Technology, Vadodara, India.

Ashok Kumar K, Karunakar Reddy Vanga, International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8, Issue-1, May 2019. Rashmi R K, Poonam Avinash Gulwane, Rahul Kudgi, Anaan Shaikh, Vaishnavi Laxmanrao Gadewar,” AUTOMATIC SPEED CONTROL SYSTEM FOR VEHICLES USING COLOR AND HALL SENSORS”, International Research Journal of Engineering and Technology (IRJET) E-ISSN: 2395 - 0056, p-ISSN: 2395-0072, Volume: 04 Issue: 04 Apr -2017.

“Automatic speed controller for automobile”, International Journal of Trend in Scientific Research and Development (IJTSRD), e-ISSN: 2456-6470, vol. 3, Issue-4 June 2019.

2.3 PROBLEM STATEMENTS:

The early effects to prevent road accidents and to ensure road safety includes the use of speed detection devices ,CCTVs, speed limiters and emergency accident units. Old

approaches emphasize the concept of problem-solving in Road safety, but it is more correct to recognize that Road safety activities doesn't solve problems. For instance, when a safer road design is implemented, hopefully the number of crashes, or their seriousness, will go down, but they will not disappear. It is more correct to say the implementation of correct policies, programs and measures will reduce numbers or consequences of crashes, but they will no be solved. This realization is important, because it changes the focus from a problem that will go away if we devote enough resources to it, to a situation requiring on-going management. This management in turn requires the development of scientifically based techniques, witch will enable us to predict with confidence that safety resources are well-spent and likely to be effective.

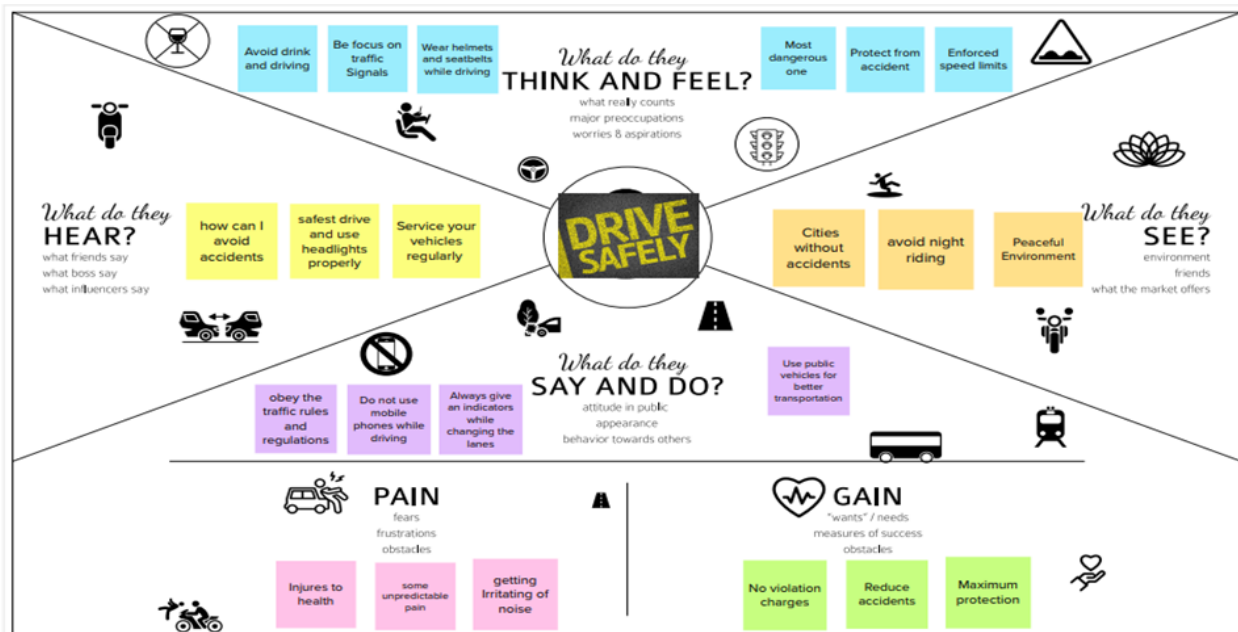


Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Student or Children	Go to school without any fear	There is risk of accident	Improper sign boards and rush hours in traffic	Insecure
PS-2	Patient in ambulance	Go to hospital within time	There is heavy traffic at every signal	There is no priority for ambulance or any such cases	Afraid of my life

3. IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP

An empathy map is a simple and easy to understand the problems about user's behavior's and feelings. It is a very useful tools to help to understanding theirs users. Creating an effective requirement are know the true problem from the person what its experience and pain.The exercise of creating the map from user's perspective goals and challenges.



3.2 BRAINSTORMING AND IDEATION:

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

Statement

This step includes the formation of the team, collaborating with the team by collecting problems of the domain we have taken, the considered the information into a single problem statement.

RAHUL KUMAR S

Traffic Problems	Increased Accident rate	Road accidents
Road Safety	Better roadways	Better Communication Smart Signs
Easy access to road condition	Decreased accident rates after Installing	Maximum protection and no violation charges

VASANTHARAJ M

Property Damage	Economic burdens on victim and family	Damage to Public properties
Traffic causes unpredictable delay and thus results in stress	Safety issues	Reduced property damage
Ensures safety	Easier communication with travelers during disaster period with the installation of device	Implementations of our projects ensures easier transportation without delay

PRADEEP S

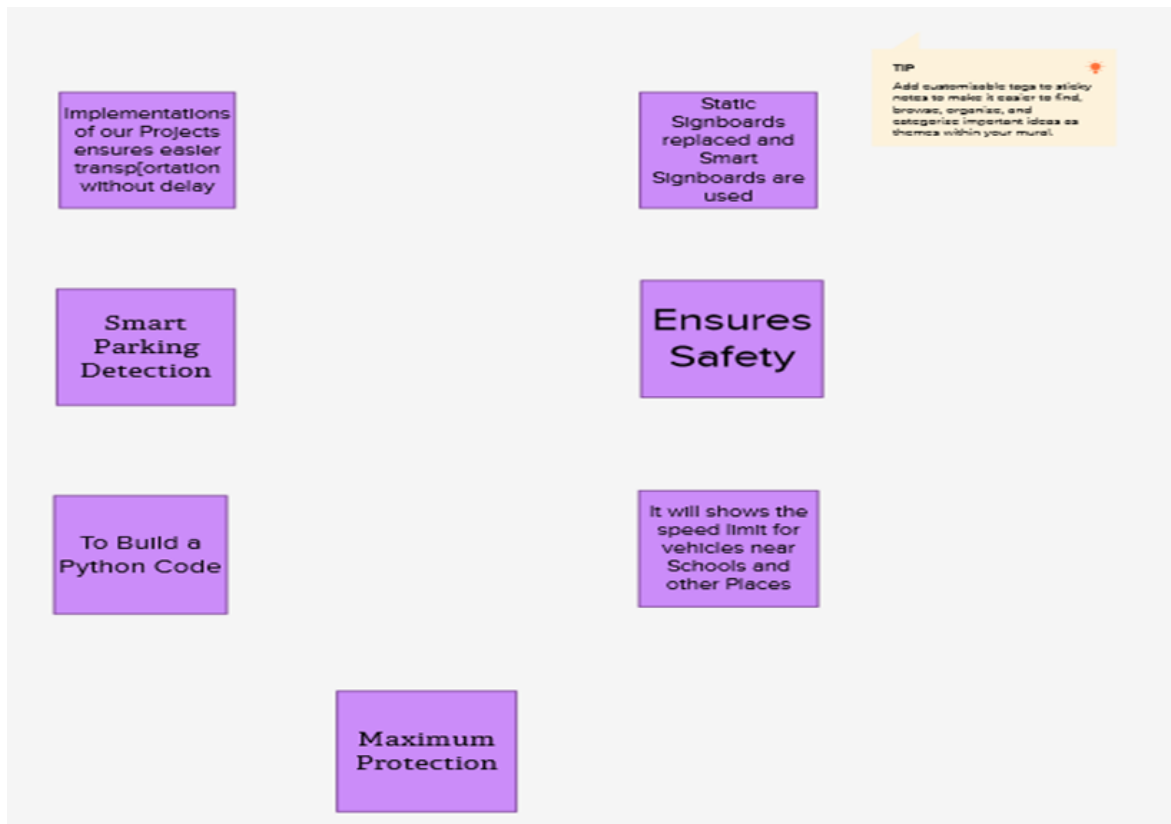
Long term physical injury	Traffic Maintenance	Traffic congestion increases air pollution and leads to global warming
Report if any issue with Vehicle details	It notifies any diversion in roads with signs	Implementing our project help people know about the road condition, speed limit during rainy or fog time
Saving on insurance cost	Help people to understand the road condition with easier signs	Our project will notify the weather condition with smart signs

NAVEEN C

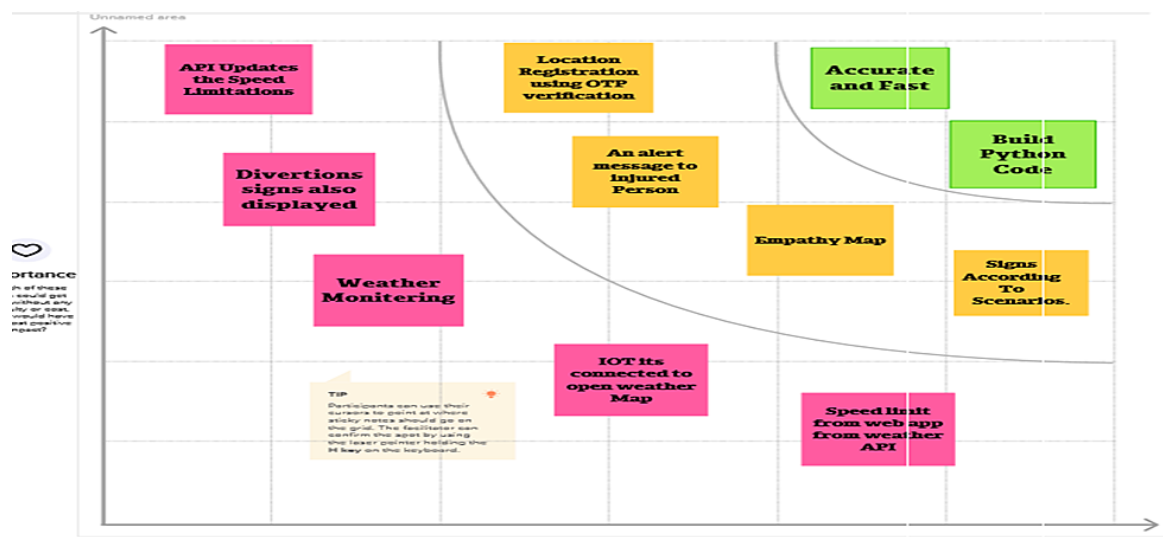
Engineering roadways with smart features notifying drivers the monitor and report changing road conditions and road conditions	Loss of human life and money	The risk of collision is high in wet weather
It shows speed limit for vehicles travelling near schools or any places	Heavy injuries to passengers as well as drivers	Maximum protection
Cost of damage will be decreased	Public properties will not be disturbed	Leads safer transportation

Step 2: Brainstorm, Idea Listing, and Grouping

This step of ideation includes the listing of individual ideas by teammates to Help with the problem statements framed. All the individual ideas have been valued and made individual clusters.



Step 3: Idea Prioritization



3.3 PROPOSED SOLUTION:

1. Problem Statement (Problem to be solved) :

Smart connected sign boards are used to replace static signboards. These intelligent connected sign. Boards update automatically and obtain the speed restrictions from a web application using weather API. The speed may increase or decrease in response to changes in the weather. The display of the diversion signs depends on the flow of traffic and possible fatalities. The necessary guide, warning, and. service signs are also posted at hospitals and restaurants.

2. Idea / Solution description:

Smart traffic signals can also be programmed to react properly to conditions like gridlock or blockage or to the movement of heavier vehicles. Smart programming and digitization. can be used to control traffic signal operations in both bigger and smaller metropolitan areas. Simple traffic programming can be utilised to avoid congestion and improve traffic. Why Road capacity may be quickly. increased when traffic lights coordinate perfectly and respond to demand in real-time. With technical experience, all of this. programming can be completed.

3. Novelty / Uniqueness:

Pedestrians have ability to request sign changes for the crosswalk signal for any application that updates using both buttons and a web API.

4. Social Impact / Customer Satisfaction:

The purpose of the diversion will be shown. Pedestrians do not need to wait to cross the street if there is no traffic. Customer can reach at the target destinations earlier than expected time.

5. Business Model (Revenue Model):

This project uses a business approach where income is earned based on how long users actively interact with the product, since APIs are used to actively monitor the customer's environment. This product is intended to be provided without charge to the general public, but cash will be created by selling it to the government for a reasonable price, reducing accidents and increasing public awareness of errors or accidents on a certain road.

6. Scalability of the Solution:

Future updates that are needed can be quickly applied, whether they are on the hardware or software side. The programming of the present product can be slightly modified and the hardware components can be directly interfaced with the microcontroller. The website application must be updated with the new capabilities in the case of software by adding a new section for the updated hardware. As a result, the product's current functionality won't be impacted, and new functionality can be added with ease. Along with the hardware, a separate circuit will be preserved to detect any issues and alert the web application. A notification will also be forwarded to the product service division.

3.4 Problem –Solution Fit Template:

The problem-solution fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem. It helps entrepreneurs marketing and corporate innovators identify behavioral patterns and recognize what would work and why.

Project Title: Signs with Smart Connectivity for Better Road Safety		Problem Solution Fit		Team ID: PNT2022TMID17080	
Define CS, fit into CL	1. CUSTOMER SEGMENT(S) CS Who is your customer? <ul style="list-style-type: none"> • Passenger • Highway department 	6. CUSTOMER LIMITATIONS CL <small>EG. BUDGET, DEVICES</small> What constraints prevent your customers from taking action or limit their choices of solutions? There was a network effect on the testing, a significant and unexpected component Because of this IoT-based system was successful in simulating a large-scale smart sign board.	5. AVAILABLE SOLUTIONS AS <small>PLUSSES & MINUSES</small> Which solutions are available to the customers when they face the problem Along roadways, inactive signs with clear directions are put as potential fixes.	Explore AS, differentiate	
	2. PROBLEMS / PAINS PR <small>+ ITS FREQUENCY</small> Which jobs-to-be-done (or problems) do you address for your customers? The Smartboard Connectivity is responsible for a variety of tasks, including maintaining accurate temperature sensor readings and telling the board of the speed of the customer's vehicle.	9. PROBLEM ROOT / CAUSE RC What is the real reason that this problem exists? What is the back story behind the need to do this job? If there was no internet connection, no sensor data from the weather would cause the speed limit to change. Some persons may cause issues by hitting the accident indicator button unnecessarily.	7. BEHAVIOR BE <small>+ ITS INTENSITY</small> What does your customer do to address the problem and get the job done? As a teacher, the IOT cloud upgrades the smartboard on the condition of the roads on a regular basis.		Focus on PR, tap into BE, understand RC
Identify strong TR & EM	3. TRIGGERS TO ACT TR What triggers customers to act ? Poor climate conditions win. The vehicle should be moving at edge speed. The sensor value should be appeared on the smart board of alarm the client.	10. YOUR SOLUTION SL We utilize smart connected sign boards as an alternative to inactive signboards. With the help of a web app and climate API, these intelligent connected sign boards automatically.	8. CHANNELS of BEHAVIOR CH ONLINE What kind of actions do customers take online? The divisions can get coordinate emails or messages from customers.	Extract online & offline CH of BE	
	4. EMOTIONS EM <small>BEFORE / AFTER</small> How do customers feel when they face a problem or a job and afterwards? Clients will feel better after selecting an operation mode with the use of smartboard connectivity, and they will then follow the instructions on the smartboard.		OFFLINE This are the following directions this is the one of the main tasks for the travelers. but they can use the smartboard signs to check the state of the road from wherever they are.		

4. REQUIREMENT ANALYSIS

4.1 Functional Requirements:

- 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.
- 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.
- 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.

4. User Convenience: The display should be big enough that it should even be visible from far distance clearly.

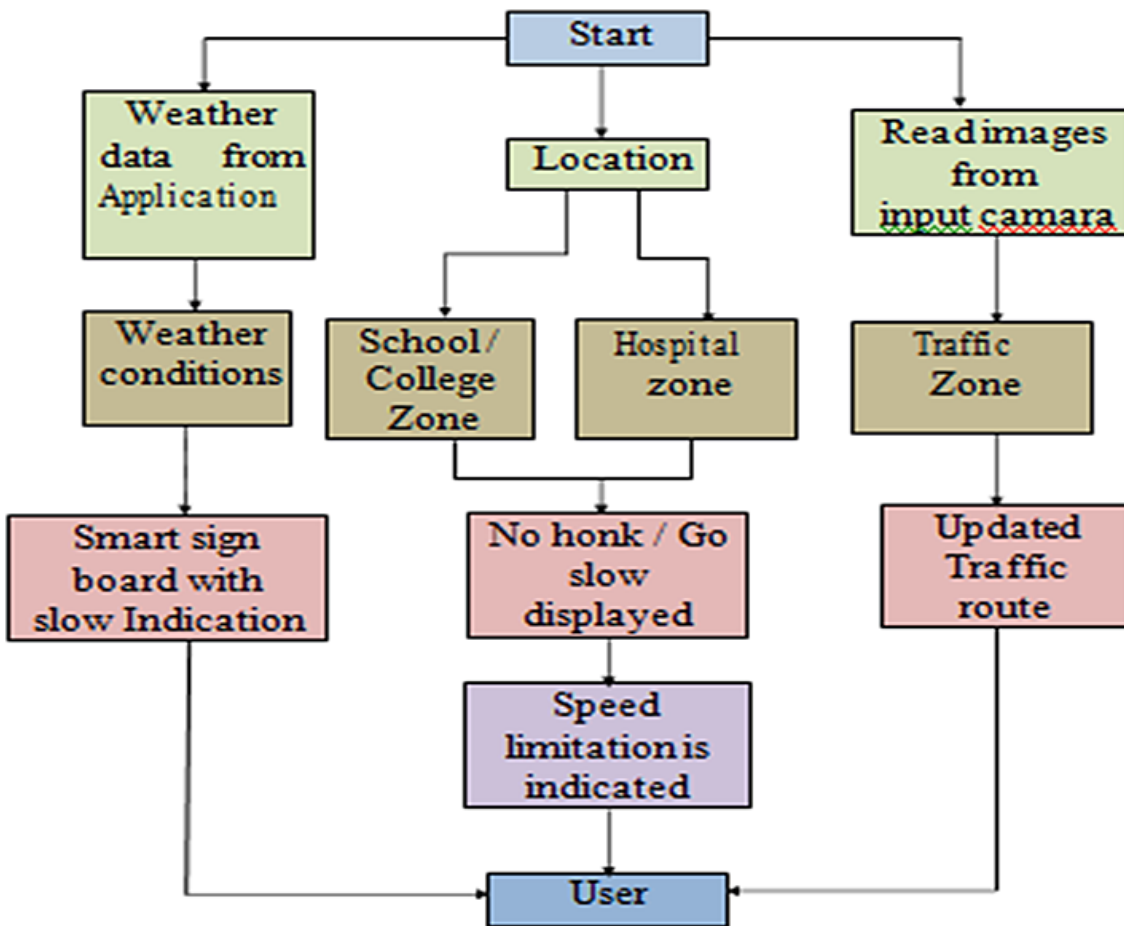
4.2 Non-functional Requirements:

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

5. PROJECT DESIGN:

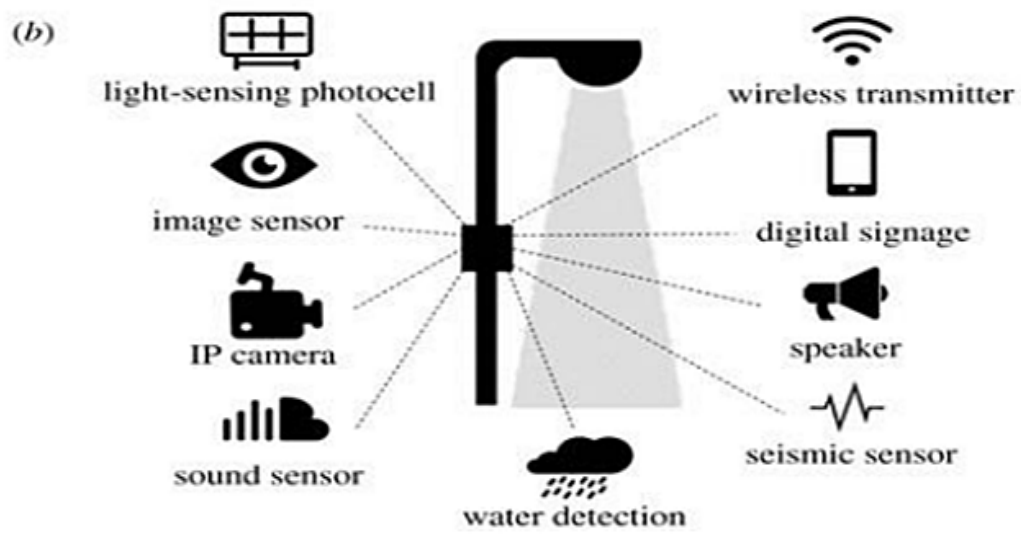
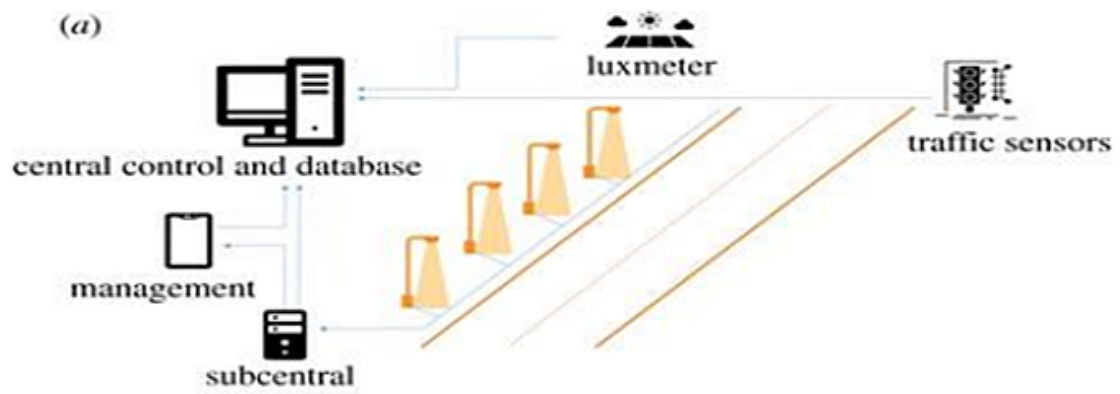
5.1 Data Flow Diagram:

Data flow representation are easily understanding tools. This templates are explained our projects step by step.



5.2 Solution and Technical Architecture

The solution architecture are perform. This task has to understand how all parts are work together including processes, operating systems, and application architectures.



6. PROJECT PLANNING AND SCHEDULING:

6.1SPRINT PLANNING & ESTIMATION:

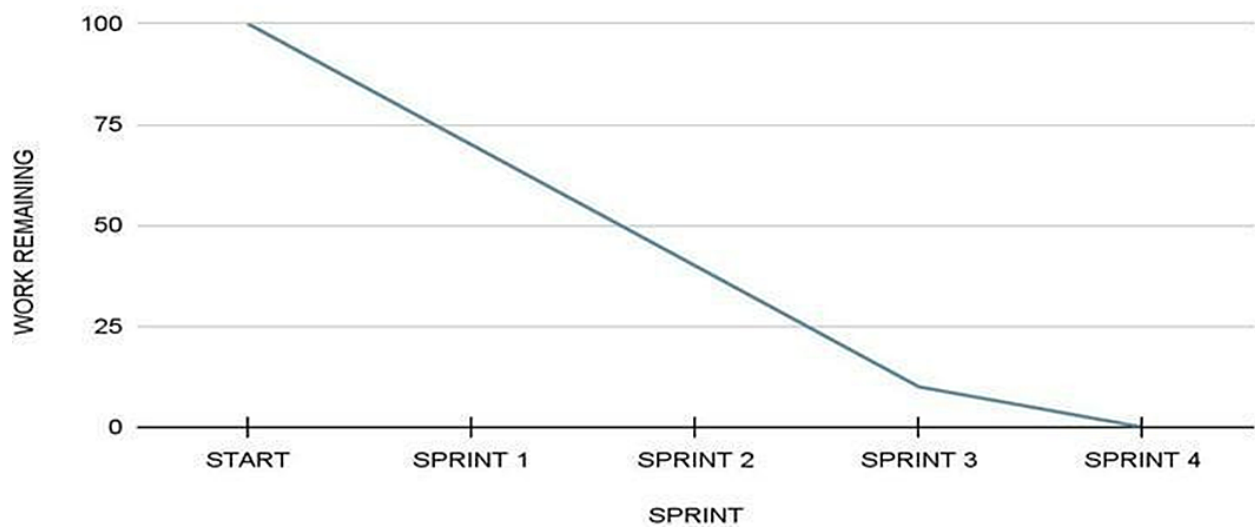
Sprint	Functional Requirement (Epic)	User Story/Task	Story Points	Priority
Sprint-1	Registration	As a user, I can register for the application by entering my email ,password, and confirming my password	2	High
Sprint-1	Confirmation	As a user, I will receive confirmation email once I have registered for the application	1	High
Sprint-2	Login	As a user, I can log into the application by entering email &password	2	High
Sprint-2	Interface	The user interface needs to be straight forward and simple to use	1	Medium
Sprint-3	Coding	Coding is a set of instructions used to manipulate information so that a certain input results in a particular output.	2	High
Sprint-4	Web Application	As a user, I will display the current weather &Automatic diversion for road traffic &Accident	2	Medium

6.2 SPRINT DELIVERY SCHEDULE:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed(Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6Days	24Oct 2022	29Oct 2022	20	29Oct 2022
Sprint-2	20	6Days	31Oct 2022	05Nov2022	20	05Nov2022
Sprint-3	20	6Days	07Nov2022	12Nov2022	20	12Nov2022
Sprint-4	20	6Days	14Nov2022	19Nov2022	20	19Nov2022

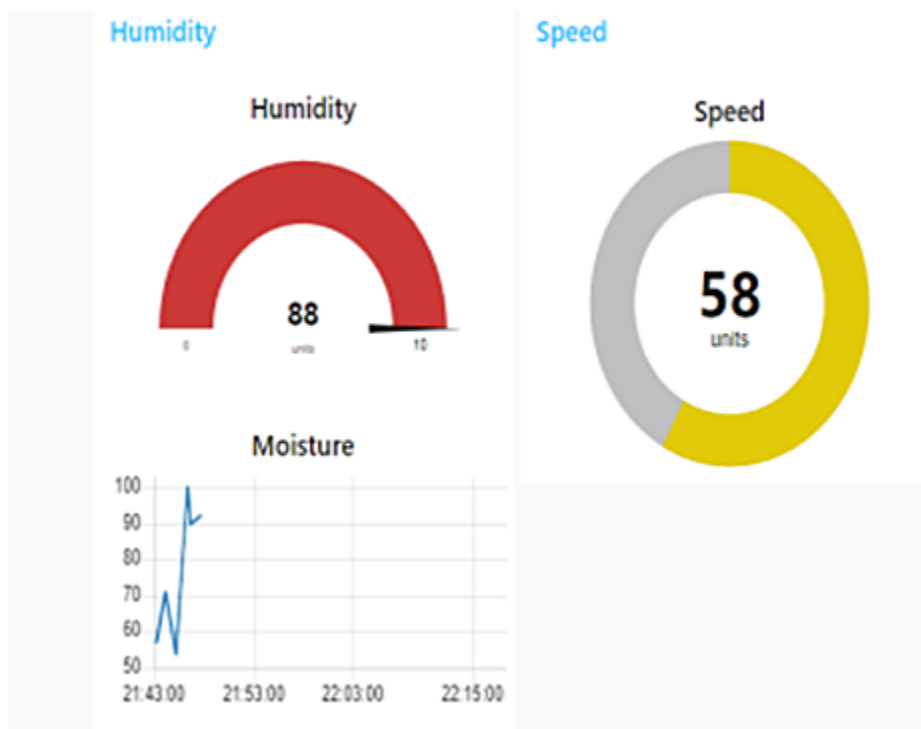
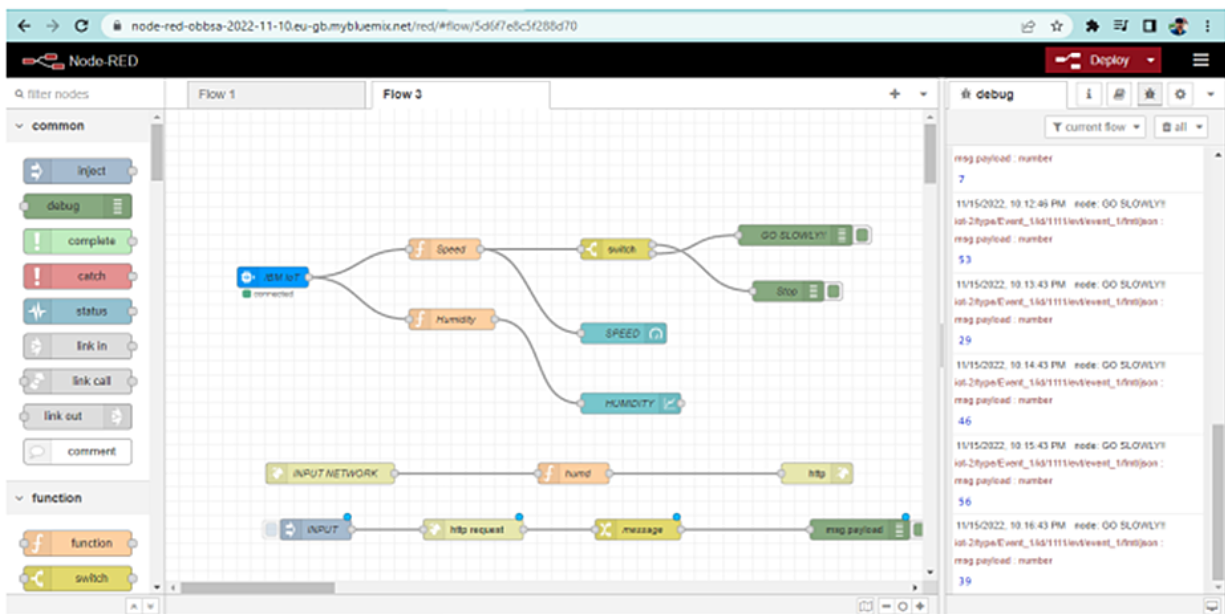
Burn down Chart:

Balance Work

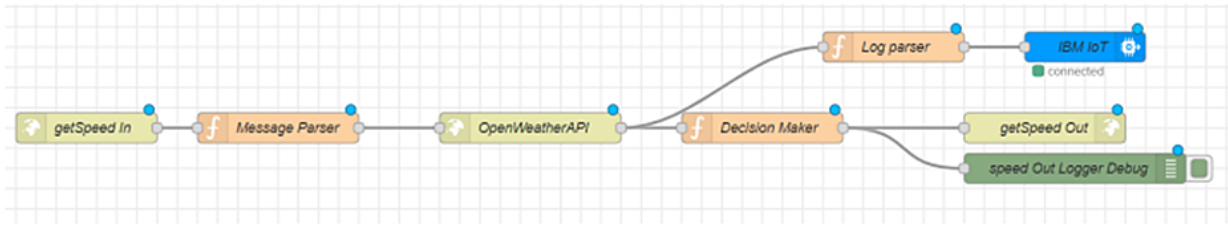


7. CODING AND SOLUTIONS:

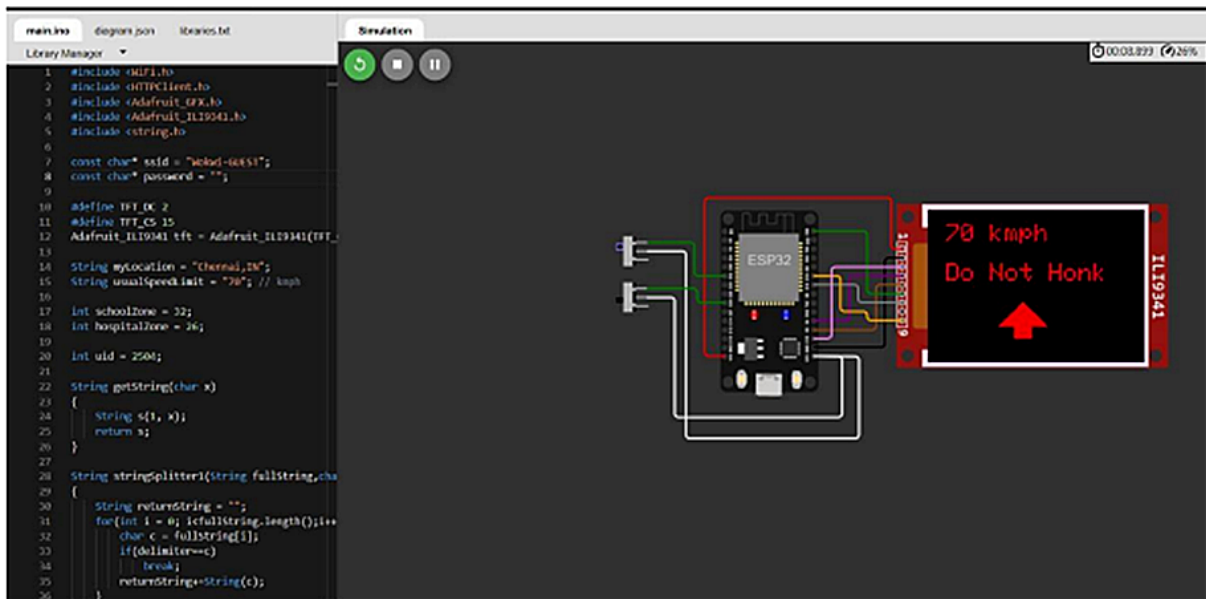
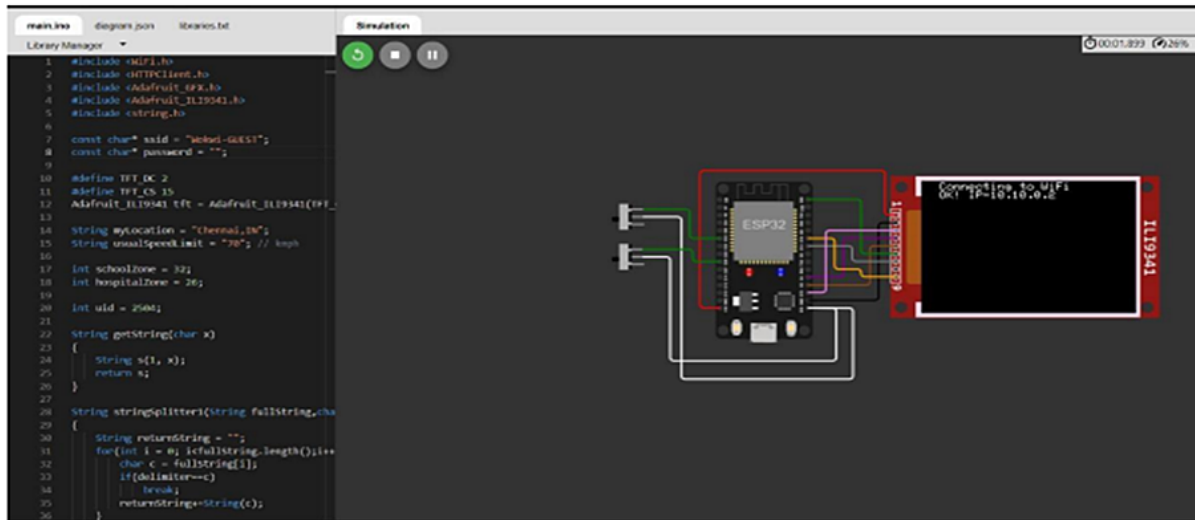
7.1 FEATURE 1



getSpeed API flow :



7.2 FEATURE 2



8. TESTING:

8.1 TestCases:

wokwi.com/projects/348426120386839123

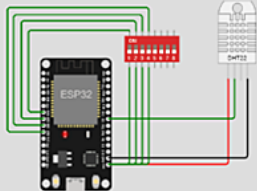
WOKWI SAVE SHARE IOT ROAD SAFETY Docs

sketch.ino diagram.json libraries.txt Library Manager

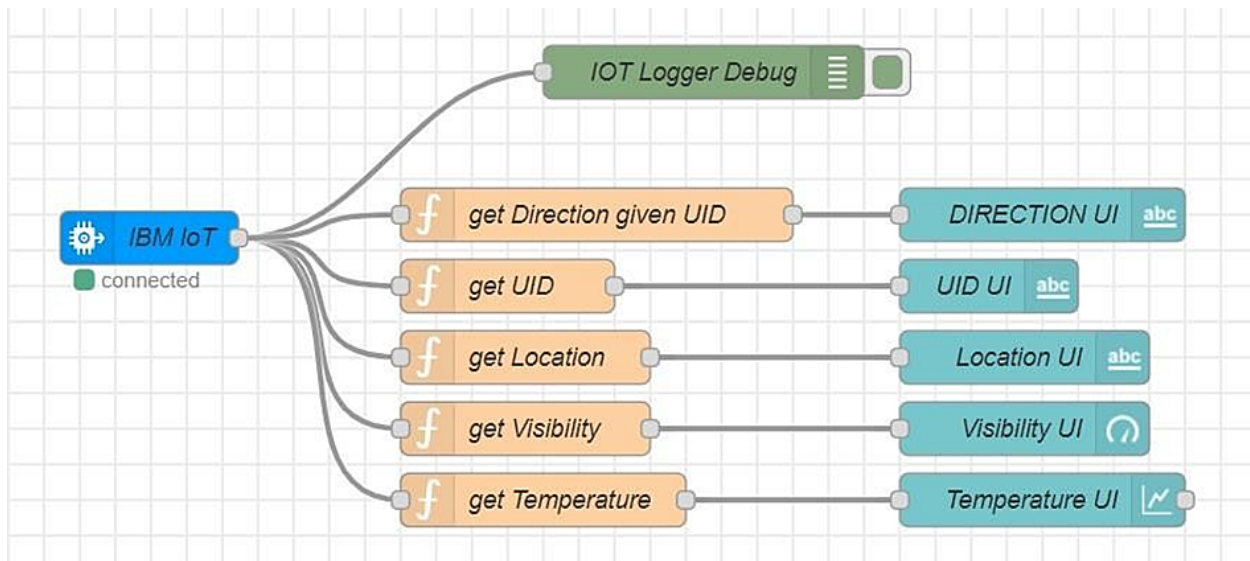
```
1 #include <WiFi.h> //library for wifi
2 #include <PubSubClient.h> //library for MQTT
3 #include "DHT.h" // Library for dht11
4 #define DHTPIN 5 // what pin we're connected to
5 #define DHTTYPE DHT22 // define type of sensor DHT 11
6
7 DHT dht (DHTPIN, DHTTYPE); // creating the instance by passing pin and type of dht
8
9 void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);
10
11 //-----credentials of IBM Accounts-----
12
13 #define ORG "b59mry" //IBM ORGANITION ID
14 #define DEVICE_TYPE "Event_1" //Device type mentioned in ibm watson IOT Platform
15 #define DEVICE_ID "1111" //Device ID mentioned in ibm watson IOT Platform
16 #define TOKEN "12345678" //Token
17 String data3;
18 float h, t;
19
20
21 //----- Customise the above values -----
22 char server[] = ORG ".messaging.internetofthings.ibmcloud.com"; // Server Name
23 char publishTopic[] = "iot-2/evt/Data/fmt/json"; // topic name and type of event
24 char subscribetopic[] = "iot-2/cmd/command/fmt/String"; // cmd REPRESENT command
25 char authMethod[] = "use-token-auth"; // authentication method
26 char token[] = TOKEN;
```

Simulation

00:03.833 61%



Connecting to ..
WiFi connected
IP address:
10.10.0.2



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

- Smart road technology can assist in optimizing traffic flow and managing road condition
- Reducing the congestion and emissions
- It helps traffic light to operate in real-time condition.

11. CONCLUSION

The road rules, avoiding excessive speeds and improved general awareness can significantly reduce the risk of a traffic accident. Regularly checking vehicle health and maintenance of parts also eliminates any potential risks.

12. FUTURE SCOPE

The Safe System goals and strategies focus on providing a road traffic system free from death and serious injury. The Safe System guides the planning, design, management, operation and use of the road traffic system so as to provide safety in spite of human fallibility.

13. APPENDIX

a. **Circuit Diagram:**

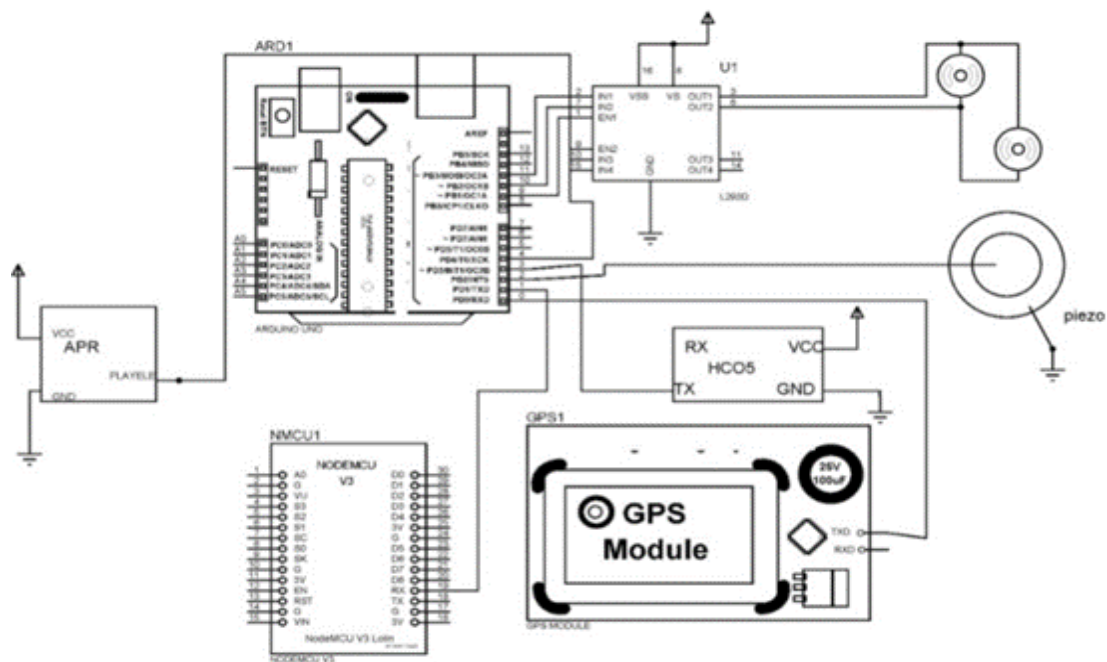


Figure 1:Control Side

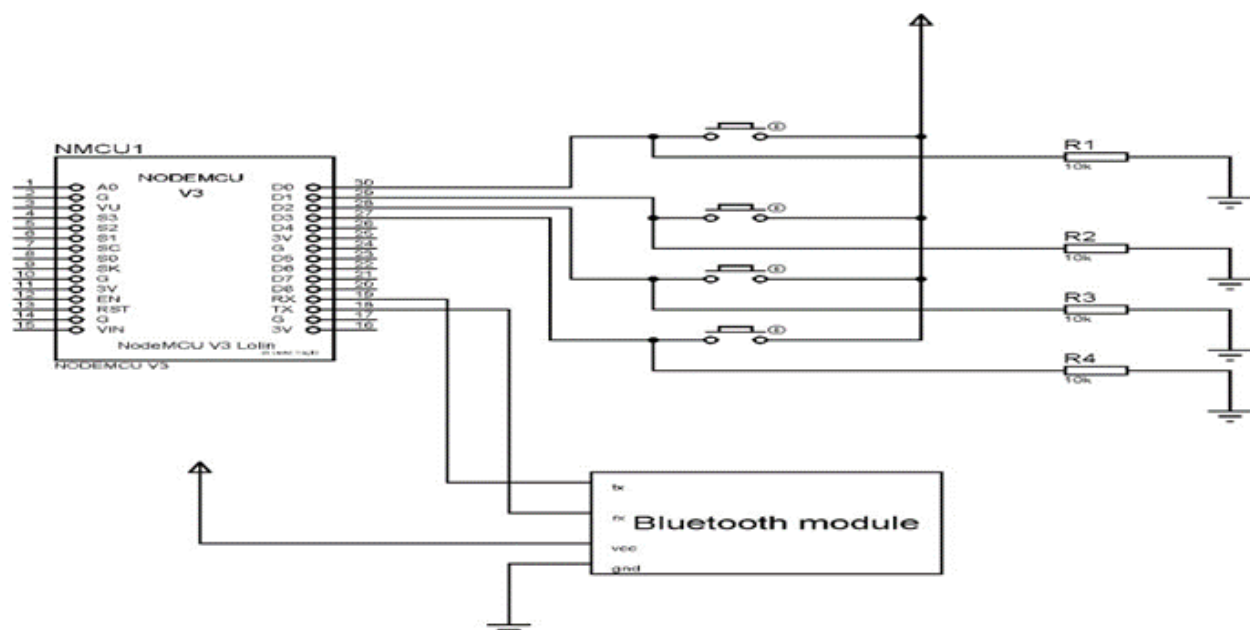


Figure 2: Another Vehicle

12.1.1 Code:

```
# IMPORT SECTION STARTS
import weather
from datetime import datetime as dt
# IMPORT SECTION ENDS
# UTILITY LOGIC SECTION STARTS
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"]):
        # hzone of the hospital
        doNotHonk = True
    else:
        if(localityInfo["schools"]["schoolZone"]==False):
            # neither hospital zone nor school
            doNotHonk = False
        else:
            # schoolzone
            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
            })
import brain
# IMPORT SECTION ENDS
```

```

# USER INPUT SECTION STARTS
myLocation = "Chennai,IN"
APIKEY = "c7388b7d0d823ee0ee0be65c6fd40411"
localityInfo = {
    "schools" : {
        "schoolZone" : True,
        "activeTime" : ["7:00","17:30"] # schools active from 7 AM till 5:30 PM
    },
    "hospitalsNearby" : False,
    "usualSpeedLimit" : 40 # in km/hr
}

import requests as reqs
def get(myLocation,APIKEY):
    apiURL =
    "https://api.openweathermap.org/data/2.5/weather?q={myLocation}&appid={APIKEY}"
    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,
    }
    if("rain" in responseJSON):
        returnObject["rain"] = [responseJSON["rain"][key] for key in
responseJSON["rain"]]
    return(returnObject)

#include <WiFi.h> #include
<HTTPClient.h> #include
<Adafruit_GFX.h>
#include
<Adafruit_ILI9341.h>
#include <string.h>
const char* ssid = "Wokwi-

```

```

    GUEST";const char* password =
    "";
    #define TFT_DC2
    #define TFT_CS 15
    Adafruit_ILI9341 tft = Adafruit_ILI9341(TFT_CS, TFT_DC);
    String myLocation = "Chennai,IN";
    StringusualSpeedLimit = "70"; // kmph
int schoolZone = 32;
inthospitalZone = 26;
    intuid = 2504; // ID
    Unique to this Micro
    ContollerString
    getString(char x)
{
    String s(1,
    x);returns;
}

String stringSplitter1(String fullString,char delimiter='$')
{
    String returnString = "";
    for(int i = 0; i<fullString.length();i++) { char
        c =fullString[i]; if(delimiter==c)
            break;
        returnString+=String(c);
    }
    return(returnString);
}

String stringSplitter2(String fullString,char delimiter='$')
{
    String returnString =
    "";boolflag = false;
    for(int i = 0; i<fullString.length();i++) { char
        c =fullString[i];
        if(flag)
            returnString+=String(c);if(delimiter=
            =c)flag = true;
        }
    return(returnString);
}

void rightArrow()
{
    int refX = 50;
    int refY = tft.getCursorY() + 40;

```



```

    tft.fillRect(refX,refY,100,20,ILI9341_RED);
    tft.fillTriangle(refX+100,refY-30,refX+100,refY+50,refX+40+100,refY+10,ILI9341_RED);
}

void leftArrow()
{
    int refX = 50;
    int refY = tft.getCursorY() + 40;

    tft.fillRect(refX+40,refY,100,20,ILI9341_RED); tft.fillTriangle(refX+40,refY-30,refX+40,refY+50,refX,refY+10,ILI9341_RED);
}

void upArrow()
{
    int refX = 125;
    int refY = tft.getCursorY() + 30;

    tft.fillTriangle(refX-40,refY+40,refX+40,refY+40,refX,refY,ILI9341_RED); tft.fillRect(refX-15,refY+40,30,20,ILI9341_RED);
}

String APICall()
{
    HTTPClient http;

    String url = "https://node-red-grseb-2022-11-05-test.eu-gb.mybluemix.net/getSpeed?";
    url += "location="+myLocation+"&";
    url += "schoolZone="+digitalRead(schoolZone)+(String)"&";
    url += "hospitalZone="+digitalRead(hospitalZone)+(String)"&";url += "usualSpeedLimit="+digitalRead(usualSpeedLimit)+(String)"&";
    url += "uid="+uid;
    http.begin(url.c_str());
    int httpStatusCode = http.GET();

    if (httpStatusCode>0) {
        String payload = http.getString();
        http.end();
        return(payload);
    }
}

```

```

    }
    else {
        Serial.print("Error code: ");
        Serial.println(httpResponseCo
            de);
    }
    http.end();
}

void myPrint(String contents) {
    tft.fillScreen(ILI9341_BLAC
        K);tft.setCursor(0, 20);
    tft.setTextSize(4);
    tft.setTextColor(ILI9341_RE
        D);
    //tft.println(contents);
    tft.println(stringSplitter1(contents));String
        c2 =stringSplitter2(contents); if(c2=="s") //
        represents Straight
    {
        upArrow();
    }
    if(c2=="l") // represents left
    {
        leftArrow();
    }
    if(c2=="r") // represents right
    {
        rightArrow();
    }
}

void setup() {
    WiFi.begin(ssid, password, 6);

    tft.begin();
    tft.setRotation(1);

    tft.setTextColor(ILI9341_WHIT
        E);tft.setTextSize(2);
    tft.print("Connecting to WiFi");

    while (WiFi.status() != WL_CONNECTED)
    {
        delay(1
            00);
        tft.print("

```

```
        .");  
    }  
  
    tft.print("\nOK! IP=");  
    tft.println(WiFi.localIP());  
}  
  
void loop(){  
    myPrint(APICall  
    ());delay(100);  
}
```

GIT HUB LINK:

<https://github.com/IBM-EPBL/IBM-Project-7388-1658854344>

DEMO VIDEO LINK:

<https://youtu.be/Us3HxMB0Y-0>

THANK YOU