TEAM ID - PNT2022TMID09925

SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

NALAIYA THIRAN PROJECT BASED LEARNING

On

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

A PROJECT REPORT

ANEESH ABDUL RAHMAN	19104017
AKASH KUMAR	19104011
CHARUGNETHRA M	19104039
DHESIKA S	19104047

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE ENGINEERING

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHOLOGY

Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC

(An Autonomous Institution, Affiliated to Anna University, Chennai)

COIMBATORE – 641 032

November 2022

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ABSTRACT

In this paper, we 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, 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.

INTRODUCTION

Smart connected Signs for Improved Road Safety

Road signs and the speed limits are Static. But we look at how road signs can be changed in a few ways. We consider cases where there are some road diversions and due to heavy traffic or due to some accidents, we will have to change the road signs as per our requirements if they are digitalized.

This project proposes a system in which digital sign boards can be changed dynamically. This can have various possibilities like when, If there is rainfall then the roads will be slippery and the speed limit would have to be decreased. We can access them online through which we can enter the data of the road diversions, accident prone areas and the information sign boards. This data is transmitted and displayed on the sign boards accordingly.

OBJECTIVES

By the end of this project we will :

- Connecting IoT devices to the Watson IoT platform and exchanging the dataand to display values.
- Getting weather data from Open Weather Map API Service
- Connecting IoT devices to the Watson IoT platform and exchanging the data to display values.

LITERATURE REVIEW

1. IoT Based Regional Speed Restriction Using Smart Sign Boards

Author: P.Madhumathy, H.K.Nithish Kumar, Pankhuri & D.S.Suspreeth Narayan

https://link.springer.com/chapter/10.1007/978-3-030-65661-4_10

Major cause for fatal accidents on the road is over speeding. Accident risk increases with an increase in speed. The judging ability of upcoming events also gets declined while moving at higher pace, which causes judgment mistakes and leads to a crash. Around 30% of road accidents are due to over speeding. There have been various ways to avoid accidents due to over speeding, but none of them can automatically control the speed and customize the regional speed limit together. An IoT-based smart solution is discussed to overcome this, limiting the vehicle's top speed to a particular region even though people are unwilling to use control stations, smart signboards, and speed control unit in the vehicle.

2. Smart transportation system using IoT

Authors: P.S.Saarika, K.Sandhya & T.Sudha

https://ieeexplore.ieee.org/abstract/document/8358540

Nowadays the concept of smart cities became more popular. The evolution of internet of things (IoT) helps the idea of smart city more achievable. A major branch of smart city is smart transportation. Problems such as traffic congestion, road safety, accident detection, automatic fare collection and limited car parking facilities can be resolved by IoT. In this paper, an IoT based smart parking system along with an intelligent signboard is proposed. The smart parking system composed of intelligent sensors deployed on site and are used

to monitor and inform the availability of parking spaces. A mobile or internet application can be provided to check the availability of parking slot. The sign board with embedded RF module and connected sensors working with solar energy as well as in battery will show the place, distance to that place, weather condition, temperature and different routes to those places.

3. Smart city for VANETs using warning messages, traffic statistics and intelligent traffic lights

Authors: Carolina Tripp Barba, Miguel Angel Mateos, Pablo Reganas Soto, Ahmed Mohamad Mezher & Monica Aguilar Igartua

https://ieeexplore.ieee.org/abstract/document/6232229

Road safety has become a main issue for governments and car manufacturers in the last twenty years. The development of new vehicular technologies has favoured companies, researchers and institutions to focus their efforts on improving road safety. During the last decades, the evolution of wireless technologies has allowed researchers to design communication systems where vehicles participate in the communication networks. Thus, new types of networks, such as Vehicular Ad Hoc Networks (VANETs), have been created to facilitate communication between vehicles themselves and between vehicles and infrastructure. New concepts where vehicular networks play an important role have appeared the last years, such as smart cities and living labs [1]. Smart cities include intelligent traffic management in which data from the TIC (Traffic Information Centre) infrastructures could be reachable at any point. To test the possibilities of these future cities, living labs (cities in which new designed systems can be tested in real conditions) have been created all over Europe. In this work, the development of a warning system composed of Intelligent Traffic Lights (ITLs) that provides information to drivers about traffic density and weather conditions in the streets of a city is proposed and evaluated through simulations.

4. Highway 4.0: Digitalization of highways for vulnerable road safety development with intelligent IoT sensors and machine learning

Authors: Rajesh Singh, Rohit Sharma, Shaik Vaseem Akram, Anita Gehlot, Dharam Buddhi, Praveen Kumar Malik, Rajeev Arya

https://www.sciencedirect.com/science/article/abs/pii/S0925753521002514

According to United Nations (UN) 2030 agenda, the transportation system needs to be enhanced for the establishment of access to safe, affordable, accessible, and sustainable transport systems along with enhanced road safety. The highway road transport system is one of the transport systems that enables to transits goods and humans from one location to another location.

The agenda of UN 2030 for the transport system will be accomplished with the assistance of digital technologies like the internet of things (IoT) and artificial intelligence (AI). The implementation of these digital technologies on highways empowers to provide reliable, smarter, intelligent, and renewable energy sources experience to the users travelling along the highways. This study discusses the significance of the digitalization of highways that supporting and realizing a sustainable environment on the highways. The significance of implementing smart display boards and renewable sources with real-time applications is also addressed in this study. Embedding the deep learning techniques in the vison node at the traffic junction and the highway lighting controller is able to deliver an intelligent system that provides sustained experience and management of the highways. Smart reflectors, adoption of renewable energy, developing vehicle-to-vehicle communication in vehicles, and smart lamppost are the few recommendations for the implementation of digitalizing highways.

5. Internet of Things Based Solutions for Road Safety and Traffic Management in Intelligent Transportation Systems

Authors: Arnav Thakur, Reza Malekian & Dijana Capeska Bogatinoska

https://link.springer.com/chapter/10.1007/978-3-319-67597-8_5

Road safety, traffic congestion and efficiency of the transport sector are major global concerns. Improving this is the primary objective of intelligent transport systems (ITS). Having Internet of things (IoT) based solutions for ITS would enable motorists to obtain prior contextual guidance to reduce congestion and avoid potential hazards. IoT based solutions enabling collection of data from client nodes in a wireless sensor network in the transport environment implementing ITS goals is studied. Road safety techniques studied include distance sensing, improper driving detection and accident prevention, weather related events and negligent driving detection and accident avoidance. Vehicle to vehicle communication and vehicle to infrastructure based channels are studied. Wireless communication technologies suitable for the channels are studied. Additional benefits and services that can be added to a system with the IoT approach are also studied. The effectiveness of such a system is studied with the use of validation framework. Multiple case studies of current and future IoT based ITS along with the challenges in the application is discussed.

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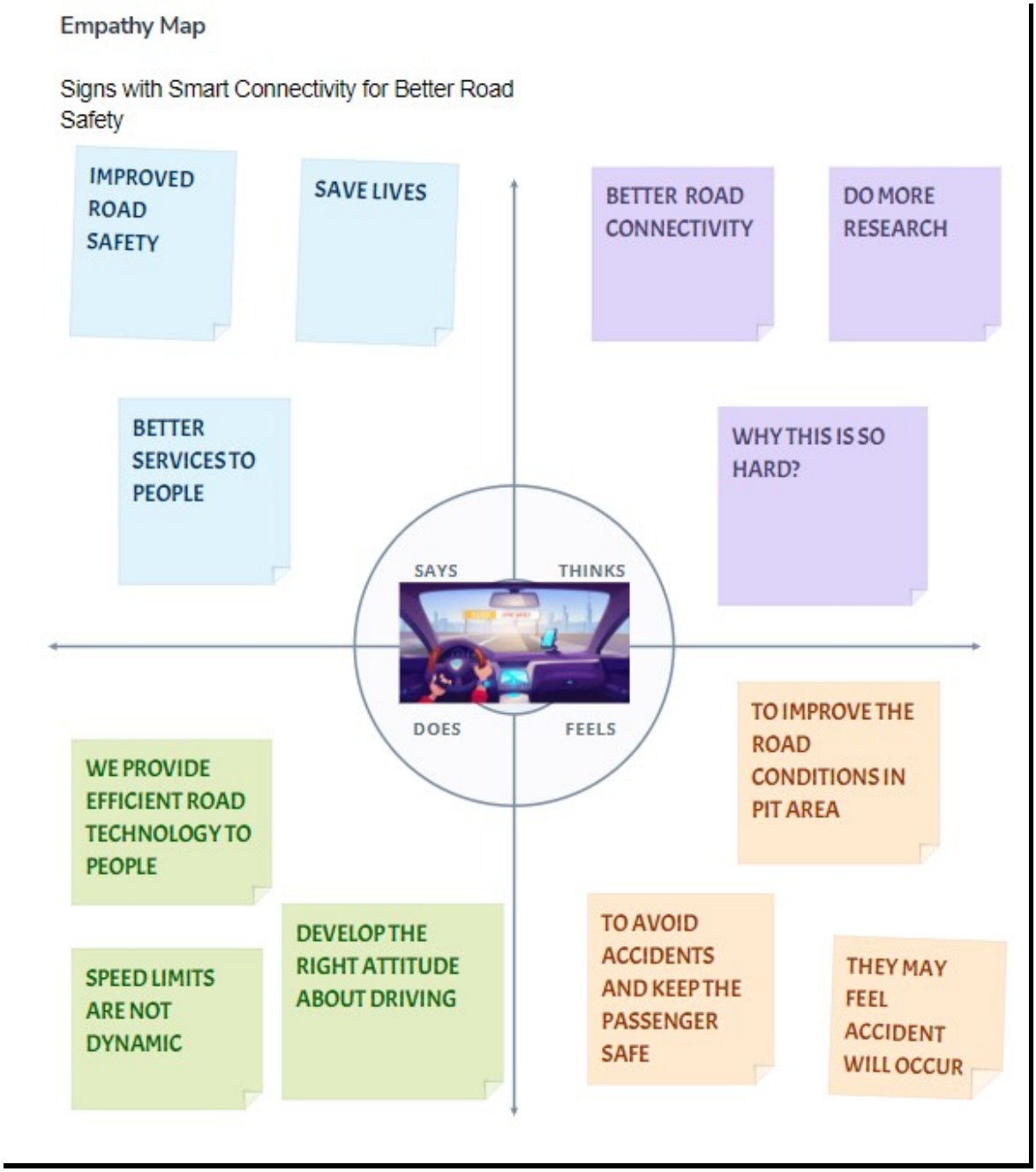
EMPATY MAP



IDEATION

1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM

How might we reduce the risk of accident and not cause any error and gives accurate information about the road safety and priortize the safety of the passengers?

2

Brainstorm

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

10 minutes

Aneesh

- Caution Signs
- Suggest speed limit while driving
- Strict follow of regulation
- proper use of indicators
- Weather monitoring
- predicting traffic
- it helps reducing risk of accident
- detects weather
- gives warning about any upcoming collapse

Dhesika

- speed limits
- gives infromation about nearest emergency sites
- checking conditions of vehicle
- automatic buzzer to alert us when we exceed speed limit
- warns us about any pursue
- using safety precautions
- detects construction sites
- restriction of Misdemeanor Offenses
- checking vehicle conditions

Akash

- Taligating should be avoided
- Stable technology system for monitoring, maintenance and repair of roads
- detect blind spots
- it can provide real-time information to the user about the status of the trafc light
- Look out for caution signs
- Electronics were always the prime sponsors for an efcient no trafc pathway and secured roads
- Density measures of trafc
- Take caution when you see an animal crossing sign
- All this helps to avoid breakdowns and, therefore, the prevention of accidents.

Charugnethra

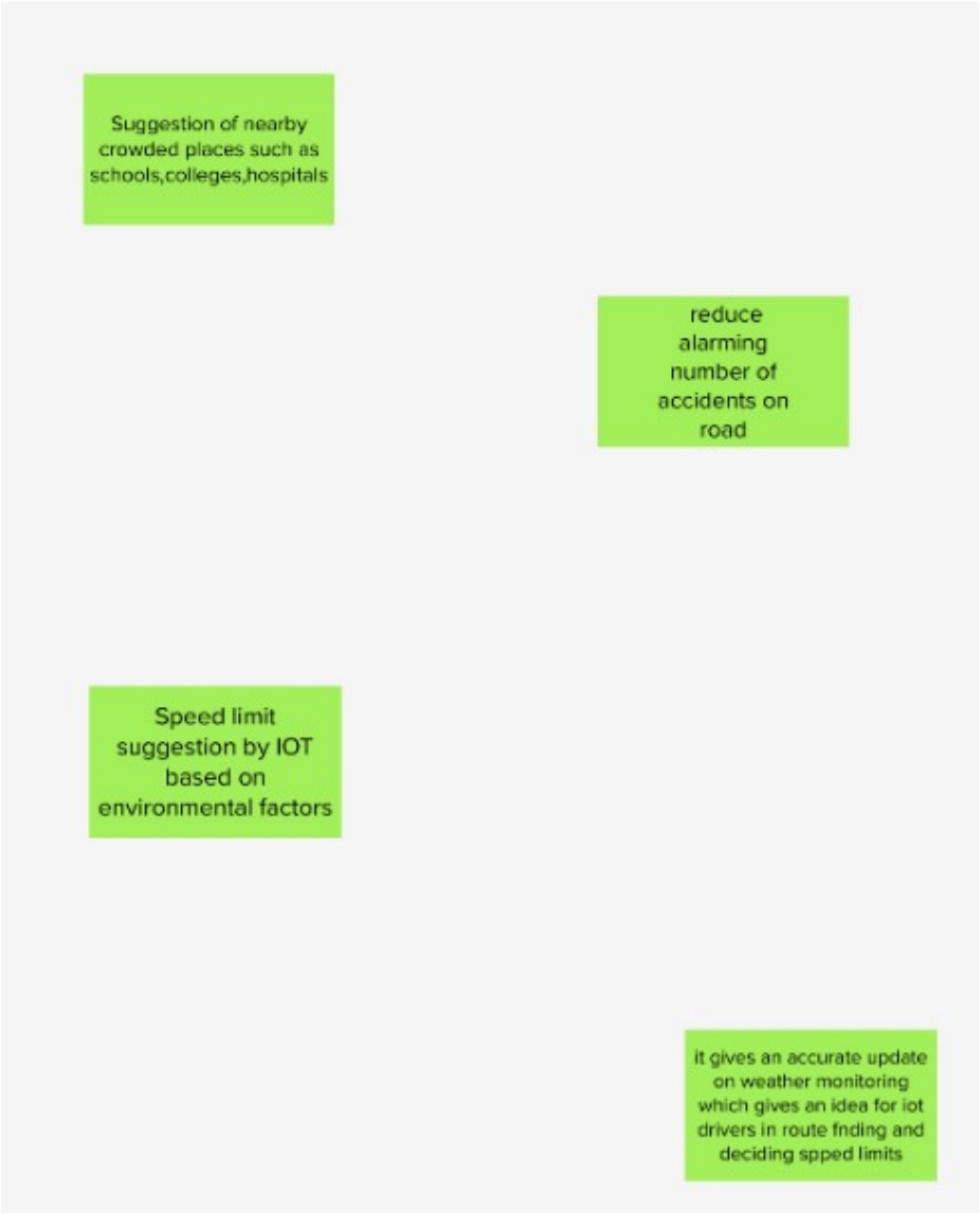
- Running Red Lights and Stop Signs
- It gives instant information on LED
- Maintain lane discipline
- It can reduces the number of accidents and improves circulation.
- Avoid using your mobile phone while driving
- Prevent Reckless Driving
- It makes the user aware about nearby whereabouts such as schools,hospitals...etc
- Running Red Lights and Stop Signs
- By knowing postions of other vehcles,the iot driver can decide regarding the speed and there is no need for emergency braking

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

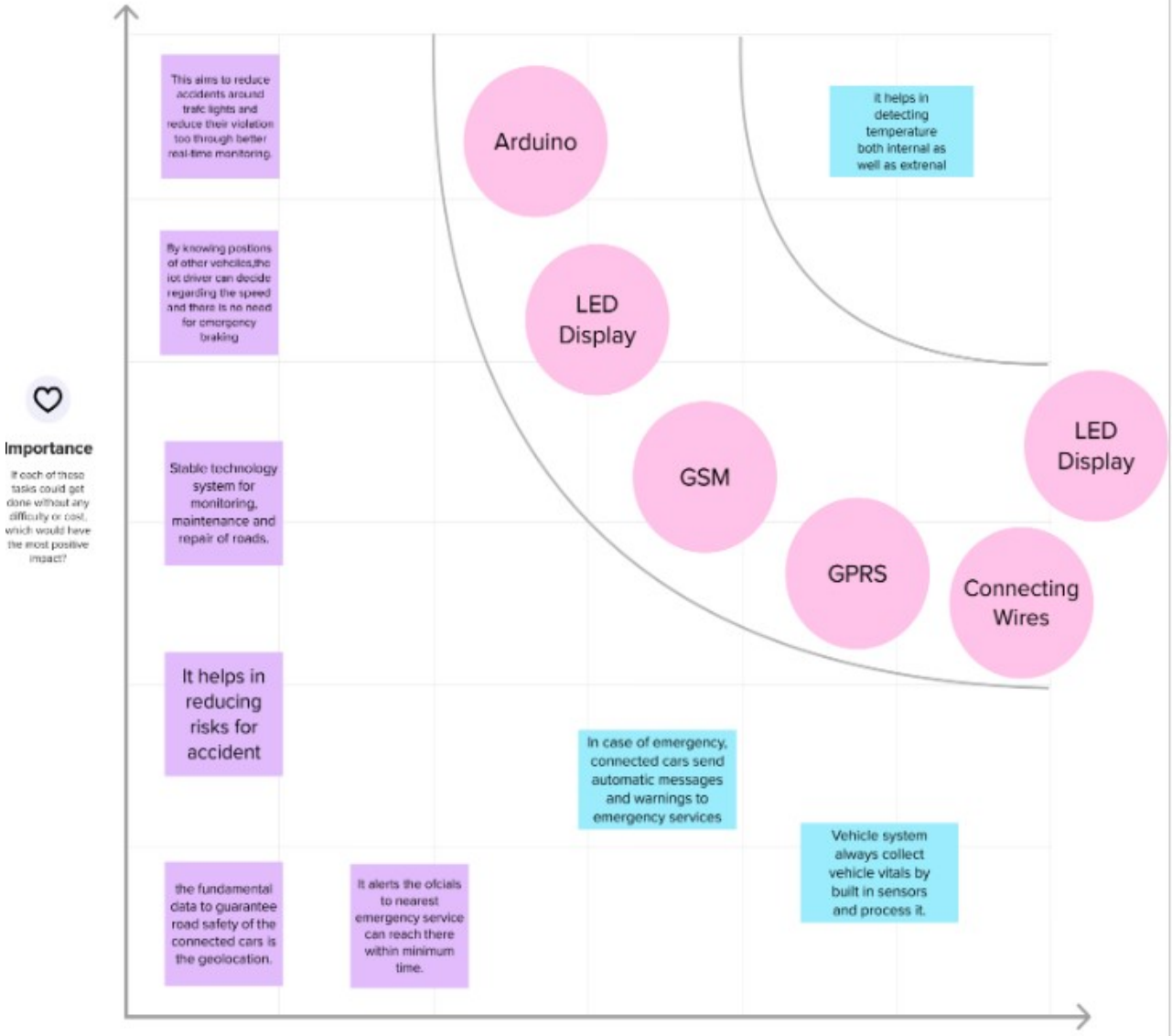


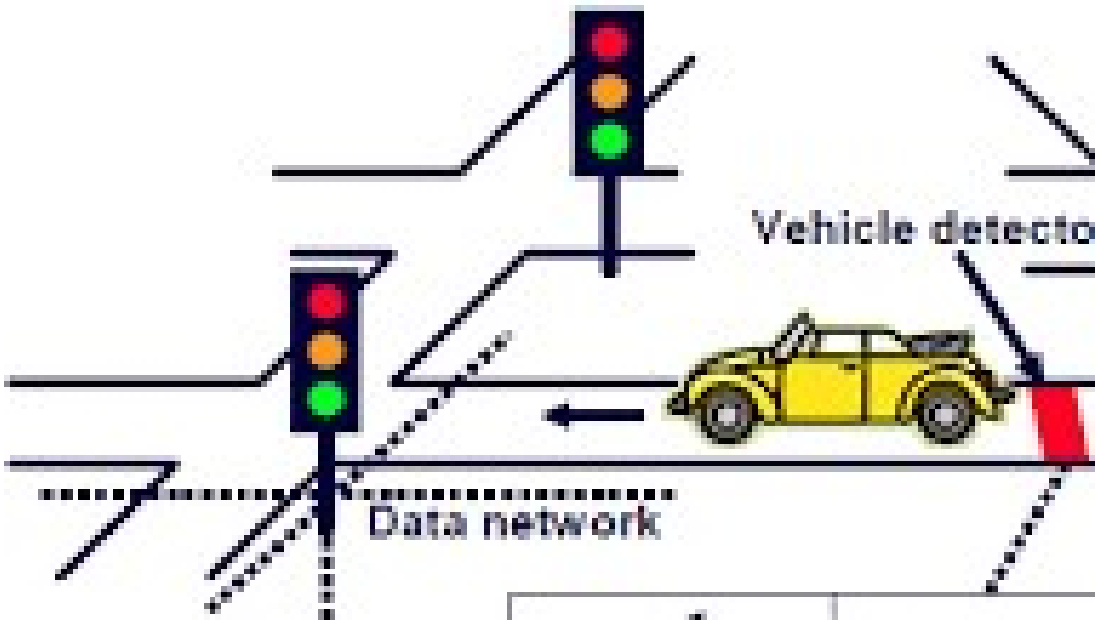
4

Prioritize

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

20 minutes





Some of the technology on and around roads has not seen the level of innovation demonstrated by the automobile itself. Examples of such technology include:

- Road Marks (introduced 1910s)
- Traffic Lights (1910-1920s)
- Traffic Signs (1910s)
- Cat's Eyes and Bott's Dots (1930s)
- Retroreflective sign paints (1939)

Smart Road Technology:

- Traffic monitoring
- Real-time monitoring
- Active transportation
- Future Road Technology
- Remote monitoring
- Autonomously driving cars

- **PROBLEM STATEMENT**

The National Highway Traffic Safety Administration has stated that hundreds of lives are lost annually to wrong-way crashes. Thousands of people sustain injuries in such accidents. Based on research and field tests performed by the Public Welfare Development (PWD), certain kinds of intelligent road indicators may effectively catch the attention of people driving the wrong way on a roadway. The indicators that were tested included blank indicators that light up when they detect the presence of wrong-way vehicles. Another type of sign was designed with lights that light up in an asynchronous manner. Once a driver is alerted by the lights and can see the “Wrong Way” lettering, that person can turn around and proceed in the correct direction. This could save numerous lives and prevent countless injuries.

So in this project we will replace the static signboards with smart connected sign boards. Also based on the traffic and fatal situations the diversion signs are displayed. Guide, Warning and Service signs are also displayed accordingly.

Different modes of operations can be selected and performed in the smart traffic sign board.

Problem Statement (PS)	USUAL SCHEDULE	But	REASON	SOLUTION..?	RESULT
PS-1	On my way to work	ROAD WORK AHEAD AND I AM LATE	Sign boards are dynamic and alternate route is not updated on time	Updating the sign boards with smart sign boards which will change dynamically	Now we have improved road safety and also whenever their is a collision ahead alternate route will be shown and we will never be late
PS-2	Walking in public cities	There are no proper signs which has to be controlled manually	sign boards are static	updating the sign boards so that the vehicles will be notified to slow down in a certain speed limit in busy cities	No we can be safer and no longer to be afraid of crossing the roads in public cities

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PROJECT DESIGN PHASE – I

PROPOSED SOLUTION

Title: Signs with Smart Connectivity for Better Road Safety
Problem statement: Signs with Smart Connectivity for Better Road Safety

Signs with Smart Connectivity for Better Road Safety

1. Updating smart sign boards:

The sign board are made digital instead of static. Considering different factors different dynamic sign can be displayed in the sign board.

2. Better road safety:

The conventional sign board does not create more effect on the roads which is easily avoid. Instead creating an smart connectivity sign board which indicates the current situation of the road which include traffic around the area, accident zone, any institute around the area ,hospital. This can achieve by sensing the condition of the area in an regular interval, creating an time based signal for the institute near area.

3. Installing smart signs everywhere:

The large-scale implementation of smart sign board will give better road safety and decrease the accident rate.

4. Improved conditions:

Based on weather, traffic diversion signs, guide signs and warning signs are displayed to the public to avoid and decrease accident rate**.**

5. Result:

The existing sign boards are replaced into digital sign boards and placed in the same location with better position and visibility. Traffic diversion are implemented with better route. Thus this model reduces the travel time and accident can be prevented.

PROBLEM SOLUTION FIT

1. CUSTOMER SEGMENT(S)

Who is your customer?
i.e. working parents of 0-5 y.o. kids

CS

- Drivers
- Passengers
- Highway Division

2. JOBS-TO-BE-DONE / PROBLEMS

Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.

- Reduce accidents
- Prevent traffic congestion
- Updates regarding diversions
- Speed limit during change in weather

3. TRIGGERS

TR

What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.

Poor weather condition prevails. The vehicle should move with threshold speed. The sensor value should be shown on the smart board to alert customer.

4. EMOTIONS: BEFORE / AFTER

EM

How do customers feel when they face a problem or a job and afterwards?
i.e. lost, insecure > confident, in control - use it in your communication strategy & design.

BEFORE: Irritated, frustrated, tensed
AFTER: Calm, relaxed

5. AVAILABLE SOLUTIONS

Which solutions are available to the customers when they face the problem

or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

- This project can withstand better than man made static signs.
- Along roadways, static signs with clear direction put as potential fixes which gives clear solutions

6. CUSTOMER CONSTRAINTS

What constraints prevent your customers from taking action or limit their choices
of solutions? i.e. spending power, budget, no cash, network connection, available devices.

- No money
- Lack of awareness about Technology
- Might think unnecessary

7. BEHAVIOUR

BE

What does your customer do to address the problem and get the job done?

i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

Directly related: Avoids over speed, follow traffic rules

Indirectly related: Advices to go slow, do not cause trouble to others

8. CHANNELS of BEHAVIOUR

CH

8.1 ONLINE

What kind of actions do customers take online? Extract online channels from #7

8.2 OFFLINE

What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.

8.1 ONLINE: Create awareness using social media, give information about diversions, weather predictions

8.2 OFFLINE: Follow traffic rules, be prepared for unfavorable weather conditions

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?
i.e. customers have to do it because of the change in regulations.

Customer have to do it because of

- Improper maintenance of roads
- Lack of update in current technology
- Carelessness

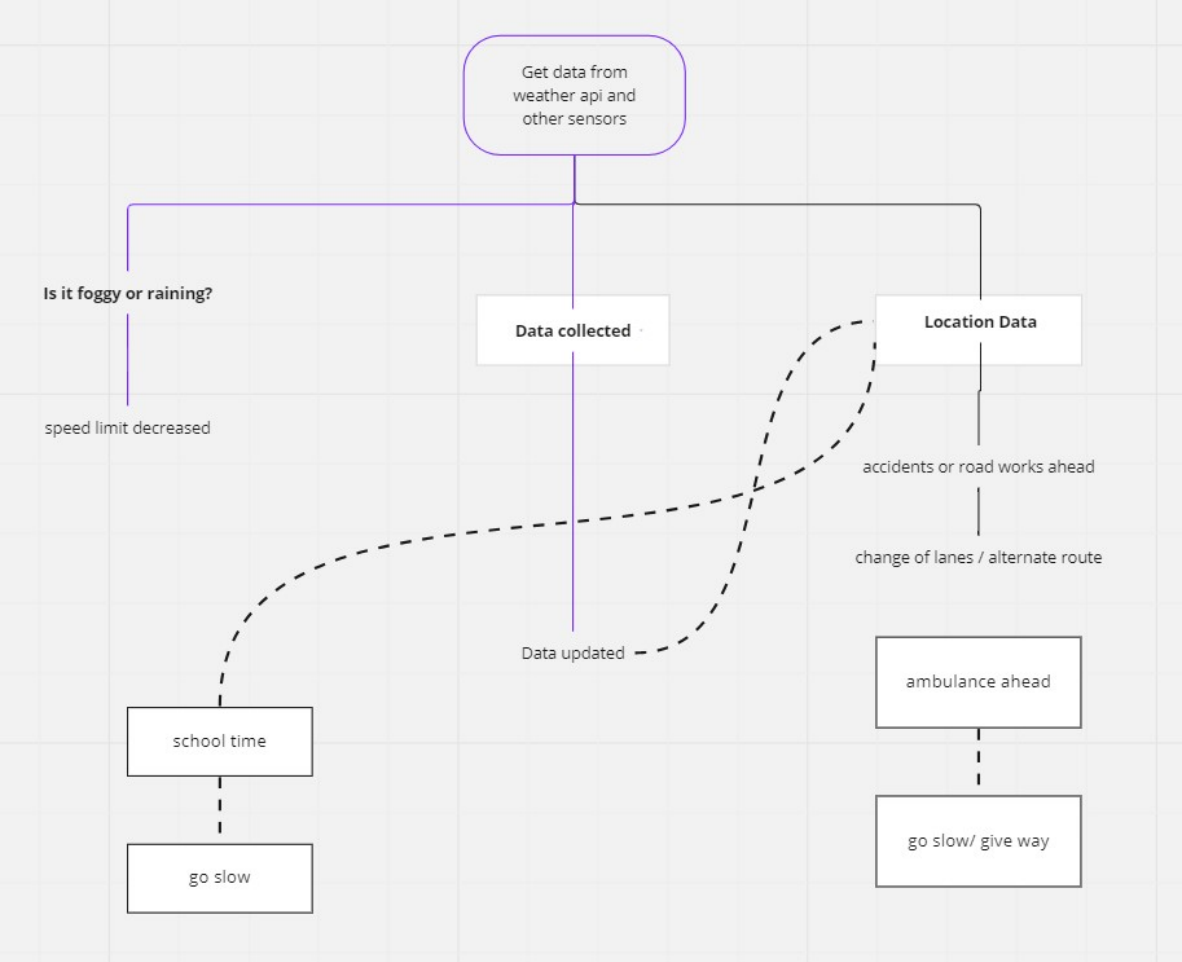
10. YOUR SOLUTION

SL

If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality.
If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.

We employ smart linked boards as an alternative to static signboards. With the help of weather app and weather API, these sign boards get automatically updated. The speed may increase or decrease in response to variations in weather. The diversion signs ae determined by traffic and potentially fatal situations.

SOLUTION ARCHITECTURE



The proposed solution can be further developed and tested using hardware. This solution helps improve the traffic light's ability to adapt to the traffic condition along with the adjustable mode to different conditions of use.

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PROJECT DESIGN PHASE – 2

SOLUTION REQUIREMENTS

- RAM-Minimum 4GB Processor-Min. Configuration OS-Windows/Linux/MAC
- 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 traffic 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.

FUNCTIONAL REQUIREMENTS

Functional Requirements:

Following are the functional requirements of the proposed solution. **FR No.**	**Functional Requirement(Epic)**	**Sub Requirement(Story/Sub-Task)**
FR-1	User Visibility	Sign Boards should be made with LED's which are bright colored and are placed in a position where it is attracted by the drivers but it should also not be too bright and distracting. The Board should not in a place which hides the part of road thus blinding cause it may lead to accidents.
FR-2	User Understanding	For better understanding of the driver, the signs should be repeated and it should in an order where the driver understands it properly. The sign should be in a symbol model thus the driver will understand without spending more time on it.
FR-3	User Convenience	The display should be big enough that it should even be visible from far distance clearly.

NON - FUNCTIONAL REQUIREMENTS

Non-Functional Requirements:

Following are the Non-Functional Requirements of the proposed solution **FR No.**	**Non-Functional Requirements**	**Description**
NFR-1	**Usability**	It should be able to update in a time interval using the sensor and based on the data provided and it should be easily upgradable because of the technical advancement so it will be feasible for the interpreter to implement the changes easily.
NFR-2	**Security**	The sign Board should be highly secured, no one should have a chance to access which may cause the sign board to give wrong signs .
NFR-3	**Reliability**	It should able to produce proper sign irrespective of the cause and sign board should not produce error.

DATA FLOW DIAGRAMS

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

TECHNOLOGY STACK

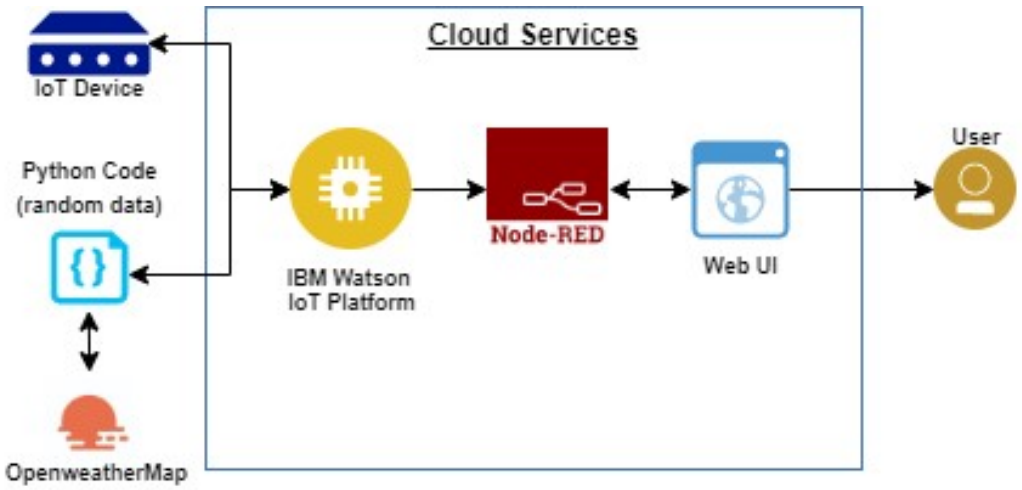

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App.	HTML, CSS, JavaScript / Angular Js
2.	Application Logic-1	Logic for a process in the application	Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson IoT Platform
4.	Application Logic-3	Logic for a process in the application	NODE-RED service
5.	Application Logic-4	Logic for a process in the application	Open Weather Map
6.	Database	Data Type, Configurations etc.	MySQL
7.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant
8.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
9.	External API-1	Purpose of External API used in the application	IBM Weather API,MQTT
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes

Table-2: Application Characteristics:

S .No	Characteristics	Description	Technology
1.	Open-Source Frameworks	There are no open-source framework in this application.	Python,NODE-RED
2.	Security Implementations	List all the security / access controls implemented, use of firewalls	Encryption
3.	Scalable Architecture	User are provided with traffic symbol online .Give awareness to road rules.	IBM cloud
4.	Availability	Controller recommendation ,Symbol ,Road rules , accident provided zones are available in applications.	IBM Waston Assistant
5.	Performance	Artificial Intelligence (AI) such as Machine Learning (ML) algorithms are very helpful to improve the performance of the overall road safety management.	AI such as Machine learning

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PROJECT PLANNING PHASE

PREPARE MILESTONE AND ACTIVITY LIST

MILESTONE AND ACTIVITY LIST (4 Marks)

Sprint	Functional Requirement (Epic)	UserStory Number	UserStory / Task	Story Points	Priority	Team Members
Sprint-1	IDE	USN-1	Installingall the softwares whichis requiredlike pythonIDE	2	High	Aneesh Abdul Rahman, Dhesika, Akash, Charugnathra
Sprint-1	Checking the simulation with conditions	USN-1	Simulating the circuits and experimenting	2	High	Aneesh Abdul Rahman, Dhesika, Akash, Charugnathra
Sprint-2	Software	USN-2	- IBM Watson Iot - Node Red Integration	2	High	Aneesh Abdul Rahman, Dhesika, Akash, Charugnathra
Sprint-2	Software	USN-2	Test the deviceand workflow.	2	High	Aneesh Abdul Rahman, Dhesika, Akash, Charugnathra
Sprint-3	Application Development	USN-3	Using MIT App Inventorcreatean App	2	High	Aneesh Abdul Rahman, Dhesika, Akash, Charugnathra
Sprint-3	Testing	USN-3	Testing theApplication.	2	High	Aneesh Abdul Rahman, Dhesika, Akash, Charugnathra
Sprint-4	WEB UI	USN-4	Userinterface with theSoftware	2	High	Aneesh Abdul Rahman, Dhesika, Akash, Charugnathra

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SPRINT DELIVERY PLAN

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Initializing resources	Create and initialize accounts in various public APIs like OpenWeatherMap API, Node-red, IBM cloud.	1	Low	Aneesh Abdul Rahman, Akash
Sprint-1	Local/Software run	Develop the Python code in which the test cases are provided like Weather, Traffic density, School timings	1	Medium	Aneesh Abdul Rahman, Dhesika S
Sprint-2	Dump the server/software to cloud	Dump the code from Sprint 1 to cloud so it can be accessed from anywhere	2	Medium	Charugnetra, aneesh , akash
Sprint-3	Initializing hardware	Integrate the hardware which is able to access the cloud functions and change the output based on the processed output	2	High	Aneesh, dhesika,charu
Sprint-4	UI/UX optimization and debugging	Optimize the hardware and software based on the and precision of the observed and make the system efficient	2	Low	Akash, dhesika,charu

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	9th Nov 2022	10 Nov 2022	20	10 Nov 2022
Sprint-2	20	6 Days	9th Nov 2022	10 Nov 2022	20	10 Nov 2022
Sprint-3	20	6 Days	9th Nov 2022	10 Nov 2022	20	10 Nov 2022
Sprint-4	20	6 Days	9th Nov 2022	10 Nov 2022	20	10 Nov 2022

PROJECT DEVELOPMENT PHASE

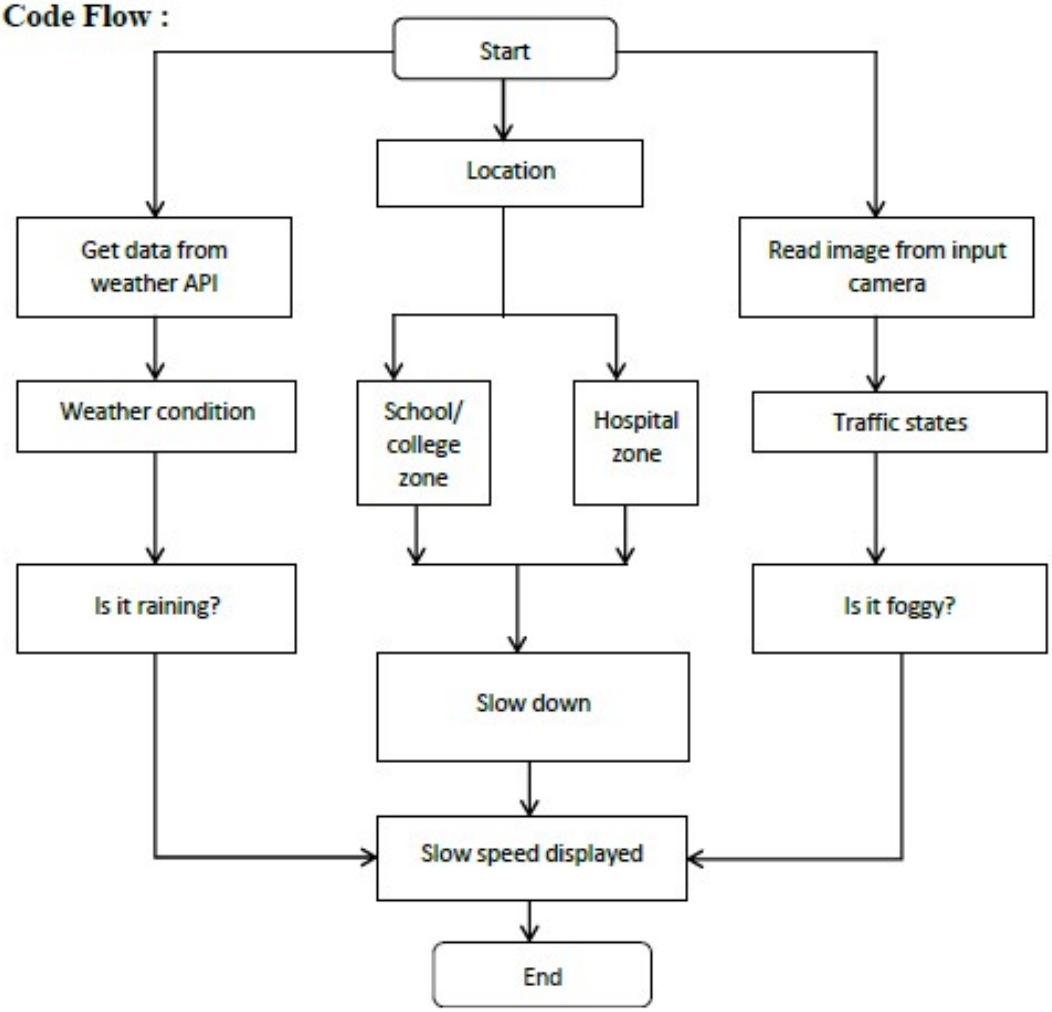
Sprint-1

Date	16th november 2022
Team ID	PNT2022TMID09925
Project Name	Signs with Smart Connectivity for Better Road Safety.

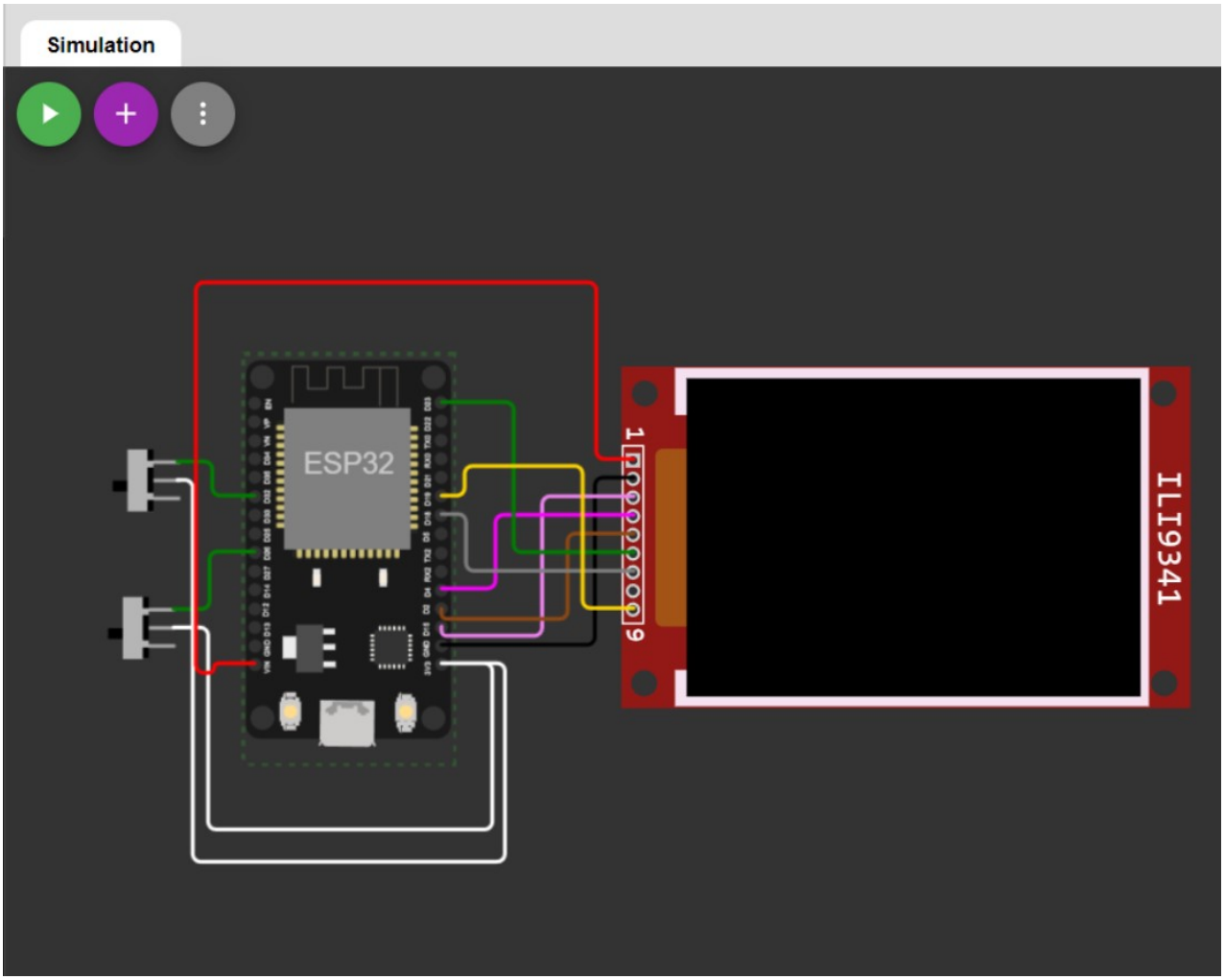
Sprint Goals :

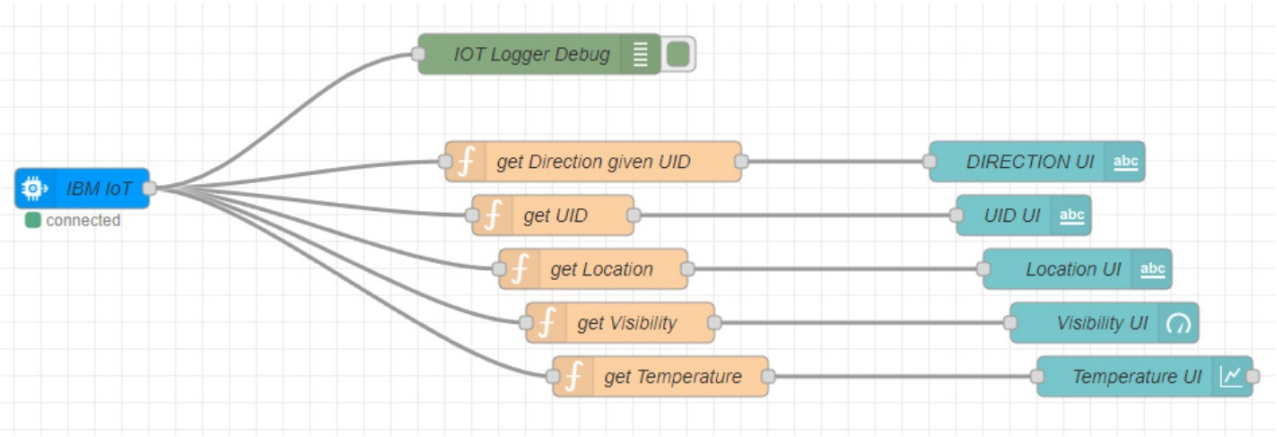
1. Create and initialize accounts in various publicAPIs like OpenWeather API.
2. Write a Python program that outputs results given the inputs like weather and location. 3. Extract data from OpenWeatherMap using APIs 4. Send the extracted data to the cloud.
5. Receive data from the cloud and view it in the python compiler.

Code Flow :



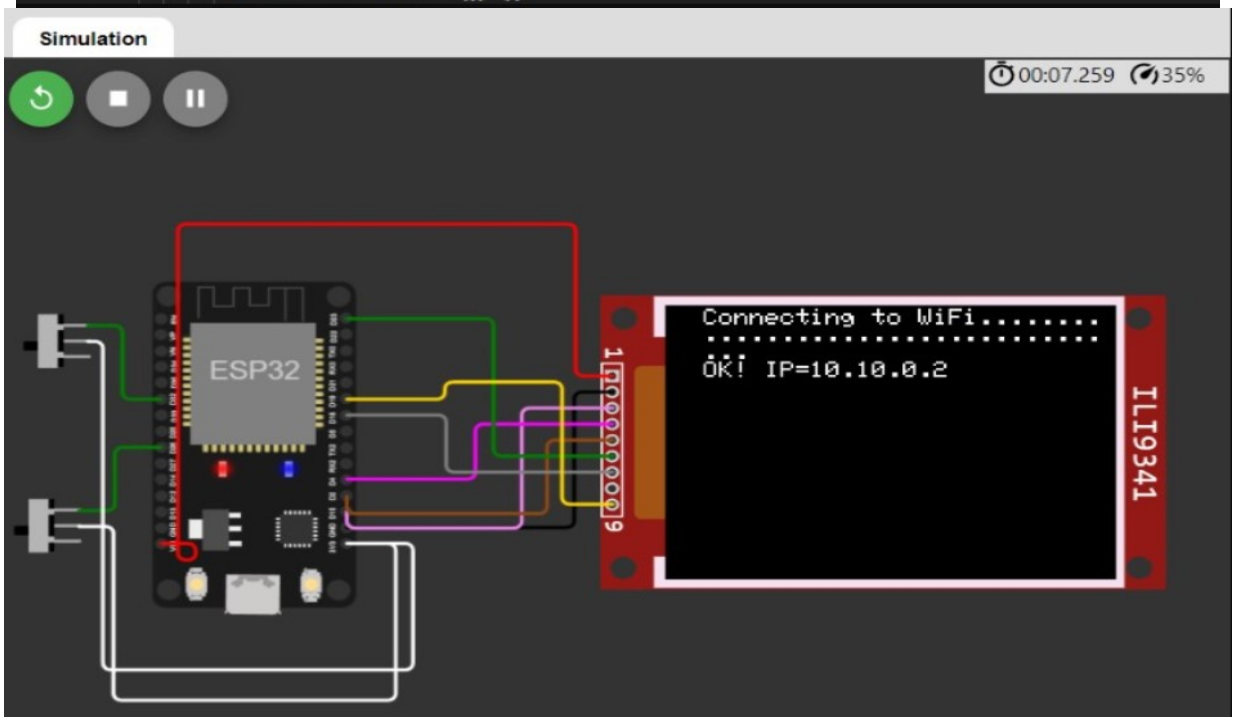
Sprint-3


Simulation
ESP32
ILI9341


IOT Logger Debug
IBM IoT
connected
get Direction given UID
get UID
get Location
get Visibility
get Temperature
DIRECTION UI
UID UI
Location UI
Visibility UI
Temperature UI

sketch.ino ● diagram.json ● libraries.txt Library Manager

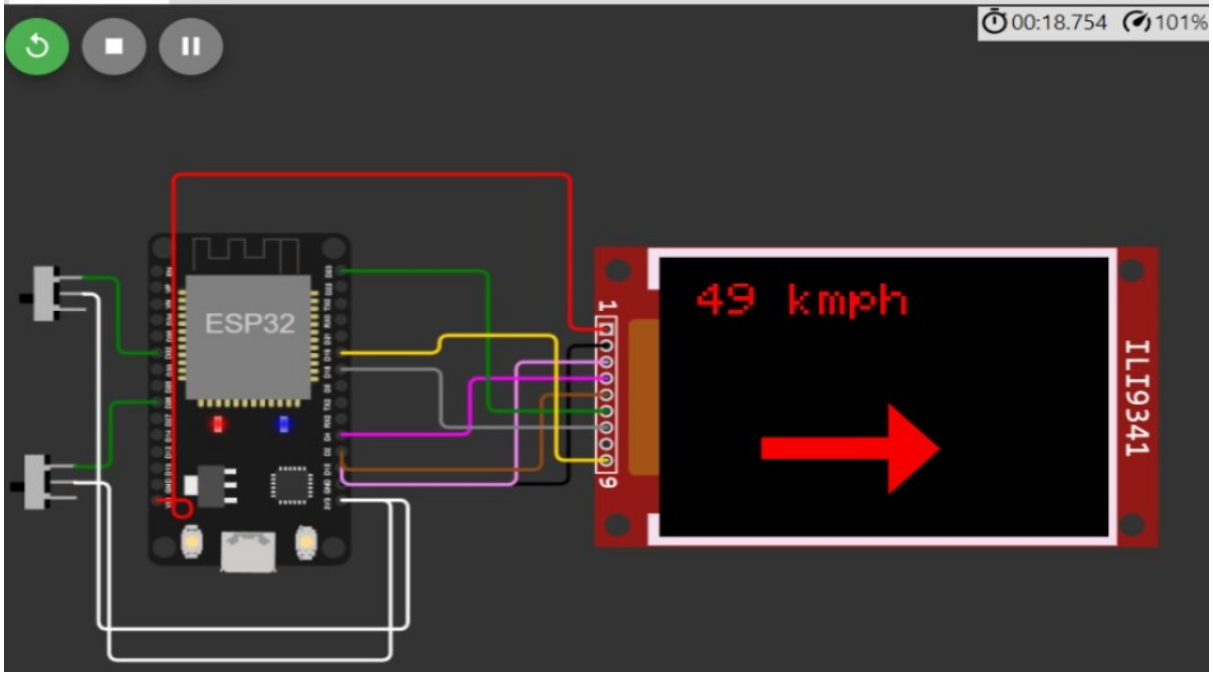
```
#include <WiFi.h>
#include <HTTPClient.h>
#include <Adafruit_GFX.h>
#include <Adafruit_ILI9341.h>
#include <string.h>

const char* ssid = "Wokwi-GUEST";
const char* password = "";

#define TFT_DC 2
#define TFT_CS 15
Adafruit_ILI9341 tft = Adafruit_ILI9341(TFT_CS, TFT_DC);

String myLocation = "Chennai,IN";
String usualSpeedLimit = "70"; // kmph

int schoolZone = 32;
int hospitalZone = 26;

int uid = 2504;

String getString(char x)
{
    String s(1, x);
    return s;
}

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



sketch.ino ● diagram.json ● libraries.txt Library Manager

```
#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_DC 2
#define TFT_CS 15
Adafruit_ILI9341 tft = Adafruit_ILI9341(TFT_CS, TFT_DC);

String myLocation = "Chennai,IN";
String usualSpeedLimit = "70"; // kmph

int schoolZone = 32;
int hospitalZone = 26;

int uid = 2504;

String getString(char x)
{
    String s(1, x);
    return s;
}

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

Simulation



Code

```
#include <WiFi.h>
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#include <Adafruit_GFX.h>
#include <Adafruit_ILI9341.h>
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const char* ssid = "Wokwi-GUEST";
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Adafruit_ILI9341 tft = Adafruit_ILI9341(TFT_CS, TFT_DC);

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int schoolZone = 32;
int hospitalZone = 26;

int uid = 2504;

String getString(char x)
{
```

```
    String s(1, x);
    return s;
}

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 = "";
    bool flag = 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-nwmrt-2022-11-04.eu-
gb.mybluemix.net/getSpeed?";
  url += "location="+myLocation+"&";
  url                                                    +=
"schoolZone="+(String)digitalRead(schoolZone)+(String)"&";
  url                                                    +=
"hospitalZone="+(String)digitalRead(hospitalZone)+(String)"
&";
  url                                                    +=
"usualSpeedLimit="+(String)usualSpeedLimit+(String)"&";
  url += "uid="+(String)uid;
  http.begin(url.c_str());
```

```
  int httpResponseCode = http.GET();

  if (httpResponseCode>0) {
    String payload = http.getString();
    http.end();
    return(payload);
  }
  else {
    Serial.print("Error code: ");
    Serial.println(httpResponseCode);
  }
  http.end();
}

void myPrint(String contents) {
  tft.fillScreen(ILI9341_BLACK);
  tft.setCursor(0, 20);
  tft.setTextSize(4);
  tft.setTextColor(ILI9341_RED);
  //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_WHITE);
  tft.setTextSize(2);
  tft.print("Connecting to WiFi");

  while (WiFi.status() != WL_CONNECTED) {
    delay(100);
    tft.print(".");
```

```
  }

  tft.print("\nOK! IP=");
  tft.println(WiFi.localIP());
}

void loop() {

  myPrint(APICall());

  delay(100);
}
```

Sprint Goals :

Objective :

Signs with smart connectivity for Better road safety

>> 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 traffic and fatal situations the diversion signs are displayed.

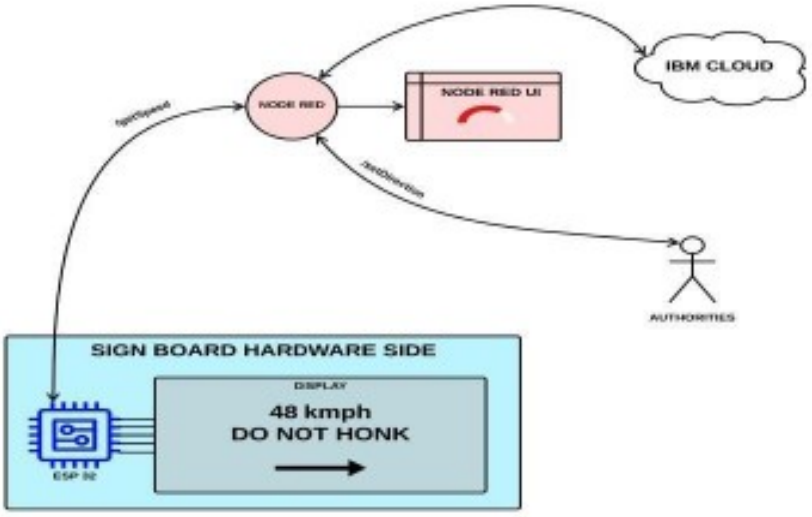
>> Guide(Schools), Warning and Service(Hospitals, Restaurant) signs are also displayed accordingly.

>> Different modes of operations can be selected with the help of buttons.

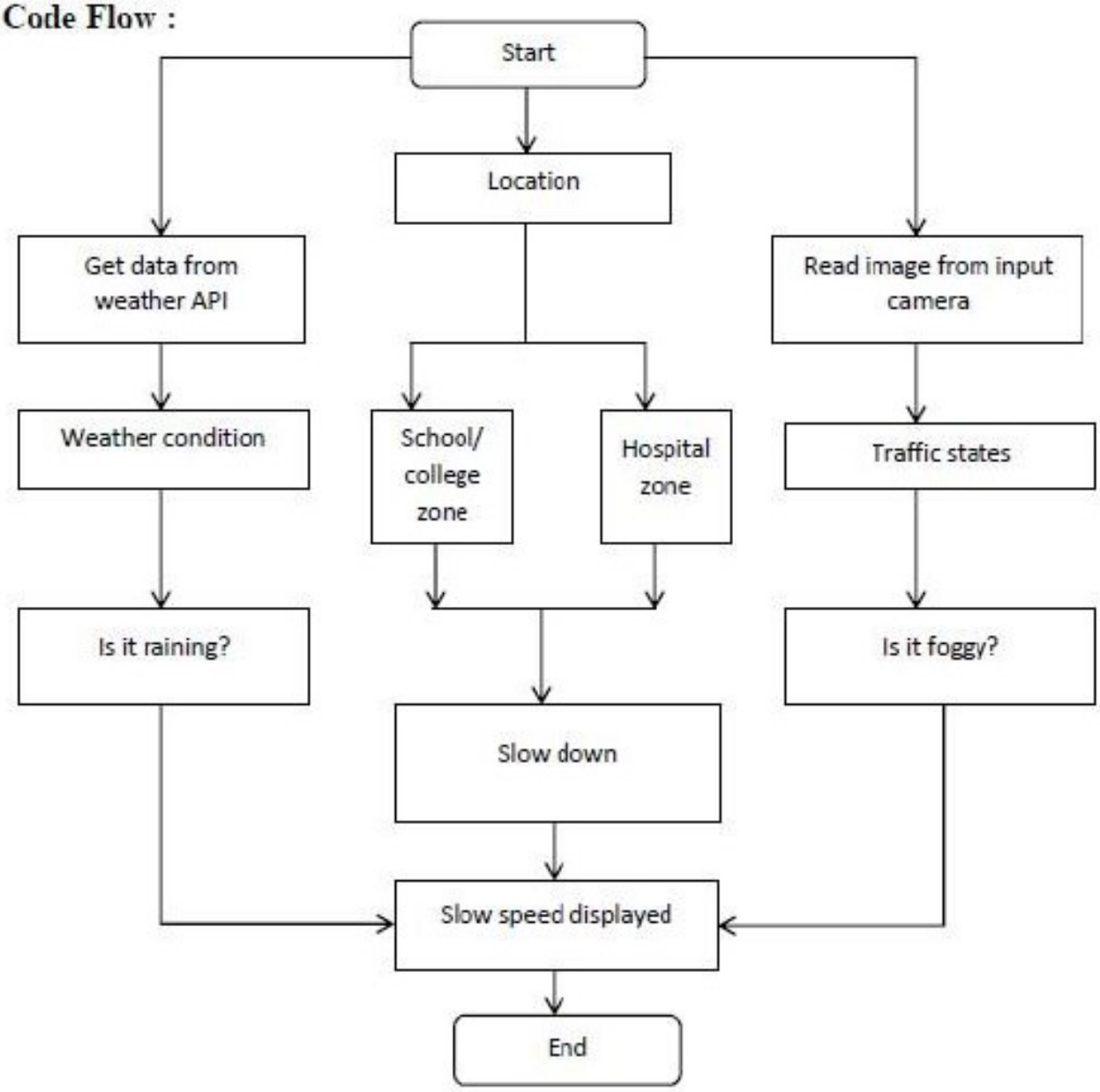
Sprint Goals :

1. Hardware & Cloud integration

Process Flow :



Code Flow :


Start
Location
Get data from weather API
Read image from input camera
Weather condition
School/ college zone
Hospital zone
Traffic states
Is it raining?
Is it foggy?
Slow down
Slow speed displayed
End

CONCLUSION

In this paper, with regards to IBM Watson IoT Platform and Node – Red, we showed the importance of delegating resources to the infrastructure in Smart Road Signs. We have also proposed an architecture of what these Smart Road Signs(SRS) are supposed to look like. This architecture will bring automation and intelligence to the road signage and would play an important role in Road Safety by providing more intelligent processes and automated systems.

In this paper we focused on how agents can support the collaboration between Smart Road Signs and Connected Vehicles. This will benefit our traffic system by Monitoring traffic, reporting incidents, so that these road signs can clear an alternative route and warn other drivers as soon as possible.

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