# SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

Done By

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*in partial fulfillment for the award of the degree of*

BACHELOR OF ENGINEERING

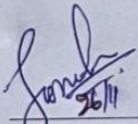IN  COMPUTER SCIENCE AND  ENGINEERING

# PERI  INSTITUTE OF TECHNOLOGY

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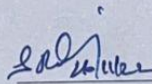
Certified that this report "SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY" is the bonafide work of S.LAKSHMI PRIYA(411519104039), HARSHINI RAJKUMAR (411519104026),HEMAVATHY.K(411519104027),SWETHA.C(4115 19104093) who carried out HX 8001 Readiness for Innovation, Employability and Entrepreneurship project offered by IBM and Anna University, Chennai.

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## NOVEMBER 2022

## BONAFIDE CERTIFICATE

Certified that this project report **"SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY"** is the bonafide work of b**Lakshmipriya S, Harshini Rajumar, Hemavathy K, Swetha C**

who carried out the projectwork under my supervision.

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# CONTENTS

# 1. INTRODUCTION:

In Global Status Report on Road Safety - 2015, the World Health Organization (WHO) noted that the worldwide total number of road traffic deaths has plateaued at 1.25 million per year, with tens of million either injured or disabled.

Different initiatives, such as the United Nations' initiativefor the 2011-2020. Decade of Action for Road Safety, have led to improvements in road safety policies and enforcements.
However, the WHO notes that the progress has been slow and has maintained the call for urgent action to reduce these circumstances.

Added to the losses in human lives and wellbeing, worldwide total number Consider able monetary losses are incurred in medical expenses, infrastructure repair, and production downtime. While the Worldwide figures have plateaued, the Global Status Report does indicate higher road fatalities and injuries in some countries. Such disparity, as noted and signals a barring-limitation in some countries to improve roadsafety by adopting solutions and need to implement.

Many governments and transport authorities understand the value of smart road technologies. However, developing smart city infrastructure at scale can be costly and complex. Leaders can break down smart road projects into phases, starting with low-investment, narrow-scale initiatives that can provide initial value, setting the stage for high-investment and large-scale efforts.

In the early days of motor-powered mobility, cars were available, but there was no suitable road infrastructure; the first private cars were hardly more effective than horse-driven wagons. Gradually, authorities recognized that only a major investment in road infrastructure would help the population reap the benefits of new transport technology.

## PROJECT OVERVIEW:

In this project we create an app with IoT features. The Internet of things (IoT) describes physical objects (or groups of such objects) with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. we need to enter device credentials with help of mail id or phone number or social media accounts and then we can see the weather condition in open weather

API (temperature, humidity); location; etc. In this project with help of IBM cloud, Nodered, MIT app inventor, python source code , etc are used for develop the app. Firstly we define the problem statement and analyse the steps how to solve. So to analysis these steps the methods are followed literature survey, empathy map, brainstorm, proposed solution , proposed solution fit, solution architecture, customer journey, data flow diagram, technology architecture, sprint delivery and with this the app is developed.

## PURPOSE:

Road accidents are defined as accidents that occurred or originated on a high way or street open to public traffic. These collisions result in injury or death between automobiles or humans. This is a major problem worldwide resulting in significant morbidity and mortality. This project proposes a system which has digital sign boards on which the signs can be changed dynamically. If there is rainfall or unexpected critical weather condition then the roads will be slippery and the speed limit would be decreased and it will be indicated in the app. There is a web app through which you can enter the data of the device credentials, location, and the other information. Then data is retrieved and display on the app like current weather condition, speed limits, etc which helpsRo the person to choose easy destination path. The purpose of this study was to develop a system that uses a smartphone to notify drivers about road signs ahead.

## 2. LITERATURE SURVEY:

A literature review is a survey of scholarly sources on a specific topic. It provides an overview of current knowledge, allowing you to identify relevant theories, methods, and gaps in the existing research. There are five key steps to writing a literature review: 1.Search for relevant literature

2.Evaluate sources

3.Identify themes, debates, and gaps

4.Outline the structure

5.Write your literature review

## 2.1 EXISTING PROBLEM:

In present system the road signs and speed limit play a vital role which are static. This leads to mislead in driving during critical situation that leads to accidents, etc.

Even some of the factor like weather conditions also promotes a way to rash driving and accidents. So to control this we need to replace static sign board with digital and create an app which displays an information and guide the driver to avoid unexpected situation and helps to reach destination.

## 2.2 REFERENCES:

1. Andrzej Czyżewski in his paper titled "Development of Intelligent Road Signs with V2X Interface for Adaptive Traffic Controlling", IEEE 2019, developed IOT based intelligent road signs capable of interacting with both the vehicles and other neighbouring sign boards using LORA. These sign boards were capable of communicating with one another and changing the speed limit based on traffic and weather.

2. Muhammed O. Sayin, Chung-Wei Lin, Eunsuk Kang, Shinichi Shiraishi & Tamer Basar in their paper titled "Reliable Smart Road Signs", IEEE 2019, proposed 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.

3. Cyberabad Traffic Police (2017)

It reveals some guidelines like, the maximum speed on Lane 1 and Lane 2 of the ORR will be 120 KM per hour and minimum speed will be 80 KM per hour. (Lane1 is the one closest to the central median) The maximum speed on Lane 3 and Lane 4 of the ORR will be 80 KM per hour and minimum speed will be 40 KM per hour. The minimum speed on ORR will be 40 KM per hour. No vehicle is permitted to travel on ORR below this speed. Faster moving vehicles should move in Right Lanes (Lane 1 and 2) and slow-moving vehicles should move in Left lanes (Lane 3 and 4) within the above speed ranges.

4. L.F.P. Oliveira, L.T. Manera, P.D.G. Luz in their paper titled "Smart Traffic Light Controller System", IEEE 2019, developed smart traffic lights capable of traffic accident detection enabling the enhancement of traffic light management systems, blocking and creating alternative routes to not only avoid the traffic jams, but also avoid new accidents.

5. Francis John Gichaga etal. Road Safety and Road Safety Audit in India:

A Review. ISSN: 2347 - 4718 This paper had reviewed the concept of the

road safety audit and its stages. Objective of the RSA is to evaluate ventures for potential mishaps end/lessening on the premise of road client learning, characteristics and aptitudes, day/night, wet/dry road conditions. It suggested on outline and before planning of agreement archives, to evaluate itemized intersection design, markings, signs, signals, lighting points of interest, Detail Design of junctions, Design of geometrics, Cross- fall Marking and Signs, Side drains, Embankment slopes, Presence of clear zone, Traffic Signals Lighting.

6. Dariusz Grabowski & Andrzej Czyzewski in their paper titled "System for monitoring road slippery based on CCTV cameras and convolutional neural networks", Springer Publications 2020, made use of Convolutional Neural Networks to identify slippery roads using CCTV cameras.

## 2.3 PROBLEM STATEMENT DEFINITION:

Problem defines that due static board it may or may not be visible to the drivers that leads to accidents and even during critical weather condition , the speed limits of drivers while driving varies frequently that may also leads to road accidents and even in some cases like road works may lead to road diversion and this causes delay to reach destination .To overcome this , we need to replace the static sign boards to smart connected sign boards or digitalised sign boards are need to be 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 that will be indicated to drivers. Based on the traffic and fatal situations the diversion signs in this project are alert message, buzzer sound are displayed

where it helps the driver to reach their destination at right time. While considering Guide (Schools), Warning and Service (Hospitals, Restaurant) signs which are located nearby means it is also indicated with help of location service and in meanwhile we can periodically view the traffic situation, weather condition and accordingly the speed limits will also varies. Like this, different modes of operations can be selected with the help of

app that has been created with device credentials and enter the particular details of location to check to it.

## 3 IDEATION & PROPOSED SOLUTION:

## 3.1 EMPATHY MAP CANVAS:

An **empathy map** is a collaborative visualization used to articulate what we know about a particular type of user. It externalizes knowledge about users in order to  1) create a shared understanding of user needs, and 2) aid in decision making.

Empathy maps are split into quadrants (*Says*, *Thinks*, *Does*, Hear, *Feels*), with the user.

Here with the help of quadrants the projects can be explained:

1. Say and Do:

- Improved control and safety can be achieved through IoT enabled cars.

- The modes or speeds could be changed if there is any network error using the button.

- Does this system helpful in real roads?

2. Hear:

- Is this project can withstand in different climate and weather conditions?

- Road traffic safety refers to the methods and measures used to prevent users from being killed or seriously injured . Does the board show correct speed limitations?

**3.** Think and feel:

- How does this system analyse the weather?

- Does this system will avoid accidents?

- Drinking alcohol and driving increases the risk of a crash

**4.** See:

- Replaced sign boards instead of static boards

- IoT is already working to ensure road safety

- Diversions sign in the board

5. Pain:

- Drivers should not horn endlessly or excessively

- When driving in reverse, you should make sure you do not cause annoyance

- Failure of signal due to electric power failure or any other cause confusion to road users

6. Gain:

- The speed limits and the direction would be shown . Always keep to

  your left.

- Opportunity to save lives through static sign boards.

## IDEATION AND BRAINSTORMING:

Ideation is the process of forming ideas from conception to implementation, most often in a business setting. Ideation is expressed via graphical, written, or verbal methods, and arises from past or present knowledge, influences, opinions, experiences, and personal convictions. Ideation is usually derived from brainstorming sessions, online forums, seminars, surveys, social media platforms, and team-building exercises. In this project the ideas are discussed and listed:

- It gives an accurate update on weather monitoring which gives an idea for IoT drivers in route finding and deciding speed limits.

- Suggestion of nearby crowded places such as schools, colleges, hospitals. •

  Weather report will be displayed in the sign board using the weather API.

- Traffic density can be viewed using GPS in mobile phone

## BRAINSTORM:

Brainstorm is defined as try to solve a problem or come up with new ideas by having a discussion that includes all members of a group and to discuss a problem or issue and suggest solutions and ideas. In this project the brainstorm ideas are discussed, listed and analysed in following manner:

Team member 1:

- Suggests speed limit while driving

- It helps in detecting temperature both internal as well as external

- Using IoT device, the accidents happened in the road can be alerted to the other drivers

- Weather monitoring using weather API

Team member 2:

- If vehicle speed is more than road speed limits than it generate user alert by buzzer

- It alerts about the upcoming accident prone zones

- Based on the weather the speed limit in the sign board may increase or decrease.

- Road diversion due to construction and traffic can be avoided

Team member 3:

- Traffic signals will change automatically by detecting the moving vehicles using sensors on the crosswalks.

- Landslide will be detected using the sensors placed in the mountain roads and alerted to the smart signed boards.

- Regulatory checks of the sign boards improve the reliability of the system

- Stable technology system for monitoring, maintenance and repair of roads.

Team member 4:

- We can digitalize the boards that can even more clearly visible to drivers.

- The fundamental data's to guarantee road safety of the connected vehicles is the geolocation.

- By knowing positions of other vehicles, the IoT driver can decide regarding the speed and there is no need for emergency braking.

- Cost efficient and user-friend.

## 3.3 PROPOSED SOLUTION:

Proposed solution should relate the current situation to a desired result and describe the benefits that will accrue when the desired result is achieved. In this project it describes the speed limit; weather condition; signs indication like buzzer and notify the message. Here the solutions are described for main six statements.

1. Problem Statement (Problem to be solved):

    *To replace the static sign boards, smart connected sign boards or digital sign board are used.

2. Idea / Solution description:

    * 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 limit. Based on the traffic, the diversion signs are displayed. Guide (Schools), Warning and Service (Hospitals, Restaurant) signs are also displayed accordingly

3. Novelty / Uniqueness:

    *    The weather and temperature details are obtained from the Open Weather Map API.

    \*  Using these details, the speed limit will be updated automatically in accordance with the weather conditions.

  4. Social Impact / Customer Satisfaction:

 \* Guide signs and warning signs are displayed to the public.

 \* If there is no traffic, Customer can reach the destination before the

  expected time.

  5. Business Model (Revenue Model) :

 \* Since APIs are used to actively monitor the customer's environment, this project employs a business strategy in which revenue will be generated on the basis of the length of time in which the customers actively interact with the product.

  6. Scalability of the Solution :

   \* It has greater chance in reducing the risk for the people as it is more visible than the normal signs, which saves a lot of lives at stake.

## 3.4 PROBLEM SOLUTION FIT:

  Problem-solution fit is a term used to describe the point validating that the base problem of the project and resulting in an app creation and that idea will be implemented and then the proposed solution where it actually solves the problem. The problem-solution fit is when-

- **Validate that the problem exists:** When validating the problem hypothesis using real-world data and feedback. That is, the information which is gathered from real users and used to determine, analysis and solve the problem.

- **Validate the solution that solves the problem.**

The problem-solution fit precedes the app development and forms the foundation upon which an information like speed limits, weather reports and location will be display using the device credentials. It helps to answer the customer queries. Here based on the problem stated and based on various analysis factors the following were stipulated and these are the main factor for considering and need to resolve it.

  **1. Defines Customer segment, Customer constrains, Available solutions:**

- Who is customer? -> pedestrians, cyclists, motorists, vehicle passengers and passengers of on-road public transport (mainly buses).

- What constraints prevent your customers from taking action or limit their choices of solutions?

-> site-level issues, such as crash patterns at intersections, curves, or corridors. ->The Vehicle should have digitally supported sensors which can be compatible with smart sign boards.

- 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?

->Along roadways, static signs with clear directions are put as potential fixes.

->Signs painted on walls and roads by corporation.

**2. Focus on the jobs what to be done/ problem; problem root cause; Behavior:**

- Which jobs-to-be-done (or problems) do you address for your customers?

->There could be more than one; explore different sides.

-> Damage of sign boards due to external or internal factors.
-> Possibility of malfunction of sensors placed in the smart sign boards.

- What is the real reason that this problem exists? What is the back story behind the need to do this job?

->Position of static sign boards is not visible and is inappropriate. There is no way to predict the weather in the desired destination through the static boards.

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

->As public use various routes for travelling, prediction of the desired routes should be on hand with the weather there.

->For above case, we need GPRS which could be modified to work under minimum internet connectivity.

3. Identify strong Triggers and emotion:

- What triggers customers to act?

-> Values show how important something is to us. They also help us make important personal decisions. We make buying decisions every day based on our values and judgments.

-> The smart sign is already implemented in some countries which triggers the customers.

- 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.

    ->The customers would able to know weather conditions in advance before reaching the destination location.

4. Extract online and offline channel behaviour:

- What kind of actions do customers take online?

    -> Videos, advertisements are made to educate the customers or public about the smart sign board.
    -> Online influencers can advertise the smart sign boards through their influencing medium.

- What kind of actions do customers take offline?

-> Necessary awareness program should be given to the public.

# 4  REQUIREMENT ANALYSIS:

The process of determining user expectations for a new or modified product. These features, called requirements that must be quantifiable, relevant and detailed. This is known as requirement analysis. Requirements analysis involves frequent communication with system users to determine specific feature expectations, resolution of conflict or ambiguity in requirements as demanded by the various users or groups of users. Here the requirement analysis splits into two types,

## 4.1 FUNCTIONAL REQUIREMENT:

A Functional Requirement (FR) is a description of the service that the software must offer. It describes a software system or its component. A function is nothing but inputs to the software system, its behaviour, and outputs. Based on user stories, the epic requirements are stated based on proposed problem statements.

| | |
|---|---|
| ● User Registration | ● Registration through mobile number (or) <br> ● Registration through Gmail |
| ● User Confirmation | ● Confirmation via Email <br><br> ● Confirmation via OTP |
| ● User visibility | ● Sign board should not be too distracting to cause accidents. <br> ● It should be made intense coloured LED's capable of attracting driver's attentions |
| ● User understanding | ● Should display information like images or illustrations with captions so that user can understand the signs correctly |
| ● User convenience | ● Speed could be predicted according to weather information |

# 1. __NON-FUNCTIONAL  REQUIREMENT:__

Non- functional Requirements (NFRs) define system attributes such as security, reliability, performance, maintainability, scalability, and usability. They serve as constraints or restrictions on the design of the system across the different backlogs. Also known as system qualities, non - functional requirements are just as critical as functional Epics, Capabilities, Features, and Stories. They ensure the usability and effectiveness of the entire system. Based on problem statement define this requirement analysis is stated as:

| Usability | Should be able to update periodically with respective time (weather) |
|-----------|---------------------------------------------------------------------|
| Security | Should be secure enough that users could access only after getting confirmation through email or OTP |
| Reliability | Should convey the traffic information correctly |
| Performance | Proper functioning of sign board according to weather condition |
| Availability | Should be available anytime and anywhere(app) |
| Scalability | Easily adaptable |

## 5. PROJECT DESIGN:

Project design is an early phase of the project lifecycle where ideas, processes, resources, and deliverables are planned out. A project design comes before a project plan as it's a broad overview whereas a project plan includes more detailed information. Here project is designed based on circumstances and preferences like Data Flow Diagrams; Solution & Technical Architecture; User Stories.

## 5.1 DATA FLOW DIAGRAM:
The flow of data of a system or a process is represented by Data flow diagram. It also gives insight into the inputs and outputs of each entity and the process itself.
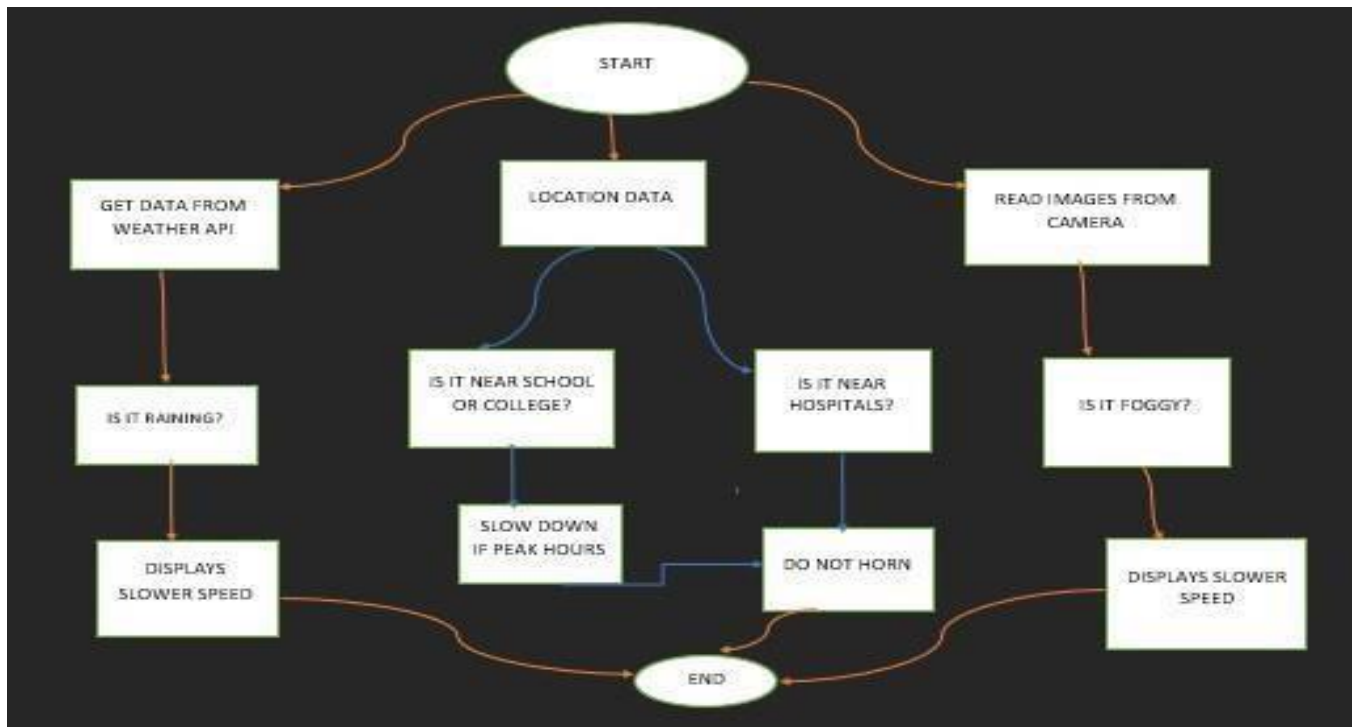
## SOLUTION & TECHNICAL ARCHITECTURE:
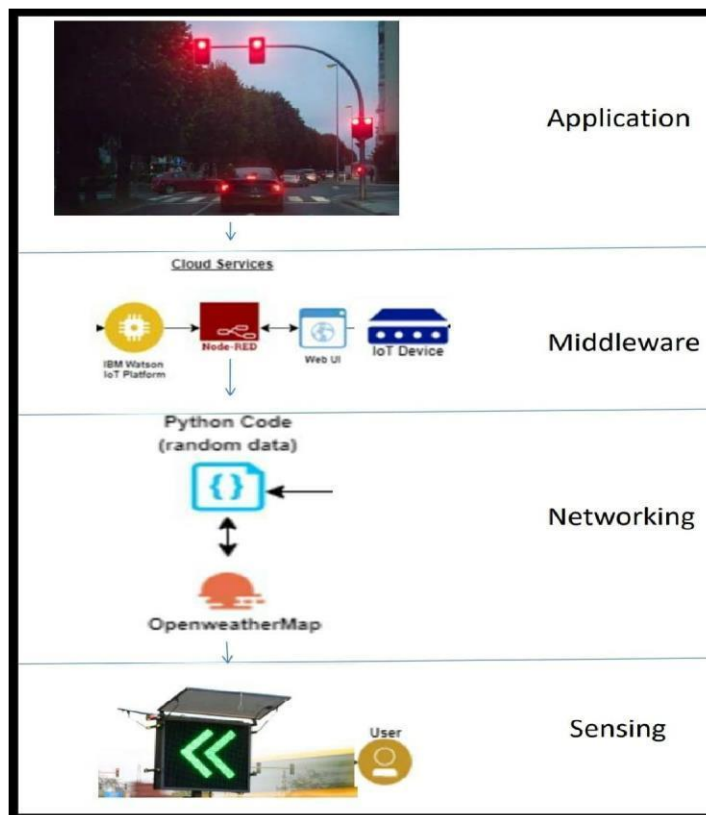


In this project the technical architecture is analysed through various categories and are discussed here

| S.No | Component | Description | Technology |
|------|-----------|-------------|------------|

| | | | |
|---|---|---|---|
| 1. | User Interface | How user interacts with application e.g. Mobile App | HTML, CSS, JavaScript / Angular Js / React Js etc. |
| 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 STT service |
| 4. | Application Logic-3 | Logic for a process in the application | IBM Watson Assistant |
| 5. | Database | Data Type, Configurations etc. | MySQL |
| 6. | Cloud Database | Database Service on Cloud | IBM DB2, IBM Cloudant etc. |
| 7. | File Storage | File storage requirements | IBM Block Storage or Other Storage Service or Local Filesystem |
| 8. | External API-1 | Purpose of External API used in the application | IBM Weather API, etc. |

**Application Characteristics:**

| S.No | Characteristics | Description | Technology |
|---|---|---|---|
| 1. | Open-Source Frameworks | List the open-source frameworks used | openweather API |
| 2. | Security Implementations | Strong security system that does not allow anyone without login credentials to enter the app | Firewall |
| 3. | Scalable Architecture | Easy to expand operating range | IoT |
| 4. | Availability | Available anytime and everywhere as long as user signed into the app | IBM Cloud |
| 5. | Performance | Supports large number of users to access the technology simultaneously | IBM Cloud |

# USER  STORIES:

A user story is an informal, general explanation of a software feature written from the perspective of the end user. Its purpose is to articulate how a software feature will provide value to the customer.

| User Type | Functional Requireme nt (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|---|---|---|---|---|---|---|
| Customer (Mobile user) | Registration | USN-1 | Speed limitation could be detected using weather application | I can receive speed limitations | High | Sprint-1 |
| | | USN-2 | As a user I can register for the application by entering {mail id or phone number}, password | I can receive confirmation email & click confirm | High | Sprint-2 |
| | | USN-3 | As a user, I can get my traffic diversion signs depending on the traffic status. | I can predict my traffic status ahead in my travel | Medium | Sprint-2 |
| | | USN-4 | As a user, I can control my speed according to weather conditions | I can increase or decrease my speed | High | Sprint-1 |
| | Login | USN-5 | As a user, I can login to open weather API by using login id and password | After entering the location the weather could be known | High | Sprint-2 |
| | User Profile | USN-6 | As a user application should be easily accessible , simple and understandable | I can access the application easily | High | Sprint-2 |
| Customer (Web user) | Data Centre | USN-7 | As a user, I can access the traffic, | I can find route to | Medium | Sprint-2 |

| | | weather condition | destination accordingly | | | |
|---|---|---|---|---|---|---|
| Customer Care Executive | | USN-8 | As a user, Help centre could be accessed at any time for any situations | Chat will be available at any time | Medium | Sprint-3 |
| Administrat or | Problem solving | USN-9 | As an official proper functionality of sign boards and customer care works can also be handle | Officials can monitor the sign board for better function at periodic intervals | Medium | Sprint-2 |

## 6 PROJECT PLANNING AND SCHEDULING:

Fundamentally, 'Project planning' is all about choosing and designing effective policies and methodologies to attain project objectives. While 'Project scheduling' is a procedure of assigning tasks to get them completed by allocating appropriate resources within an estimated budget and time-frame.

## 6.1 SPRINT PLANNING AND ESTIMATION:

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Poin ts | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | Resource initialization | USN-1 | Create and initialize accounts in various public APIs likeOpenWeather API | 2 | High | Lakshmi priya Harshini Hemavathy swetha |
| Sprint-1 | Software simulation | USN-2 | Write a python program that outputs results given the inputs in the form of weather and location | 1 | High | Lakshmi priya Harshini Hemavathy swetha |

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-2 | Pushing the softwareto cloud | USN-3 | Push the code fromsprint1 to cloudso that itcan be accessed fromanywhere | 2 | Low | Lakshmi priya Harshini Hemavathy swetha |
| Sprint-3 | Hardware initialisation | USN-4 | Integrate thehardware to be able to access thecloud functions and provide inputsto the same | 2 | Medium | Lakshmi priya Harshini Hemavathy Swetha |
| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
| Sprint-4 | UI/UX optimisation and debugging | USN-5 | Optimize all the shortcomings and provide better user experience | 1 | High | Lakshmi priya Harshini Hemavathy swetha |
|  |  |  |  |  |  |  |

## * Pro j ect Tracker , Velocit y& Burndown Chart:

| Sprint | Total Story Poin ts | Duration | Sprint Start Date | Sprint End Date (Planned) | Story Points Complet ed (as on PlannedE nd Date) | Sprint Release Date (Actual) |
|---|---|---|---|---|---|---|
| Sprint1 | 20 | 6 Days | 24 Oct 2022 | 29 Oct 2022 | 20 | 29 Oct 2022 |
| Sprint2 | 20 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | 20 | 05 Nov 2022 |
| Sprint3 | 20 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | 20 | 12 Nov 2022 |
| Sprint4 | 20 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | 20 | 19 Nov 2022 |

## Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

AV= sprint duration = $\underline{20}$ = 2 velocity

## Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies suchas Scrum.

However, burn down charts can be applied to any projectcontaining measurable progress over time.
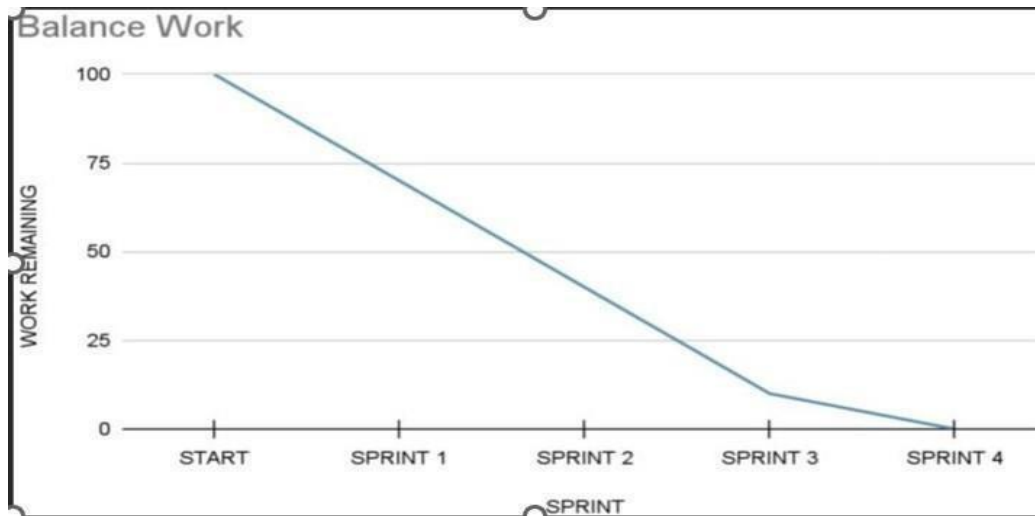


## 6.2 SPRINT DELIVERY SCHEDULE:

| TITLE | DESCRIPTION | SUBMISSION DATE |
|-------|-------------|-----------------|
| 1. Prerequisite | This section consider the followings should have an account creation and knowledge aboutusage:<br>*IBM CloudServices<br>*Software<br>*Create an accountin open weathermap API | 1November 2022 |
| 2.Ideation Phase | This section identifies the problem motive, find steps to solve | 30 September 2022 |

| | | |
|---|---|---|
| 2.1 Literature survey &Information Gathering | A literature review is a comprehensive summary of previous researches on the topic.The literature review surveys scholarly articles, books, and other sourcesrelevant to a particular areaof | 30September 2022 |
| | research. | |
| 2.2 Prepare Empathy Map | An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. It helps us to understand the customers'pain, gain and difficulties from their pointof view. | 30September 2022 |
| 2.3 Ideation – Brainstorming | Brainstorming is a group of problemsolving method that organize various ideas and thoughts from team members. | 30September 2022 |
| 3. Project Design Phase-1 | This section consider the dimensions of handling theproject through various methods: | 07October 2022 |

| | | |
|---|---|---|
| 3.1 Proposed Solution | It helped us analyze and examine our solution more in thegrounds of uniqueness, social impact,business model,scalability etc. | 4October 2022 |
| 3.2 Problem Solution Fit | It helped usunderstand and analyzeall the thoughts of our customer,their choice of options, problems, root cause, behaviour and emotions. | 08October 2022 |

| | | |
|---|---|---|
| 3.3 Solution Architecture | Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. It helped us understand the features and components used to complete the project. | 07October 2022 |
| 4.Project DesignPhase- 2 | This sectiontells about customer satisfaction | 17October 2022 |

| | | |
|---|---|---|
| 4.1 Customer Journey | It helped to analyse the various steps, interactions,goals and motivation, positives, negatives and opportunities. | 11October 2022 |
| 4.2 Functional Requirements | It briefs about functionaland non-functional requirements. It involvesthe various steps in the entire process. It also specifies features usability, security, reliability, performance, availability and scalability | 19October 2022 |

| | | |
|---|---|---|
| 4.3 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 wheredata is stored. | 12October 2022 |

| | | |
|---|---|---|
| 4.4 Technology Architecture | A tech stack is the combination of technologies a company uses to build and run an application or project. It helps us analyse and understand various technologies that needs tobe implemented in the project. | 17October 2022 |
| 5. ProjectPlan Phase | This section describes the project phase at each stages to analyse the growthwhere it is categorizedinto2 | 5 November 2022 |
| 5.1 Milestone and activity list | Helps us understand and evaluate our progress andaccuracy so far. | 5 November 2022 |
| 5.2 Sprintdelivery phase | Sprint Planning is an event in scrum that defines what can bedelivered in the upcoming sprint and how that work will be achieved.It helps us to organise andcomplete the workeffectively and efficiently. | 5 November 2022 |
| 6. ProjectDevelopment phase | This phase tells the project phasesinto 4 categories | 17 November 2022 |
| 6.1 Project Development Deliveryof phase-1 | Develop and submit the developed codeby testing it | 11 November 2022 |
| 6.2 Project Development Deliveryof phase-2 | Develop and submit the developed codeby testing it | 11 November 2022 |
| 6.3 Project Development Deliveryof phase-3 | Develop and submit the developed codeby testing it | 13 November 2022 |

| 6.4 Project Development Deliveryof phase-4 | Develop and submit the developed codeby testing it | 13 November 2022 |
|---|---|---|

# 7 CODING AND SOLUTIONING:

## FEATURE 1: ( IBM WATSON & NODE-RED)

import time import sys  import ibmiotf.application   import ibmiotf.device import random


#Provide your IBM Watson Device Credentials
organization     =     "8dxkha"       deviceType
 = "madhu" deviceId = "madhu" authMethod = "token" authToken
= "yah&46&uqf!k4Rq!n+"
#

Initialize GPIO temp=random.randint(20,50)  humid=random.randint(20,50)
lat =random.uniform(10.781377,10.78643)  lon =    random.uniform(79.781377,79.78643)  def myCommandCallback(cmd):print("Command received:


%s" % cmd.data['command']) print(cmd) try: deviceOptions = {"org": organization, "type":


deviceType, "id": deviceId, "auth-


method":  authMethod, "auth-token":
authToken}        deviceCli        =
ibmiotf.device.Client(deviceOptions)
#.............................................

except Exception as e: print("Caught exception connecting device: %s" %
str(e)) sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting"
10 times deviceCli.connect()   while

True:

    #Get Sensor Data from DHT11 data = {"d":{ 'temp' : temp,"lat":lat,"lon":lon}}  #print data

    def myOnPublishCallback():  print ("Published Temperature = %s C" % temp, "Humidity =

    %s %%" %humid, "to IBM    Watson")


    success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback) if not success:

```
        print("Not connected to IoTF") time.sleep(1) deviceCli.commandCallback
        = myCommandCallback

# Disconnect the device and application from the cloud deviceCli.disconnect()
```

```python
import time
import sys
import ibmiotf.application
import ibmiotf.device

#Provide your IBM Watson Device Credentials
organization = "8dxkha"
deviceType = "madhu"
deviceId = "madhu"
authMethod = "use-token-auth"
authToken = "yuhs46&uqf!k4Rq!n"

# Initialize GPIO

temp=60
pulse=70
oxygen= 30
lat = 17
lon = 18

def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    print(cmd)


try:
    deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)
    #..............................................

except Exception as e:
    print("Caught exception connecting device: %s" % str(e))
    sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
deviceCli.connect()

while True:
    #Get Sensor Data from DHT11

    data = {"d":{ 'temp' : temp, 'pulse': pulse ,'oxygen': oxygen,"lat":lat,"lon":lon}}
    #print data
    def myOnPublishCallback():
        print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % pulse, "to IBM Watson")
```

Ln: 12  Col: 31

---

madhukaruna68@gmail.com
ID: 8dxkha

Browse   Action   Device Types   Interfaces

**Add Device**

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

| Event | Value | Format | Last Received |
|-------|-------|--------|---------------|
| event_1 | {"temperature":29,"humidity":80,"speed":27,"vis... | json | a few seconds ago |
| event_1 | {"temperature":2,"humidity":58,"speed":29,"visi... | json | a few seconds ago |
| event_1 | {"temperature":27,"humidity":35,"speed":117,"v... | json | a few seconds ago |
| event_1 | {"temperature":14,"humidity":59,"speed":150,"v... | json | a few seconds ago |
| event_1 | {"temperature":6,"humidity":44,"speed":38,"visi... | json | a few seconds ago |

Items per page 50 ▼ | 1–1 of 1 item                    1 of 1 page   < 1 ▼ >

1 Simulation running

Project Objective (1).pdf    Project Objective.docx    Project Objective.pdf            Show all

Warning messages are displayed above

## FEATURE 2: (MIT APP INVENTOR)

## 8  TESTING:

The process of evaluating and verifying that a software product or application does what it is supposed to do. The benefits of testing include preventing bugs, reducing development costs and improving performance.

### 8.1 TEST CASES:

**NODE- RED URL:** https://node-red-ofofp-2022-11-10.eu-gb.mybluemix.net/ui
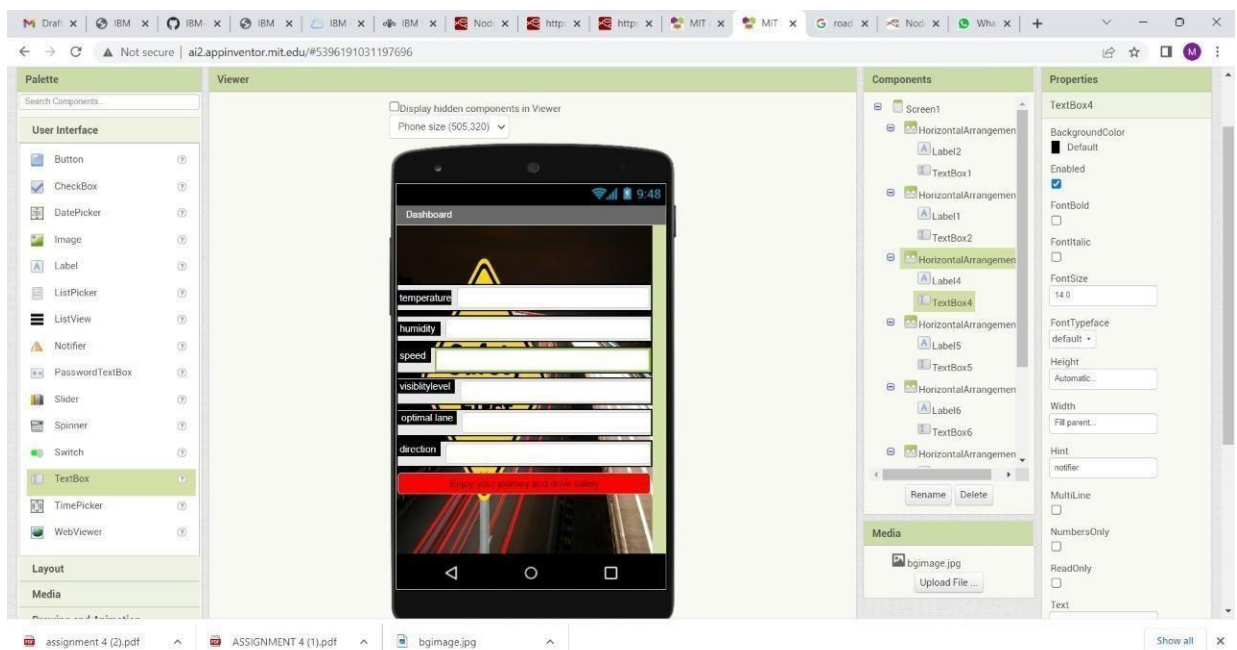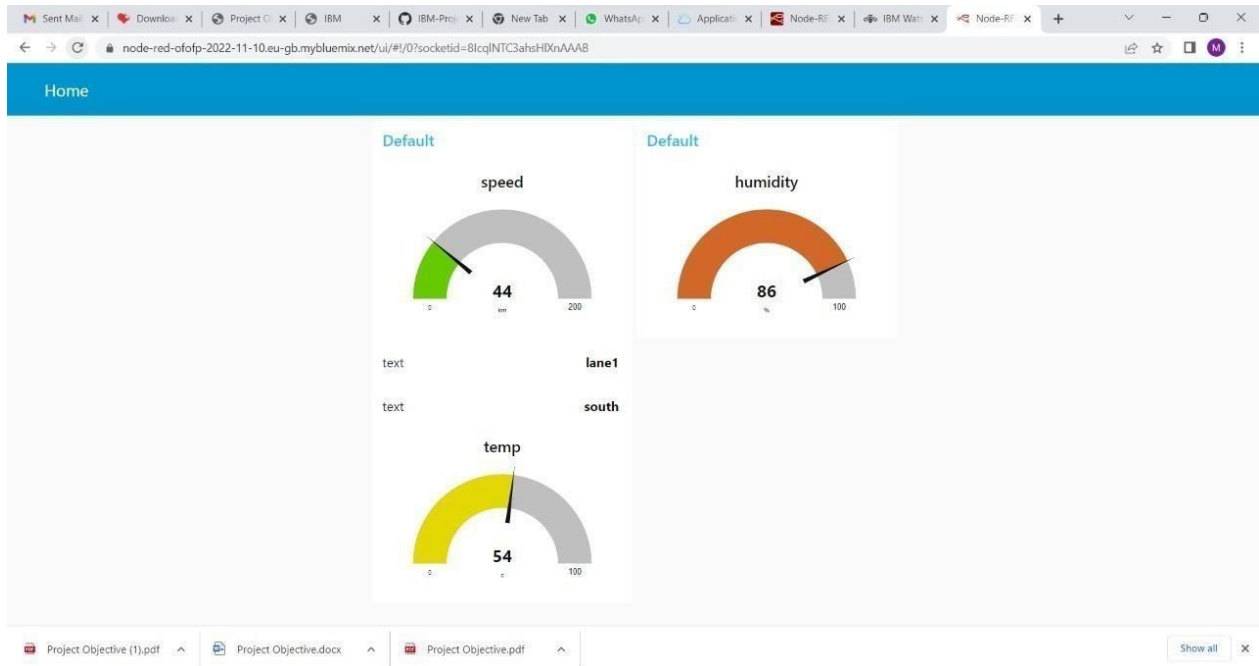
## URL LINK GIVEN AS INPUT TO MIT APP INVENTOR ARE GIVEN BELOW:

https://node-red-ofofp-2022-11-10.eu-gb.mybluemix.net/sensor https://node-red-ofofp-

2022-11-10.eu-gb.mybluemix.net/control **MIT APP INVENTOR SNAPSHOTS:**

**(FINAL OUTPUT)**

**TO SHOW DIFFERENCE IN SPEED AND OTHER PARAMETERS**

## 8.2 USER ACCEPTANCE TESTING:

**User Acceptance Testing (UAT)** is a type of testing performed by the end user or the client to verify/accept the software system before moving the software application to the production environment. UAT is done in the final phase of testing after functional, integration and system testing is done.

# 9 RESULT:
## 9.1 PERFORMANCE METRICS:

Performance metrics are defined as figures and data representative of an organization's actions, abilities, and overall quality. There are many different forms of performance metrics, including sales, profit, return on investment, customer happiness, customer reviews, personal reviews, overall quality, and reputation in a marketplace. Performance metrics can vary considerably when viewed through different industries.
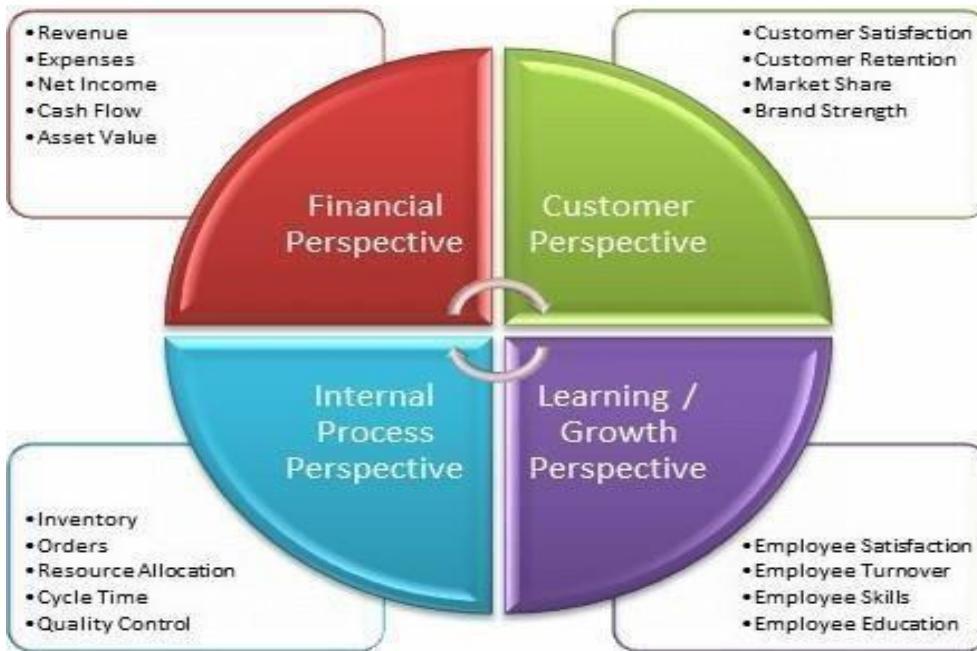
## 10 ADVANTAGES & DISADVANTAGES:

### ADVANTAGES:

● Reduces driving risks

● Improves your driving skills

● Accident free techniques

● Maximum protection

● No violation charges

● Less maintenance

● Save on insurance cost

### DISADVANTAGES:

● Increased traffic can increase carbon emissions and other pollution.

● Land use for roads can damage built and natural environment, impose mortality on wildlife if habitats are severed, and construction has associated environmental costs.

● Technical complexity

● Integration

## 11 CONCLUSION:

The chapters taken into account which includes the potential user of connected technologies : individual drivers, commercial drivers, pedestrians, cyclist and

motor cyclisist. The task force decided to studied first the potential of connected technologies in high and middle income countries. Indeed, middle income countries represent 72% of the world population, 80% of road traffic death and 47% of registered motorized vehicles, while high income countries are leader in development of connected vehicles. Since the road isn't said to be safe let's make it safer with the technologies present and available to us. The Internet of Things is one of the technologies that can lead us to travel on enhanced safe roads. So let's come together to create a better world with no accidents and a smart road for the future generation.

## 12 FUTURE SCOPE:
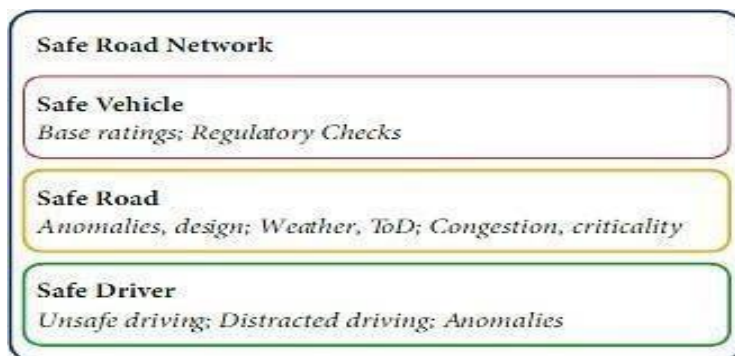


The future digital reality as follows with these technologies and ideas are :

1. Solar powered roadways
2. Smart Roads
3. Glow in the dark roads

4. Interactive lights
5. Traffic detection

## 13 APPENDIX:
### SOURCE CODE: import

time import sys import

ibmiotf.application import
ibmiotf.device import
random


#Provide your IBM Watson Device Credentials
organization     =     "8dxkha"     deviceType
 = "madhu" deviceId = "madhu" authMethod = "token" authToken
= "yah&46&uqf!k4Rq!n+"
#

```
Initialize GPIO temp=random.randint(20,50)
humid=random.randint(20,50)
lat =random.uniform(10.781377,10.78643) lon =  random.uniform(79.781377,79.78643)
def


myCommandCallback(cmd): print("Command received: %s" %


    cmd.data['command']) print(cmd) try: deviceOptions = {"org": organization,



"type": deviceType, "id": deviceId, "auth-



method":  authMethod, "auth-token":
authToken}          deviceCli          =
ibmiotf.device.Client(deviceOptions)
#............................................  except Exception as e:
print("Caught exception connecting device: %s" % str(e))
sys.exit()


# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting"
10 times

deviceCli.connect()   while

True:

    #Get Sensor Data from DHT11 data = {"d":{

    'temp' : temp,"lat":lat,"lon":lon}}

    #print data def myOnPublishCallback():
       print ("Published Temperature = %s C" % temp, "Humidity = %s %%" %humid, "to IBM
Watson")

    success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback) if not success:
    print("Not connected to IoTF")   time.sleep(1)
    deviceCli.commandCallback              =
    myCommandCallback


# Disconnect the device and application from the cloud deviceCli.disconnect()  GIT

HUB  LINK:
```

https://github.com/IBM-EPBL/IBM-Project-9156-1658984193