sign with smart connectivity for better road safety

Introduction

- 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 designhned a system to alert the driver about the speed limits in specific areas by reducing 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. 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.

- Purpose

The major purpose of this system are:

Create a system which gives alert about the speed limits in specific areas.

Create control side and vehicle side units whose controlls will be taken by a wireless area network.

LITERATURE SURVEY

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- 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.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.The standard measures used in assessing road safety interventions are fatalities and killed or seriously injured (KSI) rates, usually per billion (109) passenger kilometres.Vehicle speed within the human tolerances for avoiding serious injury and death is a key goal of modern road design because impact speed affects the severity of injury to both occupants and pedestrians.

- References

IoT is used in our system with Arduino Code and Node MCU controller with Blynk app .ArduinoDroid is a open source platform as a combination of software and hardware and Blynk

server is used to control the communications between smartphone and hardware.

Problem Statement Definition

Vehicle speed within the human tolerances for avoiding serious injury and death is a key goal of modern road design because impact speed affects the severity of injury to both occupants and pedestrians.

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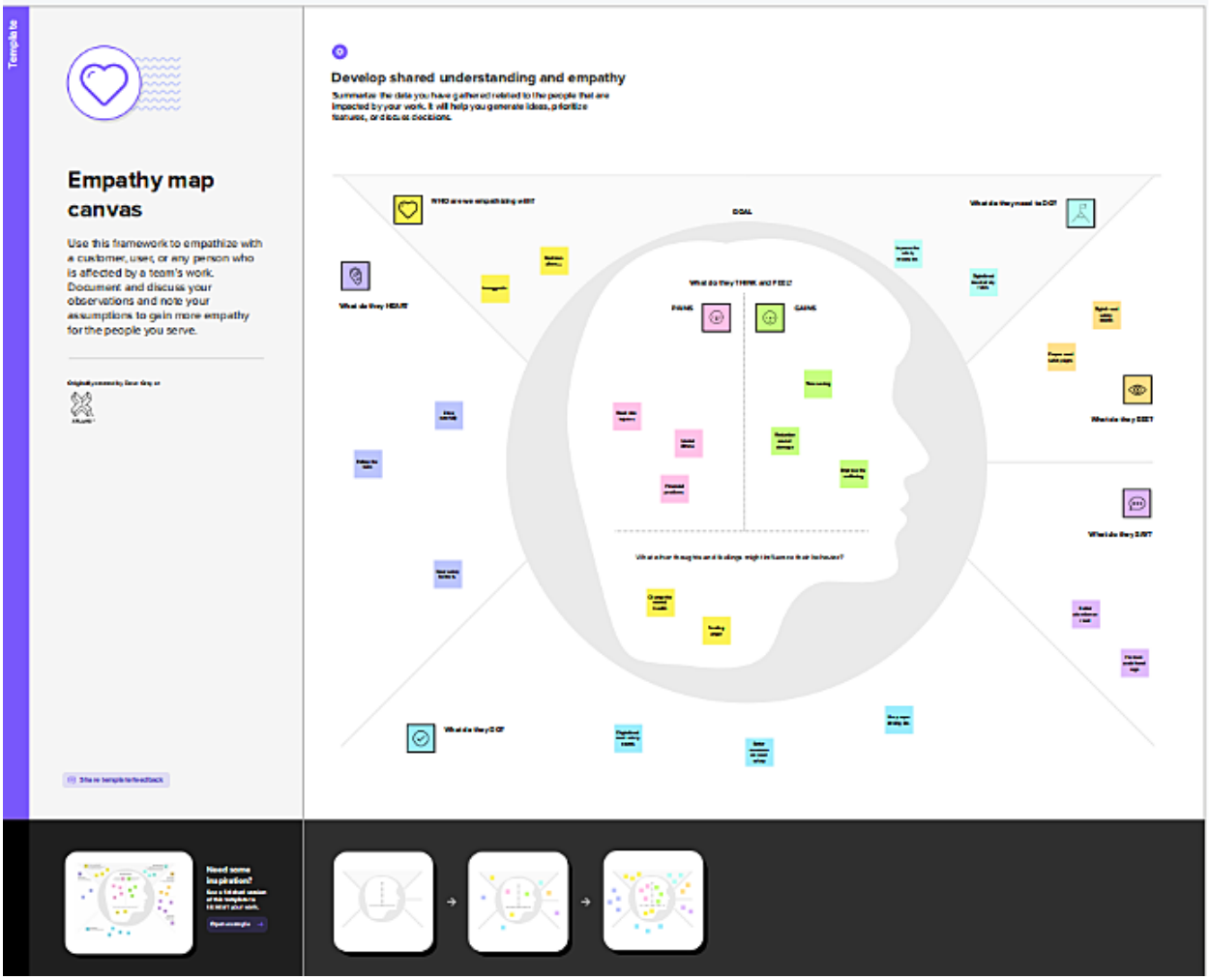
IDEATION & PROPOSED SOLUTION

- Empathy Map Canvas



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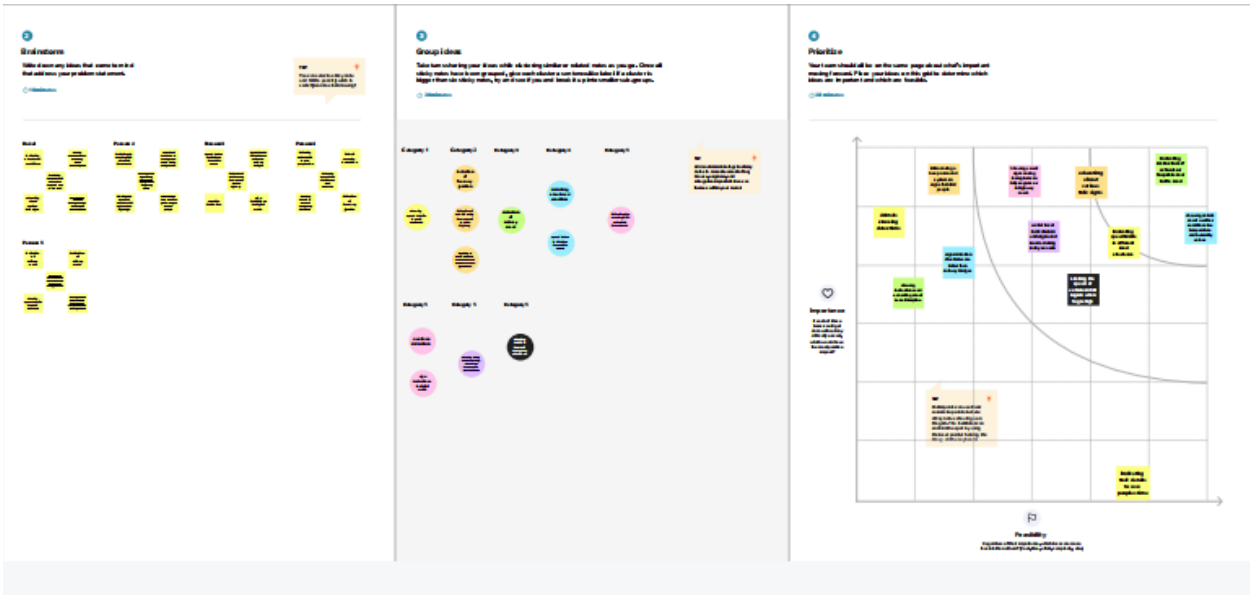
- Ideation &Brainstorming



- PROPOSED SOLUTION

I evaluate the proposed Road Safety system with the IoT connected technology.

I propose to use node MCUs connected with IoT which controls and limits the speed in some speci_c areas and GPS to get the exact location where the accident may occur

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S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Project - Signs with Smart Connectivity for Better Road Safety is used to educate the drivers digitally using IOT who do not have knowledge about traffic signs and weather indication for the drivers and passengers convenience.
2.	Idea / Solution description	Replacing the man made painted signs into digital as well as their name which is more visible compared to current signs and also indicating weather in the same sign boards for driver where weather is not predictable.
3.	Novelty / Uniqueness	Weather indication on sign boards is unique which will help mostly the two wheelers from unfortunate heavy rains and winds. Digital traffic signs also educates the drivers to follow traffic rules easily.
4.	Social Impact / Customer Satisfaction	It makes the people to know about traffic signs if they don't know ,it shows signs digitally to avoid the accidents and weather indication based on IOT to avoid accidents and it helps mostly for two wheeler passengers .
5.	Business Model (Revenue Model)	This project can make revenue by selling many equipments to the government sector and also private sectors(educational &medical institutions).Maintain services are also taken by the company.
6.	Scalability of the Solution	It makes the daily life of drivers and passengers better. The product can be scalable by adding new features to the product makes more revenue.

.

- PROPOSED SOLUTION FIT

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REQUIREMENT ANALYSIS

- FUNCTIONAL REQUIREMENT

In software engineering and system engineering, functional requirement de_nes function of

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asystem and its components. A function is described as a set of inputs, the behavior and outputs.Functional requirements may be calculations, technical details, data manipulation and processingand other speci_c functionality that de_ne what a system is supposed to accomplish. Behavioral requirements describing all the cases where the system uses the functional requirements arecaptured in use cases. Functional requirements are supported by non-functional requirements (also known as quality requirements), which impose constraints on the design or implementation(such as performance requirements, security, or reliability). Generally, functional requirementsare expressed in the form "system must do requirement", while non-functional requirements are"system shall be requirement". The plan for implementing functional requirements is detailedin the system design. The plan for implementing non-functional requirements is detailed inthe system architecture. As de_ned in requirements engineering, functional requirements specfy particular results of a system. This should be contrasted with nonfunctional requirementswhich specify overall characteristics such as cost and reliability. Functional requirements drive the application architecture of a system, while non-functional requirements drive the technicalarchitecture of a system.

- NON FUNCTIONAL REQUIREMENTS

In systems engineering and requirements engineering, a non-functional requirement (NFR) is arequirement that speci_es criteria that can be used to judge the operation of a system, ratherthan speci_c behaviors. They are contrasted with functional requirements that de_nespeci_cbehavior or functions. The plan for implementing functional requirements is detailed in the system design. The plan for implementing nonfunctional requirements is detailed in the systemarchitecture, because they are usually Architecturally Signi_cant Requirements. Broadly, functional requirements de_ne what a system is supposed to do and nonfunctional requirementsde_ne how a system is supposed to be. Functional requirements are usually in the form of "system shall do requirement", an individual action or part of the system, perhaps explicitlyin the sense of a mathematical function, a black box description input, output, process and control functional model or IPO Model. In contrast, non-functional requirements are in theform of "system shall be requirement", an overall property of the system as a whole or of a particular aspect and not a speci_c function. The system's overall properties commonly markthe di_erence between whether the development project has succeeded or failed. Non-functional requirements are often called "quality attributes" of a system. Other terms for non-functionalrequirements are "qualities", "quality goals", "quality of service requirements", "constraints" and "non-behavioral requirements".. Qualities|that is non-functional requirements|can bedivided into two main categories: Execution qualities, such as safety, security and usability, which are observable during operation (at run time). Evolution qualities,

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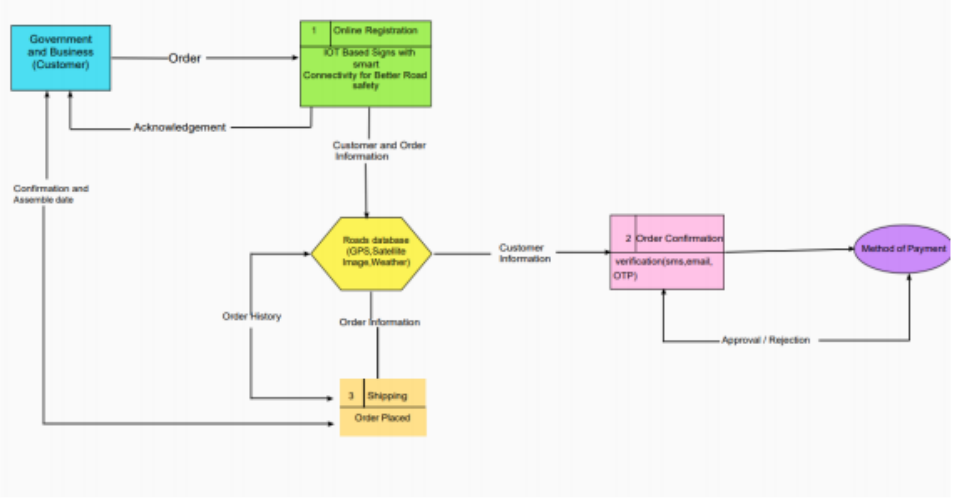
5.PROJECT DESIGN

GANTT chart is a graphical representation of the project. This chart shows the start and enddates of each activity in the project. It shows week, month or quarter required to complete eachactivity. It is also known as timeline chart. It shows information about activities in the formof horizontal bars. It is prepared on graph paper. In case if it is complex it is prepared usingapplication such as Microsoft Excel.In the First Phase of our project we want to prepare block diagram and circuit diagramof the system.It takes three weeks.After that we enter to case study and it tooks 5 weeks tocomplete.

- 5.1DATA FLOW DIAGRAMS



- 5.2 SOLUTION AND TECHNICAL ARCHITECTURE

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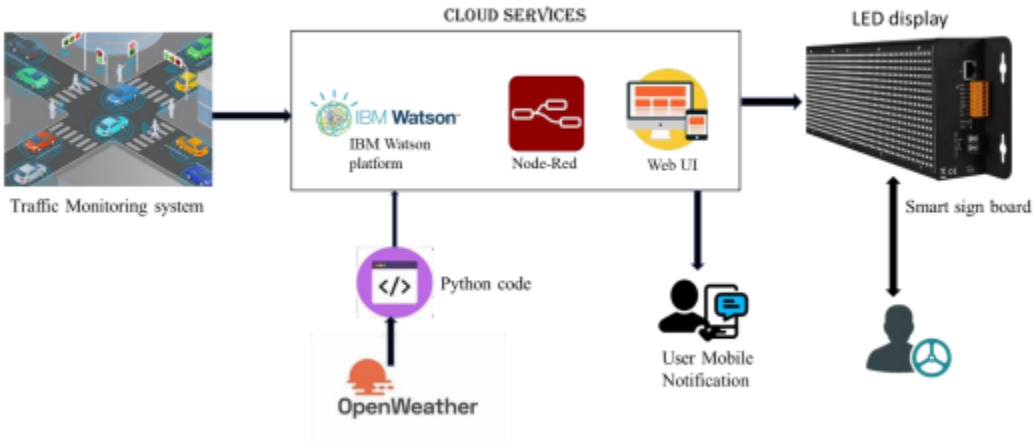

5.3 USER STORIES

The Internet of Things (IoT) is one of the fastest growing trends in technology. The growth is occurring in part because many different types of devices are being connected to the Internet. This includes everything from garbage barrels to home appliances, in the area known as the Consumer IoT (CIoT). It also includes many machines inside factories, and it affects all industries within the Industrial IoT (IIoT). The number of connected devices of computers, tablets, and mobile phones combined within the next five years.

6.PROJECT PLANNING &SCHEDULING

The early e_ects 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_rst phase.Despiteachieving the state-of-the-art performance, the existing systems su_er from two main problems,_ Over Speed

These systems cannot control speed at some speci_c zones. Exact location of accident occurs eventually

- ## 6.1 SPRINT PLANNING & ESTIMATION

Description This system will alert the driver about the speed limits in speci_c areas bywireless

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local area network.FunctionalRequirements Any vehicle entering the network zone cannot overcome the speed limit by the system. reducingthe speed of the vehicles in sensitive public zones without any interference of the drivers wherecontrols are taken automatically by the use of awireless local area network.FunctionalRequirements Any vehicle entering the network zone cannot overcome the speed limit by the system.

- 6.2 SPRINT DELIVERY SCHEDULE

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1		US-1	Create the IBM Cloud services which are being used in this project.	6	High	S.Rakul S.Vineesh M. Seetha Raman L. Pratheep Kumar S.Pyshone Mathew
Sprint-1		US-2	Configure the IBM Cloud services which are being used in completing this project.	4	Medium	S.Rakul S.Vineesh M.Seetha Raman L.Pratheep Kumar S.Pyshone Mathew
Sprint-1		US-3	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	5	Medium	S.Rakul S.Vineesh M.Seetha Raman L.Pratheep Kumar S.Pyshone Mathew
Sprint-1		US-4	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials.	5	High	S.Rakul S.Vineesh M.Seetha Raman L.Pratheep Kumar S.Pyshone Mathew
Sprint-2		US-1	Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform.	10	High	S.Rakul S.Vineesh M.Seetha Raman L.Pratheep Kumar S.Pyshone Mathew
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members

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Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2		US-2	Create a Node-RED service.	10	High	S.Rakul S.Vineesh M.Seetha Raman L.Pratheep Kumar S.Pyshone Mathew
Sprint-3		US-1	Develop a python script to publish random sensor data such as temperature, humidity,rain to the IBM IoT platform	7	High	S.Rakul S.Vineesh M.Seetha Raman L.Pratheep Kumar S.Pyshone Mathew
Sprint-3		US-2	After developing python code, commands are received just print the statements which represent the control of the devices.	5	Medium	S.Rakul S.Vineesh M.Seetha Raman L.Pratheep Kumar S.Pyshone Mathew
Sprint-3		US-3	Publish Data to The IBM Cloud	8	High	S.Rakul S.Vineesh M.Seetha Raman L.Pratheep Kumar S.Pyshone Mathew
Sprint-4		US-1	Create Web UI in Node-Red	10	High	S.Rakul S.Vineesh M.Seetha Raman L.Pratheep Kumar S.Pyshone Mathew
Sprint-4		US-2	Configure the Node-RED flow to receive data from the IBM IoT platform and also use Cloudant DB nodes to store the received sensor data in the cloudant DB	10	High	S.Rakul S.Vineesh M.Seetha Raman L.Pratheep Kumar S.Pyshone Mathew

- 6.3 REPORTS FROM JIRA

There are plenty of expensive solutions such as Polarion and IBM Doors which are commonly used by companies in automotive and aerospace, but these are out of reach of the typical startup. However, in the spirit of a startup hustle mindset, it is possible to“hack” a requirements management (RM) solution that gives you most of the power of the big boys without the price tag. One of the best solutions around is Jira Cloud from Atlassian. It provides some customisations and is startup friendly at only $10/month for less than 10 users. You can also get a server version (Jira Server), but we’ll focus on Jira Cloud today as this is the platform that is most used by start-ups.

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7.CODING AND SOLUTIONING

Good user interface design facilitates _nishing the task at hand without drawing unneces-sary attention to itself. Graphic design and typography are utilized to support its usability,inuencing how the user performs certain interactions and improving the aesthetic appeal of thedesign; design aesthetics may enhance or detract from the ability ofusers to use the functions ofthe Interface.The design process must balance technical functionality and visual elements (e.g.,mental model) to create a system that is not only operational but also usable and adaptable tochanging user needs.

- 7.1 FEAUTURE 1

A block diagram is a diagram of a system in which the principal parts or functions are represented by blocks connected by lines that show the relationships of the blocks..A cir-cuit diagram (electrical diagram, elementary diagram, electronic schematic)graphical representation of an electrical circuit. A pictorial circuit diagram uses simple images ofcomponents.Here we have Node MCU,GPS,APR module and bluetooth transmitter

- 7.2 FEATURE 2

Road side unit transmit the speed limit in the area using bluetooth transmitter.Speed limit information from road side unit is received by Vehicle unit using bluetooth receivernd produce a voice announcement for alerting the driver using APR module Accordingto the zonal details the vehicle speed will be reduced automatically controlling the motors for navigation.Once accident occurs, piezoelectric sensors in vehicle unit get activated andsend the information along with GPS location (When any accident occur, the system takes the location data using GPS Modem) to control room through IoT communication.Controlroom send the alert to the road side unit using IoT communication.Road side transmit theaccident information through bluetooth to the vehicles entering the accident zone.

- 7.3 DATA BASE SCHEMA

The system will alert the driver about the speed limits in speci_c 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. Any vehicle entering the

network zone cannot overcome the speed limit de_ned by the system. The system is capable of detecting the accidents and give noti_cation to the control room. The system operates in such way that the accident information is passed to the vehiclesentering the same zone to take diversion to avoid tra_c congestion

8.TESTING

In computer programming, unit testing is a software testing method by which individual unitsof source code, sets of one or more computer program modules together with associated controldata, usage procedures, and operating procedures, are tested to determine whether they are _t for use. In our system,_ Test to check whether block and circuit diagrams are well designed. _ Test to check whether hardware implementation work properly. _ Test to check whether the IoT connections are guaranteed.

• 8.1 TEST CASES

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

_ Check whether the system gives alerts.

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

• 8.2 USER ACCEPTANCE TESTING

A test plan documents strategy that will be used to verify and ensure that a product or system meets its design speci_cation and other requirements. A test plan is usually prepared by or with signi_cant input from the engineer.This document describes the plans for testing the architectural prototype of System. In my Project the system has to be tested to get the Desired Output.I use di_erent speedfor testing the system.

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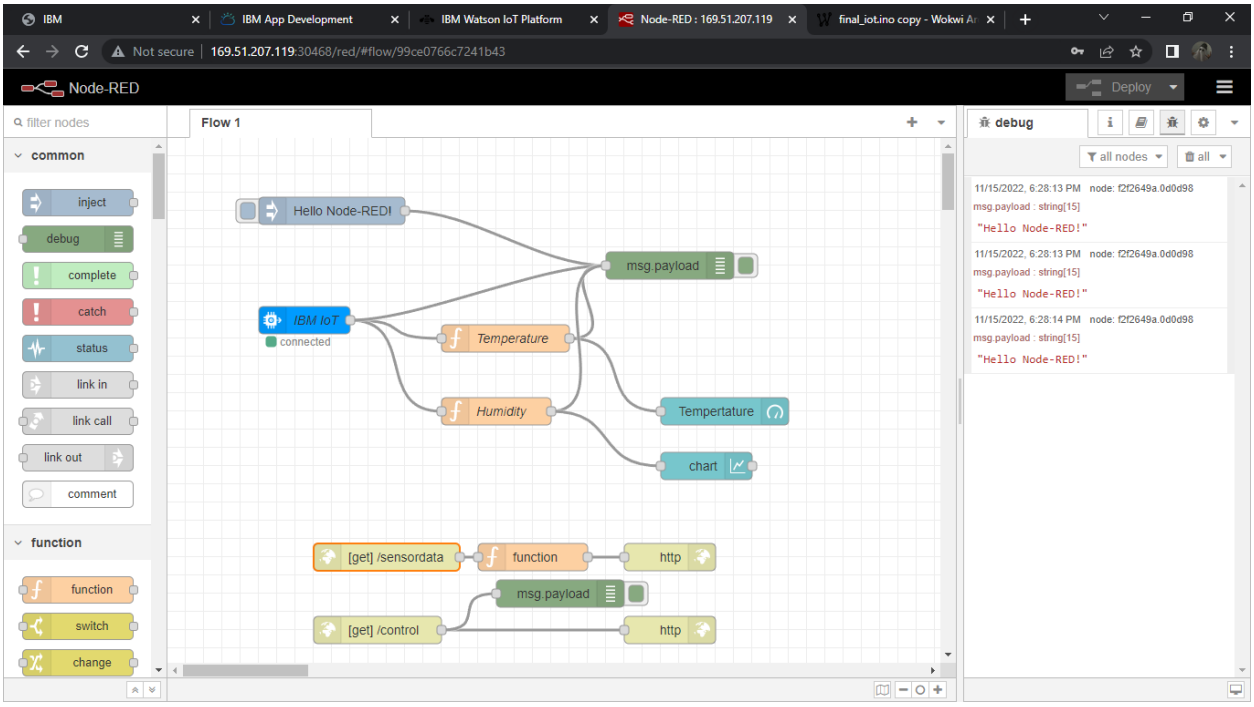
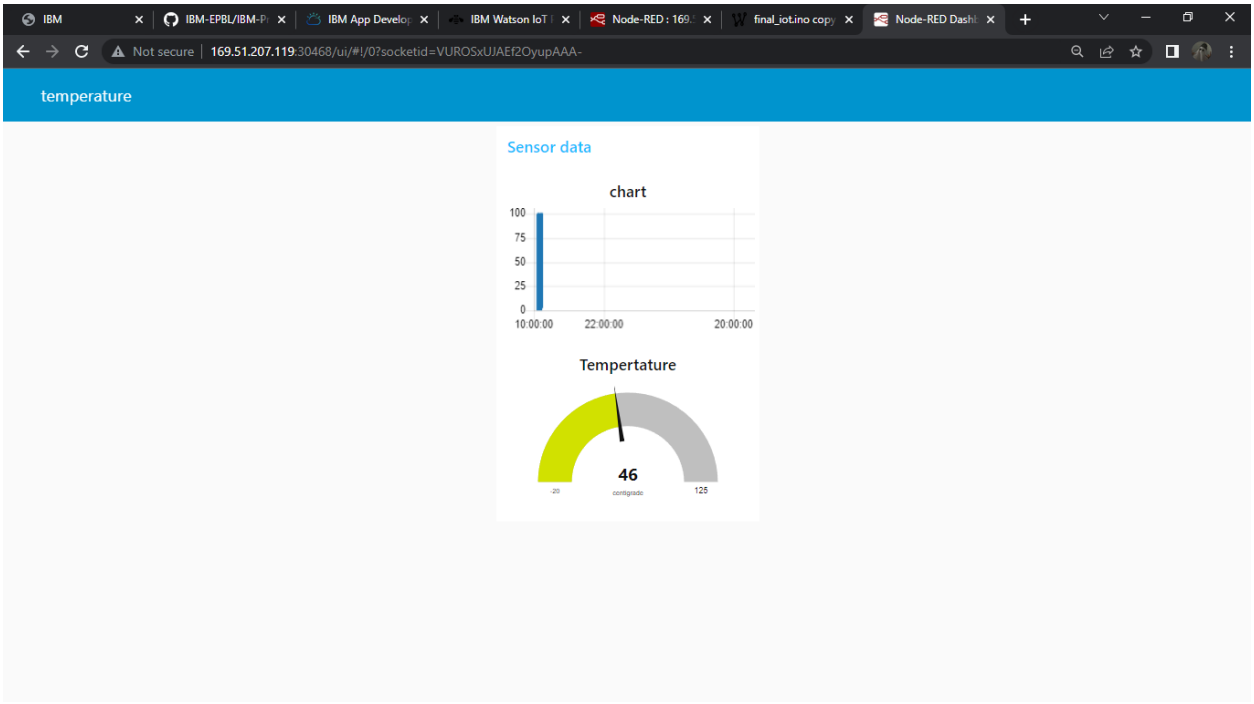
RESULTS





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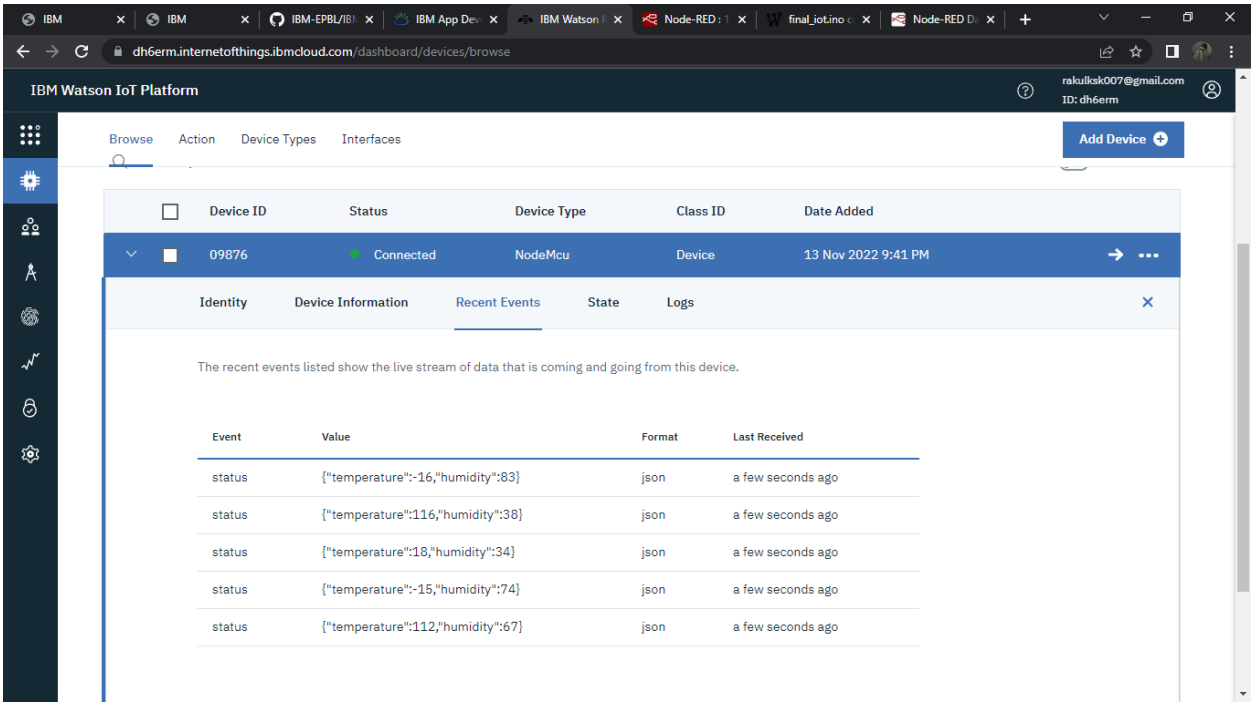

Advantages & Disadvantages

significantly reduce costs by reducing the number of drivers needed in logistics. In many countries in Europe, it is estimated that around 40% of total cost for road freight operators are categorised as driver costs. Infrastructure changes, such as developing, trialling and implementing smart roads, take considerable resources and investment. Due to the link to city infrastructure and legislation, infrastructure innovations are usually backed by government funding but can lack private investment.

Conclusion

The road is often overlooked when discussing the future development and digital transformation of the modern transport infrastructure. Afterall, we have all heard of connected cars, self-driving cars, gps navigation, route optimization apps and ride-hailing services. You would be forgiven for thinking how the common road fits into this digital revolution, as it turns

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out, the road itself can be a platform for an amazing array of innovations.

Roads can be upgraded with communication, lighting and power transmission technologies that can support sustainability, improve safety and efficiency which in turn will help transform the driving experience.

Source code ;

```
import wiotp.sdk.device
import time
import random
import ibmiotf.application
import ibmiotf.device
import requests, json
myConfig = {
#Configuration
"identity": {
"orgId": "dh6erm",
"typeId": "NodeMCU",
"deviceId":"09876"
},
#API Key
"auth": {
"token": "12345678"
}
}
#Receiving callbacks from IBM IOT platform
def myCommandCallback(cmd):
print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
m=cmd.data['command']
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()#OpenWeatherMap Credentials
BASE_URL = "https://api.openweathermap.org/data/2.5/weather?"
CITY = "Salem, IN"
URL = BASE_URL + "q=" + CITY + "&units=metric"+"&appid=" + "f58e4720c739a54c439aba9b05176839"
while True:
response = requests.get(URL)
```

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```
if response.status_code == 200:
data = response.json()
main = data['main']
temperature = main['temp']
humidity = main['humidity']
pressure = main['pressure']
report = data['visibility']
#messge part
msg=random.randint(0,5)
if msg==1:
message="GO SLOW, SCHOOL ZONE AHEAD"
elif msg==2:
message="NEED HELP, POLICE STATION AHEAD"
elif msg==3:
message="EMERGENCY, HOSPITAL NEARBY"
elif msg==4:
message="DINE IN, RESTAURENT AVAILABLE"
elif msg==5:
message="PETROL BUNK NEARBY"
else:
message=""
#Speed Limit part
speed=random.randint(0,150)
if speed>=100:
speedMsg=" Limit Exceeded"
elif speed>=60 and speed<100:
speedMsg="Moderate"
else:
speedMsg="Slow"
#Diversion part
sign=random.randint(0,5)
if sign==1:
signMsg="Right Diversion"
elif sign==2:
signMsg="Speed Breaker"
elif sign==3:
signMsg="Left Diversion"
elif sign==4:
signmsg="U Turn"
else:
signMsg=""
#Visibility
```

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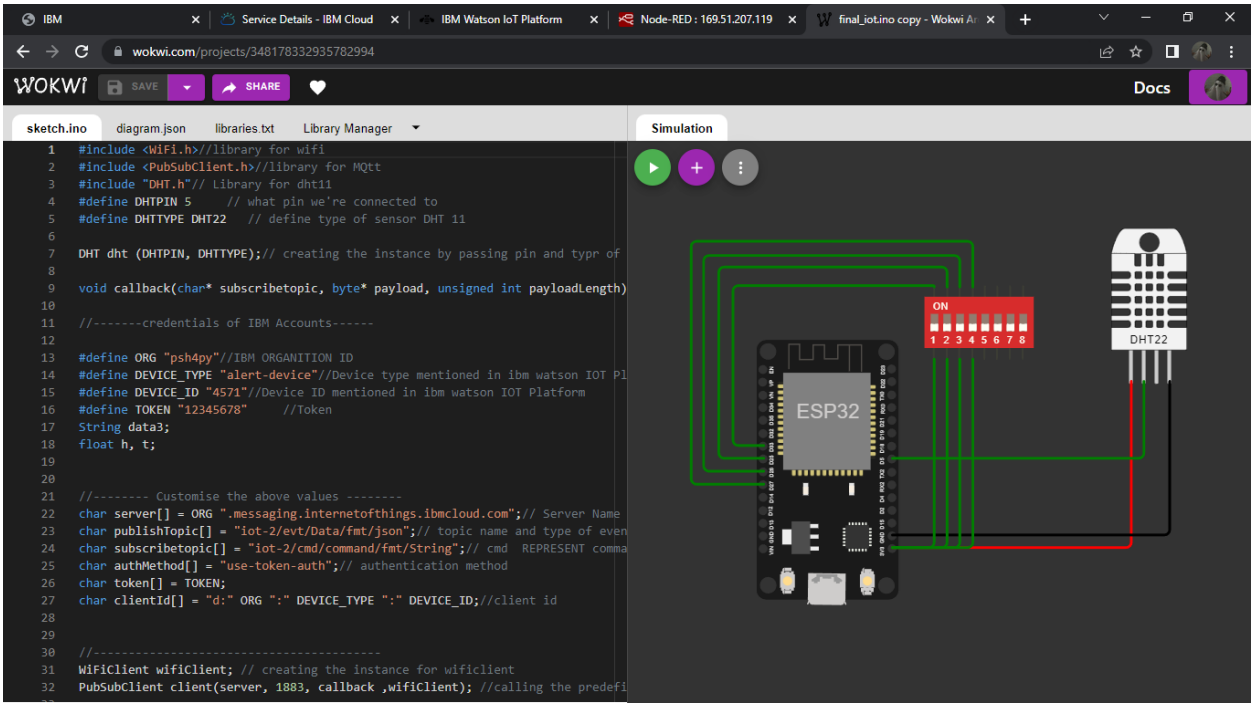
```
if temperature < 24:
visibility="Fog Ahead, Drive Slow"
elif temperature < 20:
visibility="Bad Weather"
else:
visibility="Clear Weather"
else:
print("Error in the HTTP request")myData={'Temperature':temperature, 'Message':message, 'Sign':signMsg,
'Speed':speedMsg,
'Visibility':visibility}
client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
#PUBLISHING TO IOT WATSON
print("Published data Successfully: ", myData)
print("
")
client.commandCallback = myCommandCallback
time.sleep(5)
client.disconnect()
```



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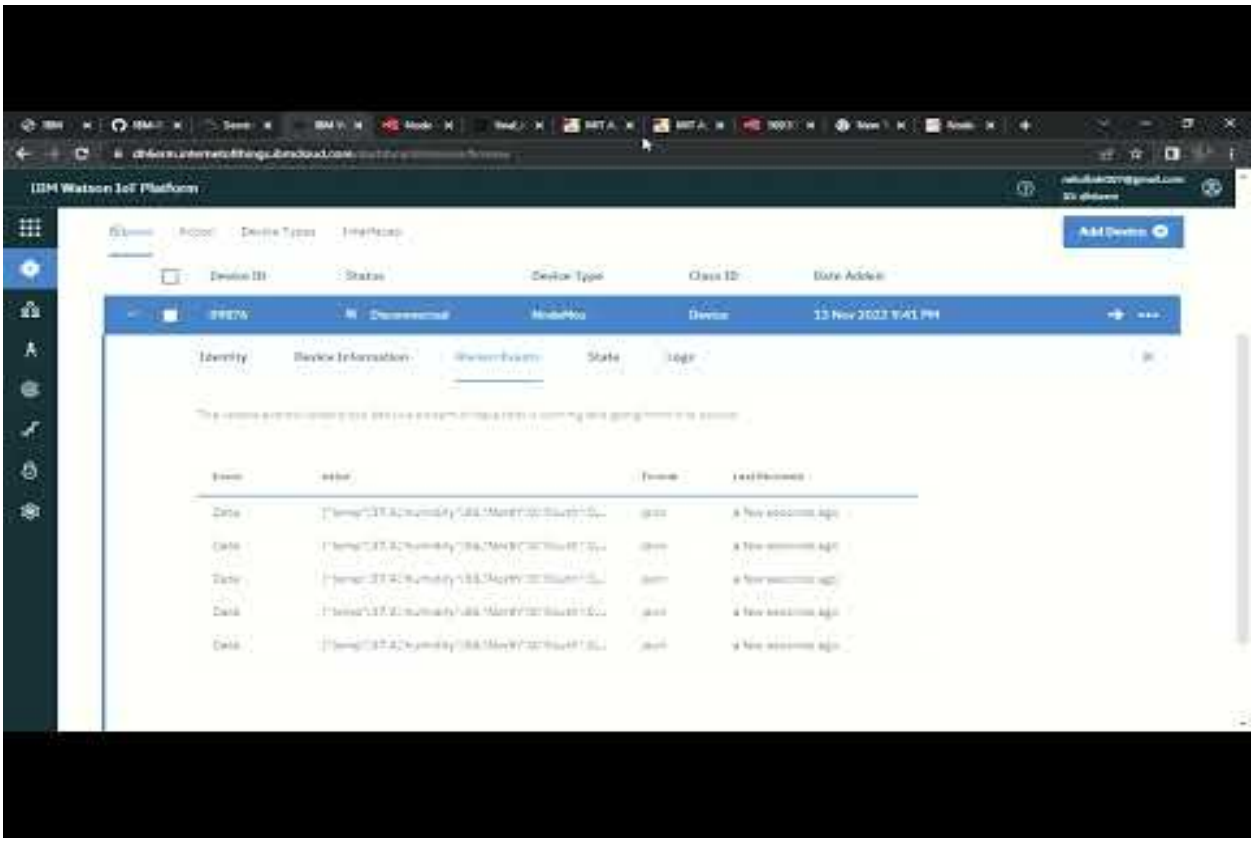
Github link ;

https://github.com/IBM-EPBL/IBM-Project-48797-1660813010

Demo link;