IBM PROJECT

Signs with Smart Connectivity for Better Road Safety

Batch: B11-5A1E

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1. INTRODUCTION

1.1 Project Overview:

In present system the road signs and the speed limits are static.But the road signs can be changed in some cases when they are some road division due to heavy trafficor due to accidents then we can change the road signs accordingly if they are digitalized .This project process a system which has digital sign boards on which the signs can be changed dynamically. If there is a rainfall then the roads will be slippery and the speed limit would be decreased

In project system the road sign and the speed limits are static .But the road signs can be changed in some cases. We can consider some cases when there are some roads diversion due to accident then we can change the road signs accordingly creased .There is a web app through which you can enter the data of the road of the road diversion, accident prone areas and the information sign boards can be entered through web app . This data is retrieved and displayed on the sign boards accordingly

1.2 Purpose:

The main purpose of this project, signs with smart connectivity for better road safety is to save time in times of high traffic and change directions when there is bad weather conditions for the project ,other extra idea can also be added like speed sensors, for checking the speed of the vehicles .passenger counter for counting the number of passenger in a vehicle This project is wireless, cost efficient and easy to install .

2. LITERATURE SURVEY

2.1 Existing Problem:

There are a lot of problems that drivers face while driving in highways cause of bad weather condition lead to accidents, Tree's falling which halts traffic and time is wasted .There are a lot of vehicles which are driven far past the speed limit which cause accidents so to speed sensors are placed to alert authorities about over speeding a lot of other ideas can be added according to problems that arises

2.2 Survey:

Abd-Elhamid M. Taha et al [1] introduces a cost-effective Internet of Things (IoT) architecture that facilitates the realization of a robust and dynamic computational core in assessing the safety of a road network and its elements. In doing so, we introduce a new, meaningful, and scalable metric for assessing road safety. We also showcase the use of machine learning in the design of the metric computation core through a novel application of Hidden Markov Models (HMMs). W. H. D. Fernando et al [2] worked on Automatic Road traffic signs detection and recognition using 'You Only Look Once' version 4 (YOLOv4) which addresses road traffic sign detection and recognition using a technique that initially detects the bounding box of a traffic sign. Then the detected traffic sign will be recognized for usage in a speeded-up process.

García-Garrido et al [3] developed a traffic sign recognition system that uses a vision camera mounted on a vehicle. Based on the colours and shapes of the road signs, the system detected and recognized the signs. Wong Hwee Ling et al [4] performed a study that used a smartphone back camera to recognize traffic signs and alert drivers for an incoming sign. The phone was placed on a windscreen for the camera to face the road. The distinct advantage of the system was that it did not require additional hardware. Rajale et al [5] developed a road sign notification system based on the global positioning system (GPS) and wireless radio frequency identification (RFID) technology. A database of road signs and their locations was created. RFID transmitters were placed at the locations of road signs, and a receiver was placed in the vehicle. Using the system, drivers were alerted about the next road signs at some predetermined specific distance before the road signs were encountered.

A.Bhawiyuga et al [6] proposes the implementation of communication equipped road sign system which consists of two components: Road Side Unit (RSU) module deployed at road sign and On Board Unit (OBU) module deployed at each vehicle. In our proposed scheme, both of the devices communicate each other through the widely-used Wi-Fi protocol (IEEE 802.11n) operating in ad-hoc mode. While a OBU equipped vehicle is moving towards the communication range of RSU, it will make an association to a predefined wireless ad-hoc network. Once it is associated, the OBU can receive message broadcast by the RSU. Upon reception, OBU display alert message indicating that the vehicle is approaching a road sign.

From performance testing we observe that the proposed system can give relatively good service the vehicle moving as fast as speed 90km/h with the distance as far as 90m. W. Liang et al [7] conducts a study about VANETs which use vehicles as mobile nodes are a subclass of mobile ad hoc networks (MANETs) to provide communications among nearby vehicles and between vehicles and nearby roadside equipment but apparently differ from other networks by their own characteristics. Specifically, the nodes (vehicles) in VANETs are limited to road topology while moving, so if the road information is available, we are able to predict the future position of a vehicle; what is more, vehicles can afford significant computing, communication, and sensing capabilities as well as providing continuous transmission power themselves to support these functions

Yiqiang Wu et al [8] worked on Real-time traffic sign detection and classification towards real traffic scene. a real-time traffic sign recognition algorithm which is robust to the small-sized objects and can identify all traffic sign categories. Specifically, we present a two-level detection framework which consists of the region proposal module (RPM) which is responsible for locating the objects and the classification module (CM) which aims to classify the located objects. In addition, to solve the problem of insufficient samples, we present an effective data augmentation method based on traffic sign logo to generate enough training data.

Adnan Shaout et al [9] worked on An Intelligent Real Time Road Sign System. The behavior of US Interstate 94 was modelled, where the typical road throughput was simulated and published to an MQTT broker for the embedded system to display the expected travel time to Ann Arbor, Michigan from the US23 junction. The embedded system additionally sampled a digital temperature and humidity sensor to note road conditions, where an external input allowed operators to provide a real time update when an unexpected event causes traffic (i.e., vehicle collision) or when the road has been cleared.

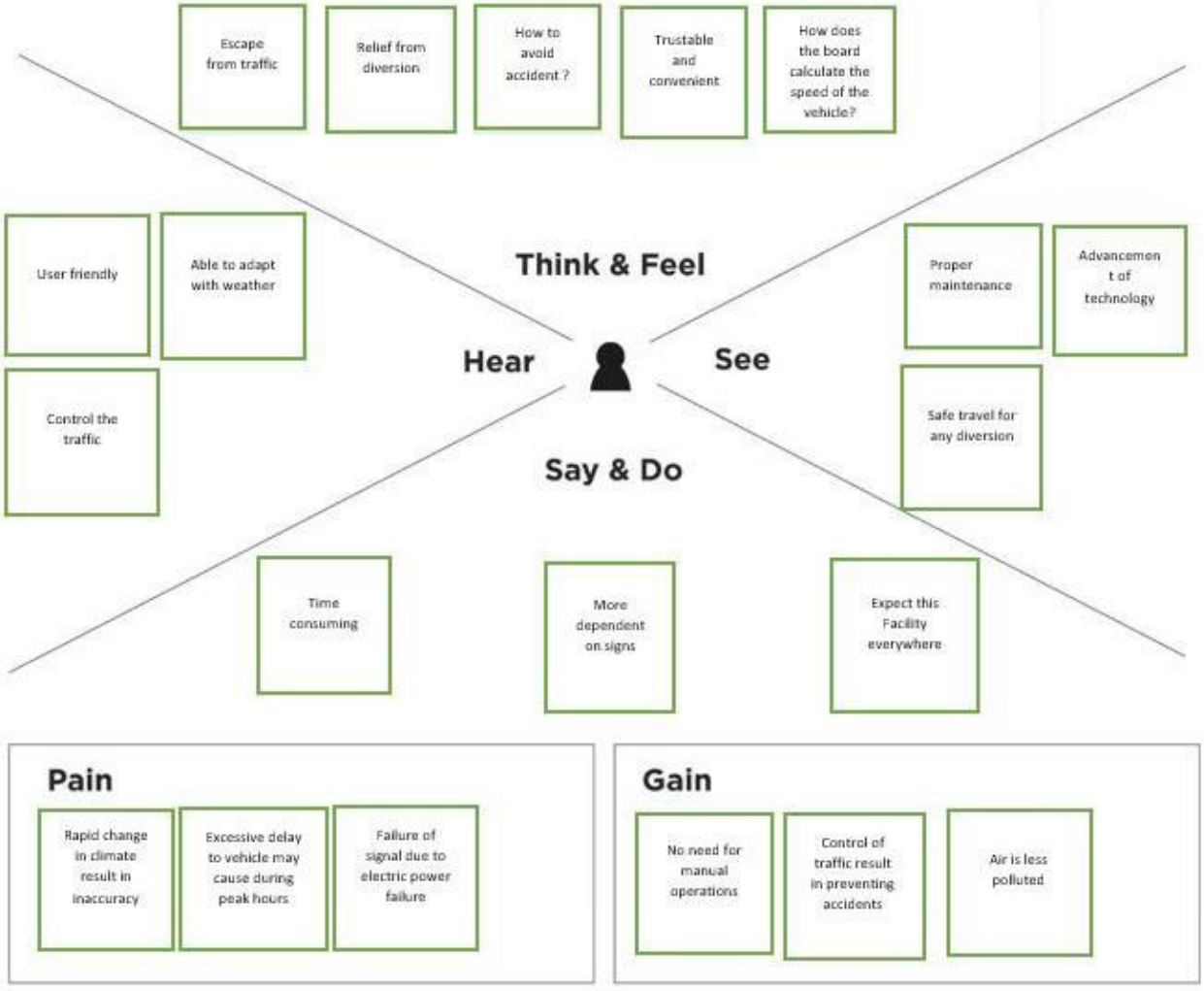
Srinivas Bachu et al [10] develops a system which works by signaling or warning through WIFI, to avoid the accident in nearby areas. If the Bridge zone is narrower than 100 meters from vehicles, a mobile warning will be issued via the WI-FI network. The person reduces the vehicle speed following this indication. Just like if a school area closer to vehicles is within 100 meters, the cell phone will be alerted via WI-FI. The person reduces the speed of the vehicle after this indication. Like Fog, it gives message warning to mobile devices via the WIFI area within 100 meters. The individual decreases the speed of the vehicle following this indication. This sign helps us to reduce road injuries.

2.3 Problem statement definition:

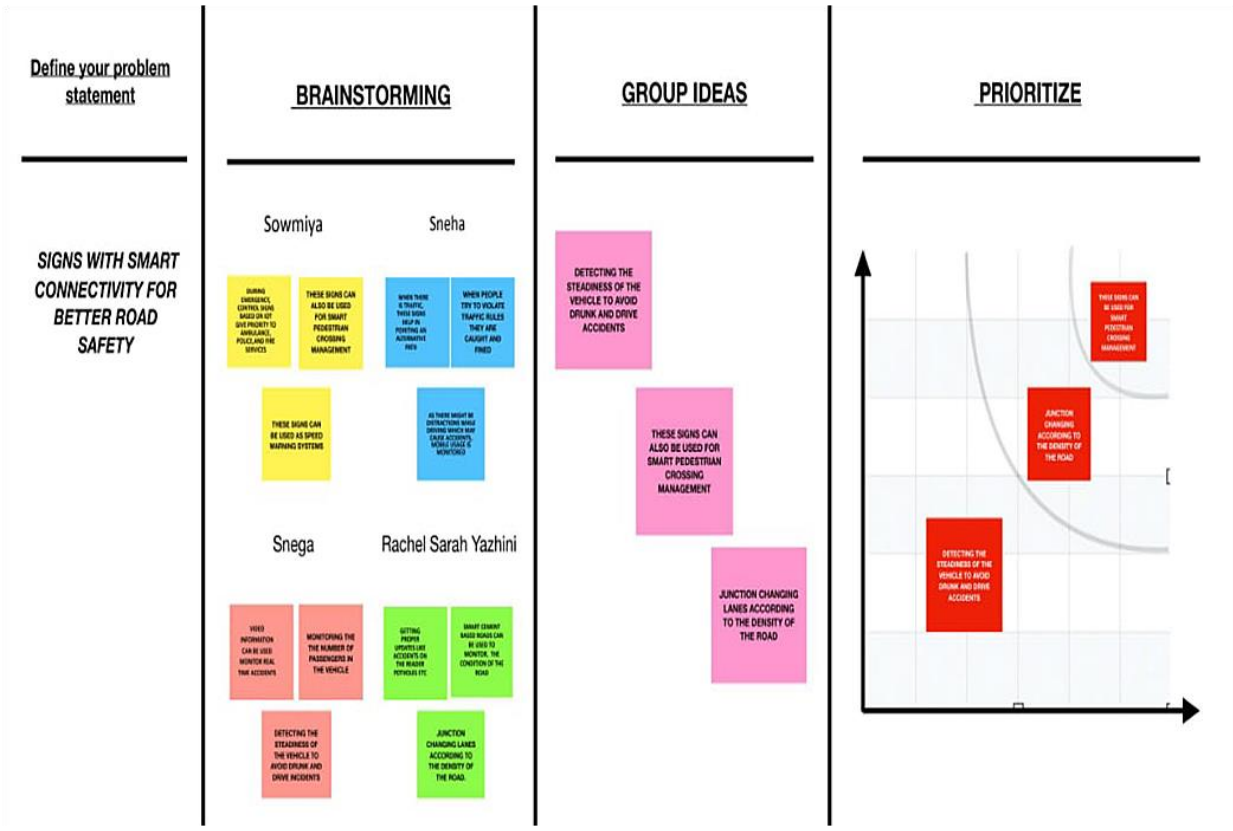
The avenue symptoms and velocity restrict these days are static so occasionally when there is intense weather condition it's miles very taught for the riders to look the speed restriction and instruction .This task may be very beneficial for the riders purpose when there may be excessive site visitor appropriate virtual symptoms can be shown to alternate the direction .Where there's rainfall the roads get very slippery which may additionally lead to quite few accidents so that you could prevent them technology can be used.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:


Escape from traffic
Relief from diversion
How to avoid accident ?
Trustable and convenient
How does the board calculate the speed of the vehicle?
User friendly
Able to adapt with weather
Think & Feel
Proper maintenance
Advancement of technology
Hear
See
Control the traffic
Safe travel for any diversion
Say & Do
Time consuming
More dependent on signs
Expect this Facility everywhere
Pain
Rapid change in climate result in inaccuracy
Excessive delay to vehicle may cause during peak hours
Failure of signal due to electric power failure
Gain
No need for manual operations
Control of traffic result in preventing accidents
Air is less polluted

3.2 Ideation & Brainstorming:

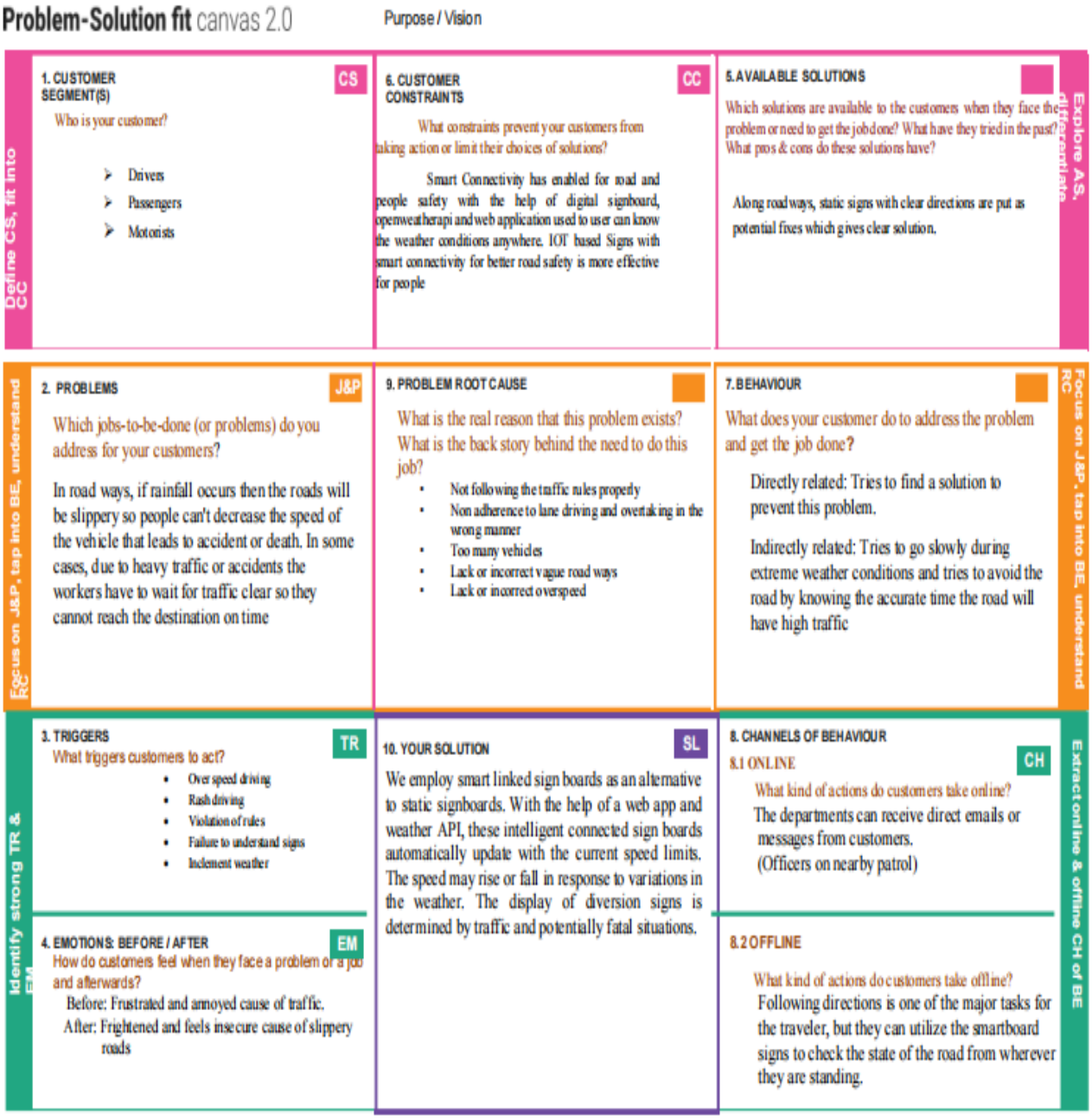


3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	In Static Signboard, the road sign and the speed limits are static. In some cases, due to heavy traffic or accidents then we can change the road signs accordingly if they are digitalized.
2.	Idea / Solution description	➢ Replacing traditional roadside signage with IOT-enabled smart ones. Smart signs are built using LED and the Internet of Things. ➢ The problem of this project is to potholes and climate change. So basic concept to solve this is that to detect the potholes and the change in climate and then convey the intermediate person to maintain the speed if the user is connected to internet and for the user who are not connected to the internet will receive the information by the digital board placed at a particular interval of distance. ➢ If there is rainfall then the roads will be slippery and the speed limit would be decreased by dynamically change signs. To avoid the traffic by prediction of traffic jam or accidents in earlier to take diversion of road.
3.	Novelty / Uniqueness	➢ Traffic detection using IOT. ➢ We detect the climate change and convey about the safety measures to be followed users. ➢ It gives information about nearby places like hospitals, schools, etc. so that customers may make decisions based on that knowledge, such as
4.	Social Impact / Customer Satisfaction	➢ There is no more waiting time in the traffics. ➢ Decrease in the number of accidents. ➢ Disaster updates can be shown on the signboard. ➢ Customers can travel peacefully at all type of climatic changes because of the earlier intimation.

5.	Business Model (Revenue Model)	➢ It doesn't require more cost because inmost of the junction already contains camera in the top of the signal towers,we just analyse the number of vehiclesin the lane by a Python code and change the signals accordingly with the help of IOT. ➢ The government's implementation of these for common citizens is an excellent endeavour to increase publicawareness. This can be fundedseparately by the government, which lays the groundwork for a safer environment. ➢ The installation of digital smart sign boards cost about (1.5lakh) approximately which helps to drastically reduce the accidents and vehicle collision
6.	Scalability of the Solution	➢ Using weather Prediction in earlier stage that will lead to help the people to slow down speed by indicating the sign and by knowing the accident or traffic jam before that leads to people take diversion other way. ➢ This solution will help to decrease the death rate up to 80%. ➢ Most of the people are struggling in thetraffic signal by waiting for a long in the same lane. They can be cleared by this idea.

3.4 Problem Solution Fit:



4. REQUIREMENT ANALYSIS

4.1 Functional Requirement:

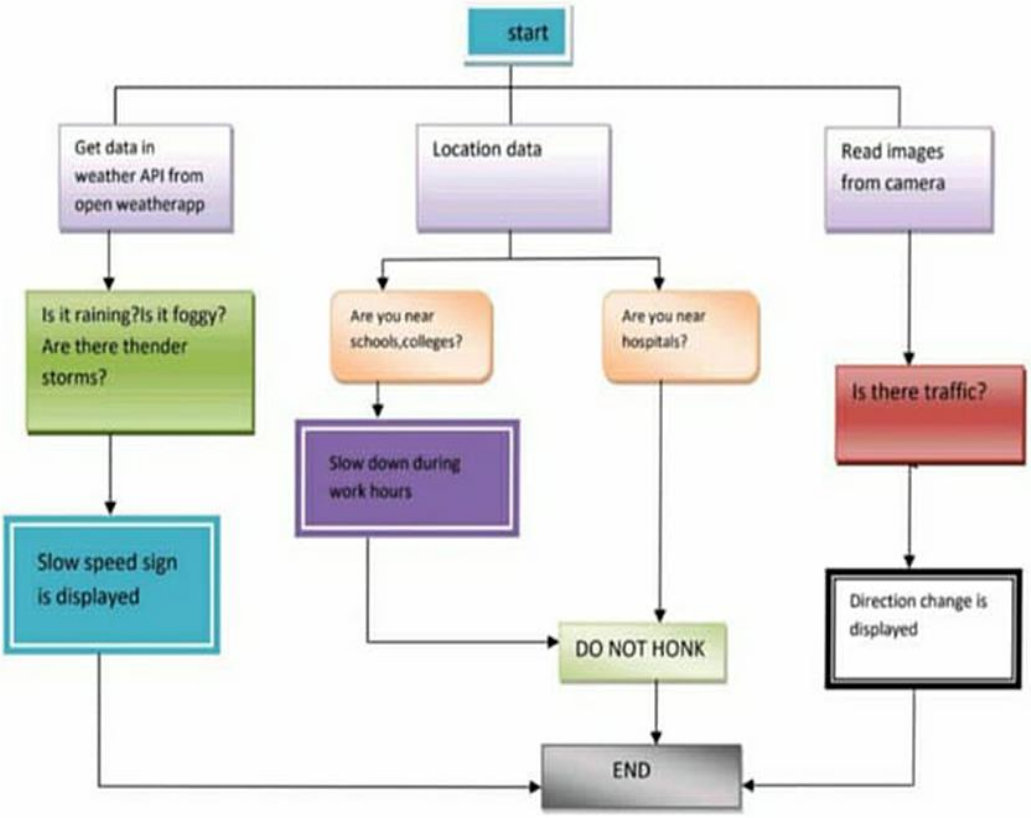
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration can be done through Website or using theemail in the mobile application
FR-2	User Confirmation	Confirmation is done using the user email or OTP to theuser's mobile
FR-3	Sensors	Used for predicting the traffic and distance between vehicles to avoid collisions
FR-4	Weather Monitoring App (API)	Connecting the system to an API to get weather forecast
FR-5	Accessing Datasets	Retrieving the datasets from the cloud platform for analysis
FR-6	WIFI modules for connectivity	Providing connectivity to the devices involved in the system
FR-7	Web Application	Signboard and sensors in the road can be controlled byweb application

4.2 Non-Functional Requirement:

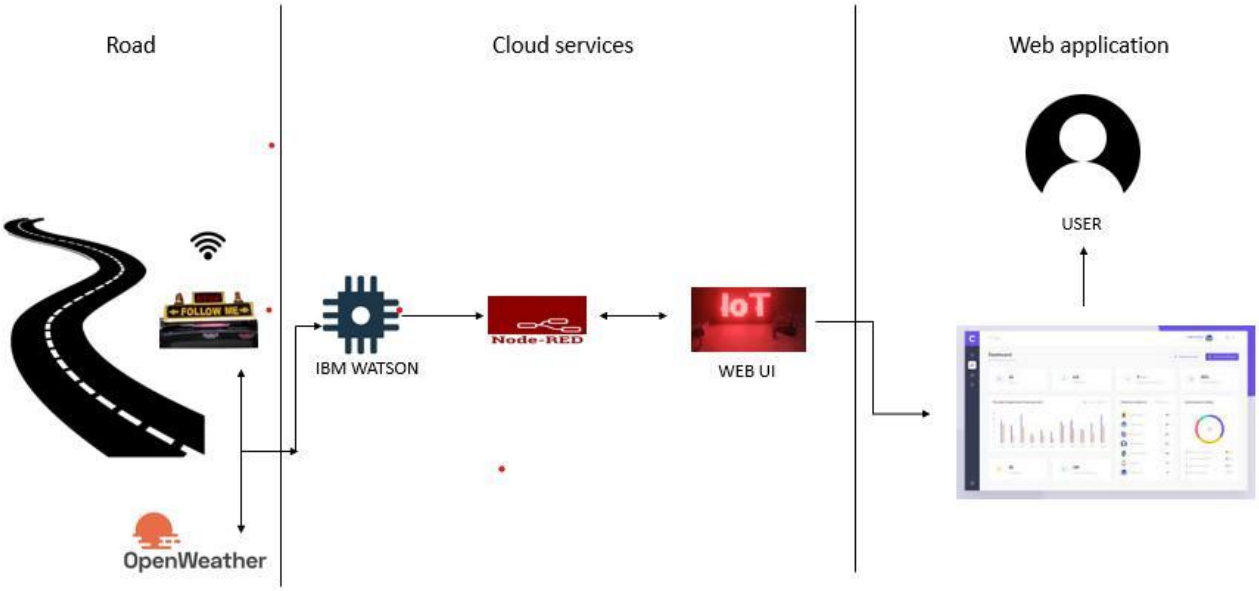
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	It's used for the people who cross the road slowly, and also those who are rushing to the exams or meetings preventing pedestrian accidents. It is used to control traffic congestion and prevent accidents during weather change.
NFR-2	Security	Cloud data must be contained within the network, collapsing to be the real-time avoidance should be avoided, and the board will be monitored constantly.
NFR-3	Reliability	It should be able to display to information correctly and error-free.
NFR-4	Performance	It should be able to automatically update itself when certain weather or traffic problem occurs and provide accurate results.
NFR-5	Availability	It's available for 24x7 hours and in any climate conditions.
NFR-6	Scalaility	The weather condition report and the vehicle details are updated in the cloud platform dynamically and old data is erased and there is more than enough memory for computation and provides fast execution.

5. PROJECT DESIGN

Data Flow Diagram:



5.1 Solution & Technical Architecture:



User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Pedestrian	Pedestria nAspects	USN-1	The system should detect the pedestrian trying to cross the road using sensors and changes the signs based on the number of pedestrians and the vehicles on the road.	The board can receive the detection of people presence in the lane and sent it to the sign board	High	Sprint-1
Driver	Driving Aspects	USN-2	Drivers get distracted due to the long wait period in the red signal but the opposite lane isempty. This makes the person to feel frustrated.We monitor the vehicular density and change the signs for lane change according to it.	I can travel in peaceful manner and reach the destination on time.	Medium	Sprint-1
Passenger	Travelling Aspects	USN-3	Passengers gets frustrated due to waiting for a long time in traffic. Our system monitors the vehicles and changes the traffic signs according to the rush hours to avoid traffic congestions	Passengers should experience a pleasant journey	Medium	Sprint-2
Emergency vehicles driver	Emergency Mission aspects	USN-4	As an emergency responder, I need to know theaccurate state of road, routes and schedule andto know the best possible or prioritized route to the incident and to hospitals.	I can able to know the bestroute to the hospital to fulfil my duty.	High	Sprint-1
Students	School Zones	USN-5	There will be a lot of traffic during the school opening and closing hrs in school zones. I needto cross the school zone by diverting to other roads without causing an incident with the walking students.	Students will be preventedfrom accidents.	High	Sprint-1
Customer (App User)	Reporting an d safety information aspects	USN-6	Reporting information and feedback abouttraffic, accidents, speed limit, road safety.	I can sense the level of higher safety	Low	Sprint-2

6. ROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning & Estimation:

Sprint	Functional Requirement(Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	IDE	USN-1	Installing all the softwares which ARErequired like pythonIDE	2	High	Lokeshwaran S Logeshwaran M
Sprint-1	Checking the simulation with conditions and coding	USN-2	Simulating the circuits and experimentingand Write a Python program that outputs resultsgiven the inputs like weather and location.	2	High	KarthickeyanB KarthickeyanP Lokeshwaran S
Sprint-2	Software	USN-3	Working with IBM Watson IOT and Node Red integration and test the device andworkflow	2	High	Logeshwaran M MuthamizhselvanJ
Sprint-3	Application Development	USN-4	Using MIT App Inventor create an Appand testing the application	2	High	Lokeshwaran S Karthickeyan B
Sprint-4	WEB UI	USN-5	Creation of an User interface with theSoftware and Optimize all the shortcomings and provide better user experience.	2	High	Karthickeyan P MuthamizhselvanJ Logeshwaran M

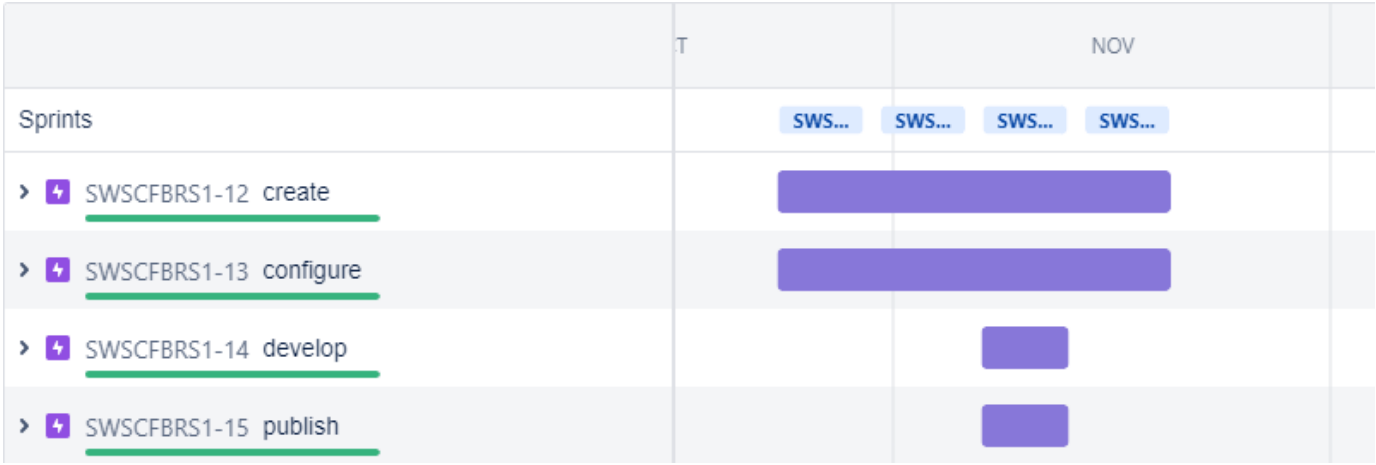
6.2 Sprint Delivery Schedule:

Project Tracker ,Velocity & Burndown chart :(4 marks)

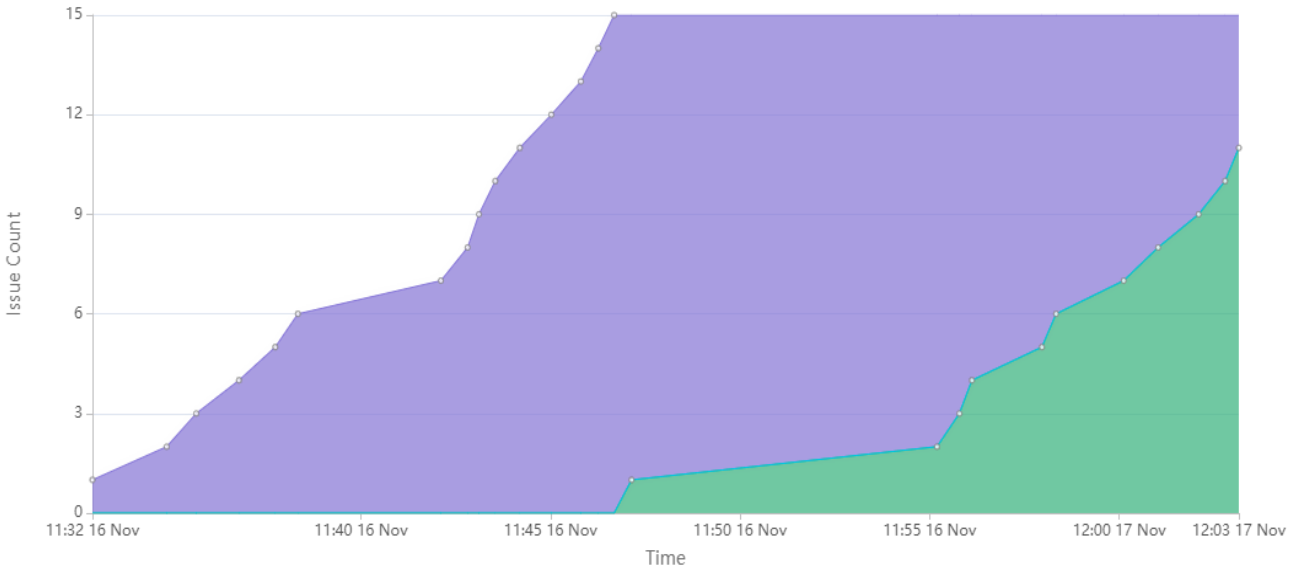
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6Days	24Oct2022	29Oct2022	20	29Oct2022
Sprint-2	20	6Days	31 Oct2022	05Nov2022	20	05Nov2022
Sprint-3	20	6Days	07Nov2022	12Nov2022	20	12Nov2022
Sprint-4	20	6Days	14Nov2022	19Nov2022	20	19Nov2022

6.3 Reports From JIRA:

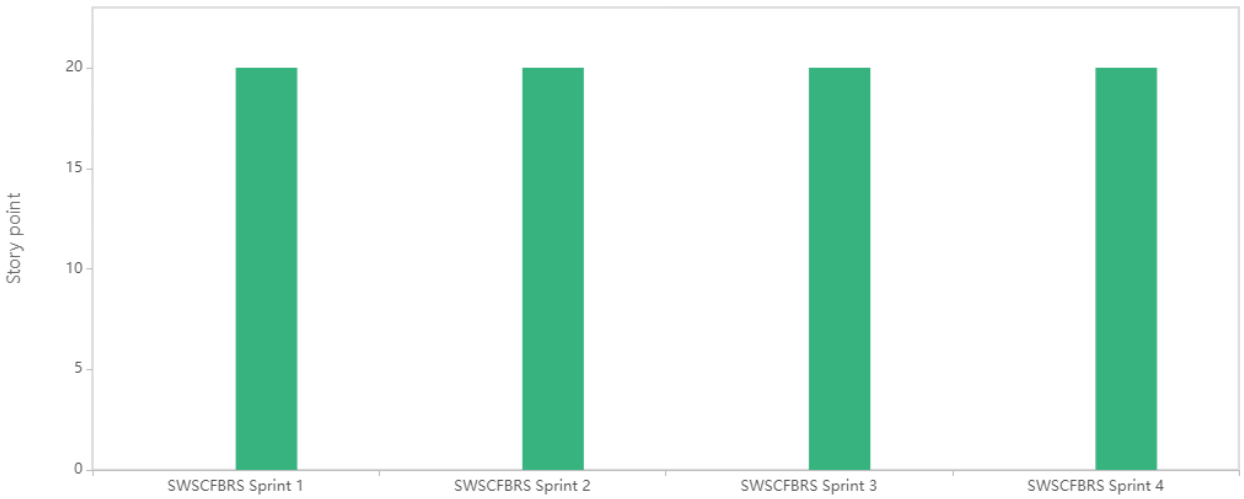
BURNDOWN CHART



CUMULATIVE FLOW DIAGRAM

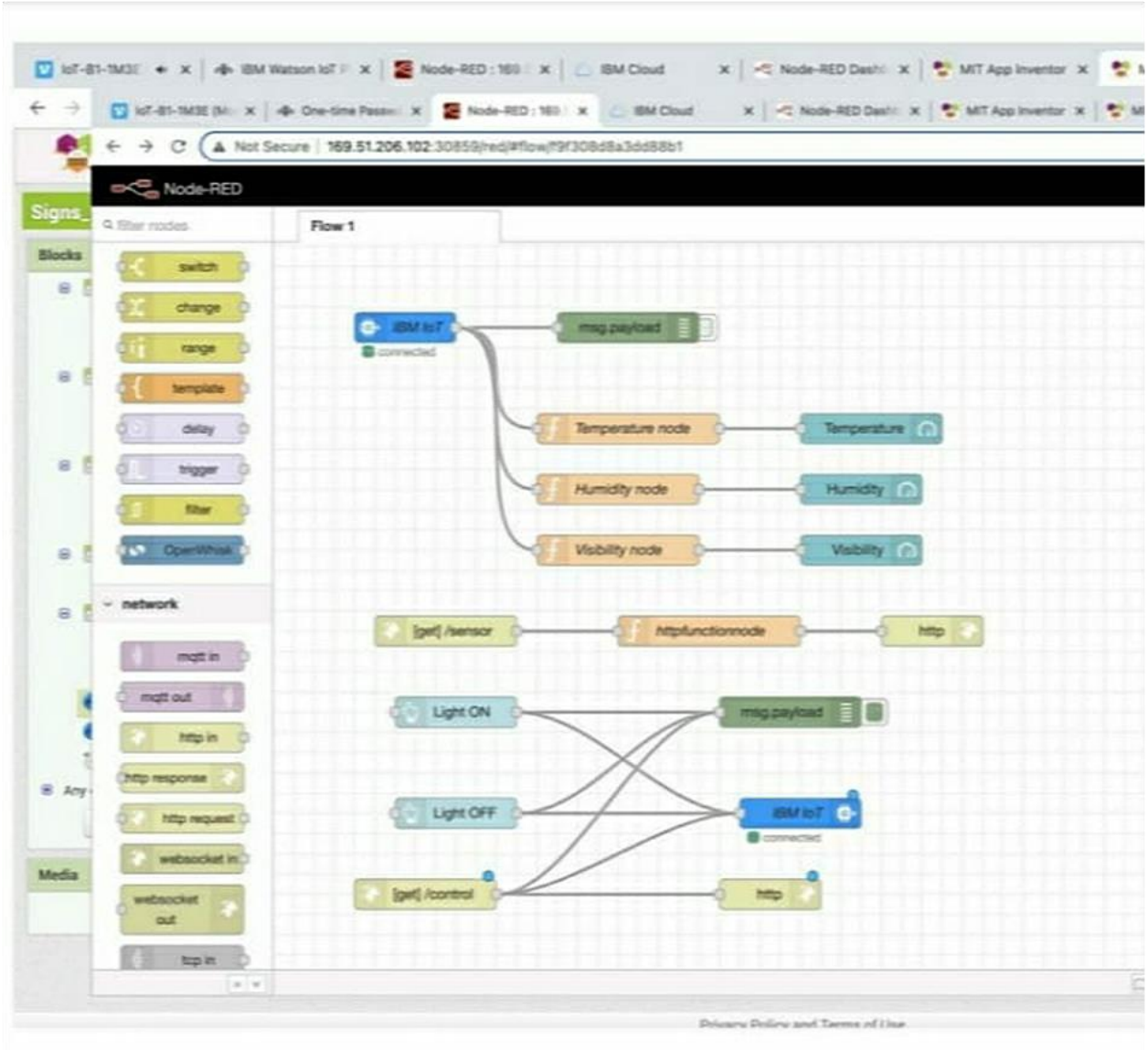


VELOCITY CHART

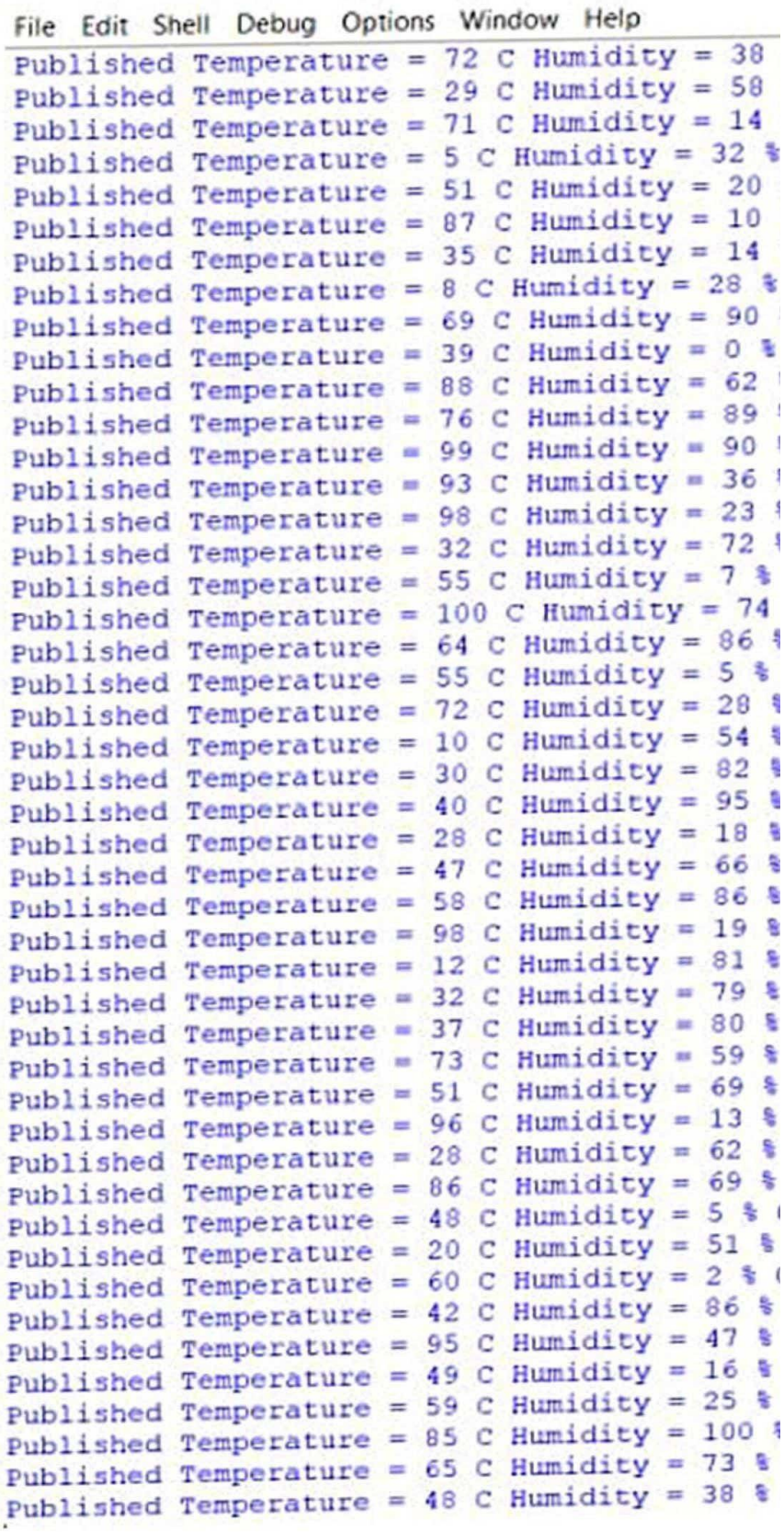


7. CODING AND SOLUTIONING

7.1 Feature 1(Node Red Output)



7.2 Feature 2: (Python Output):



8. TESTING

8.1 Test Cases
8.2 User Acceptance Testing

9. RESULTS

9.1 Performance Matrics
9.2 DEMO LINK
9.3 GITHUB LINK

10. ADVANTAGES AND DISADVANTAGES

Advantages

- Monitor the Traffic
- Used to keep in check over speeding drivers
- Helps people to change direction when under a time constraint
- Ensure safety of drivers and passengers
- Helps in finding the number of passengers in a vehicle so as to maintain the convert limit for passenger
- Helps in supervising the roads and catch criminals

Disadvantages:

- It times of complete shutdown , Inverts cannot be used for every single.
- Sometimes malfunctioning or even hacking can be done

11. CONCLUSION

Static signboards are not very efficient and cannot properly help the drivers Hence, this leads to accidents ,Time wastage and a lot problems .This project will be very helpful and it is a very necessary project which will reduce a whole lot of accidents and save lines this project can be used by the government to improve road safety

12. FUTURE SCOPE

As we know, the population of the world just become 8 billion so as the population grows the numbers of people in metropolitan cities increase which in turn leads to a lot of people using cars and roads .Hence ,roads should be safe for the people to use .the scope for this project will skyrocket in the coming years this project also is very flexible that is a lot of new ideas can be added to this base idea. This project has also be implemented in some part of India .it is only matter of time it is implemented everywhere.

13. APPENDIX

Source Code:

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

        #Provide your IBM Watson Device Credentials
        organization = "33lnun"
        deviceType = "PNT2022TMID21569

        "
        deviceId = "PNT2022TMID21569"
        authMethod = "token"
        authToken = "BGM(9-Tgfy&lrHmglp"

        #Intialize GPIO
        def myCommandCallback(cmd):
          print("Command received: %s % cmd.data['command']")
          status=cmd.data['command']
          if status=="lighton":
           print ("led is on")
        else :
```

```
   print("led is off")

#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

temp=random.randint(0,100)
humid=random.randint(0,100)
visi=random.randint(0,100)

data = {'temperature'=temp, 'humidity'=humid,'visibility'=visi}

#print data
def myOnPublishCallback():
    print("Published temperature=%s C" %temp,"humidity =%s %%"
%humid,"visibility =%s %%" %visi,"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( )
```

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