PROJECT BASED EXPERIENTIAL LEARNING PROGRAM (NALAIYA THIRAN)

SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES

A PROJECT REPORT

Submitted by

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NOVEMBER 2022

INTRODUCTION :

The rate at which solid wastes are produced in most developing countries is becoming alarming. This increase may be due to recent population growth and rural-urban migration. Garbage is made up of non-renewable resources used daily to meet our needs then throw away. As increase in consumption of paper, clothing, bottles, and product packaging increases, the generation of garbage also increases significantly. The form and type of solid waste depends on a number of factors which include the living standard and life style of the inhabitants of the region and the natural resources found in the region. There are two categories of Urban waste namely, organic and inorganic. The organic waste category can be further categorized into three units: nonfermentable, fermentable and putrescible. The Putrescible wastes tend to decay faster, and if not cautiously managed, decomposition can lead to an offensive odour with an unpleasant view. Fermentable waste which also tends to decompose rapidly do so without the accompanying of offensive odour. Non-fermentable waste most times do not decompose or do so at a very slow rate. Unless organic waste is managed appropriately, the stricken negative effect it has will continue until full decomposition or stabilization occurs. Decomposed products which are poorly managed or uncontrolled can and often times lead to contamination of air, water and soil resources . One of the challenges a developing country faces due to rapid increase in population is proper solid waste management. A typical example is the garbage bins seen around which appear overfull to the point of spilling out, leading to environmental pollution. The effect of this is increase in the number of diseases because it gives room for insects to breed. Solid waste requires systematic management the content, origin or hazard potential notwithstanding as this will ensure environmental best practices and living standard. Because solid waste management forms a very critical aspect of our environmental hygiene, it is therefore necessary to incorporate it into environmental planning .

The recent advances in computers have led to the birth of new innovations and opportunities like the Internet of Things where things (embedded systems) that are connected to the internet can also be controlled and interacted with via the internet. The term Internet of Things (IoTs) was first introduced by Kevin Ashton, a former director of the Auto-ID Centre of MIT in 1999 . The idea of IoTs is to connect objects around us through wired and wireless network with human intervention. Communication and exchange of information are carried out by the object to provide advance intelligent service for the users. In the case of the proposed solid waste management system, the bins are connected to the internet to relay real-time information of the status of the bin. The rapid growth in population in recent years has led to more waste disposals, necessitating the need for a proper waste management system to avoid unhygienic living conditions. Implementation of the system translates to the bin being interfaced with microcontroller-based system with ultrasonic sensors and a Wi-Fi module. The data which would be sent from the bins would be received, analysed and processed in the ThingSpeak cloud that displays the level of the garbage in the bin on a graph in its web page. The main drive of solid waste management is the reduction and elimination of adverse effect of waste materials on human health and environment leading to improvement in quality of life. In this work, an intelligent solid waste monitoring system is developed using Internet of Things (IoT) and cloud computing technologies. This is a recent innovation as cloud computing has been applied in other areas like . Ultrasonic sensors are employed to detect the fill level of solid waste in each of the containers. The data obtained by the sensor is then transmitted to an IoT cloud platform, called ThingSpeak, using a Wi-Fi communication link. For each designated fill level, the system sends appropriate notification message (in form of tweet) to alert relevant authorities and concerned citizen for necessary action.

Also, the fill level is monitored on ThingSpeak in real-time.

LITERATURE SURVEY

PAPER TITLE	**AUTHOR**	**OUTCOME**
Analysis of Load cell.	1) Ranjeet Kumar 2) Sandeep Chhabra	Load Cells 4.1 General Load Cell related information A load cell is meant to measure the size of a mass but actually is a force sensor which transforms force into an electrical signal. The load cell needs the earth gravity to work. Every mass is attracted by the earth gravimetric field, that force is named “load”
IoT Based Smart Garbage System.	1) T.Sinha 2) R.M Sahuother	Indicates directly that the dustbin is filled to a certain level by the garbage and cleaning or emptying them is a matter of immediate concern. This prevents lumping of garbage in the roadside dustbin which ends up giving foul smell and illness to people.The design of smart dustbin includes a single by ultrasonic sensor which configured with Arduino Uno with this research,it is sending SMS to the MunicipalCouncil that particular dustbin is to overflow

Smart Waste Management System.	1) Sanjiban Charkraborty	This Waste management is one of the serious challenges of the cities,the system now used in cities, we continue to use an old and outmoded paradigm that no longer serves the entail of municipalities, Still find over spilled waste containers giving off irritating smells causing serious health issues and atmosphere impairment.
Raspberry pi-based smart waste management system using Internet of Things	1)Shaik Vaseem Akram 2)Rajesh Singh	Nowadays it is becoming a difficult task to distinguish wet and dry waste. The new waste management system covers several levels of enormous workforce. Every time labourerS must visit the garbage bins in the city area to check whether they are filled or not. The data communicates to the cloud server for real-time monitoring of the system. With the real-time fill level information collected via the monitoring platform, the system reduces garbage overflow by informing about such instances before they arrive.

Paper 1:

A Survey on Garbage Collection and Monitoring System for Smart cities using IOT Publisher: Dept of Computer Engineering, Terna Engineering College,Nerul,Navi Mumbai Reference: https://www.irjet.net/archives/V5/i2/IRJET-V5I2118.pdf

Paper 2:

IOT enabled solid waste management in smart cities Publisher: S. Vishnu 1 , S. R. Jino Ramson 1,2,3,* , Samson Senith 4 , Theodoros Anagnostopoulos 5 , Adnan M. Abu-Mahfouz 6 , Xiaozhe Fan 2 , S. Srinivasan 3 and A. Alfred Kirubaraj 4

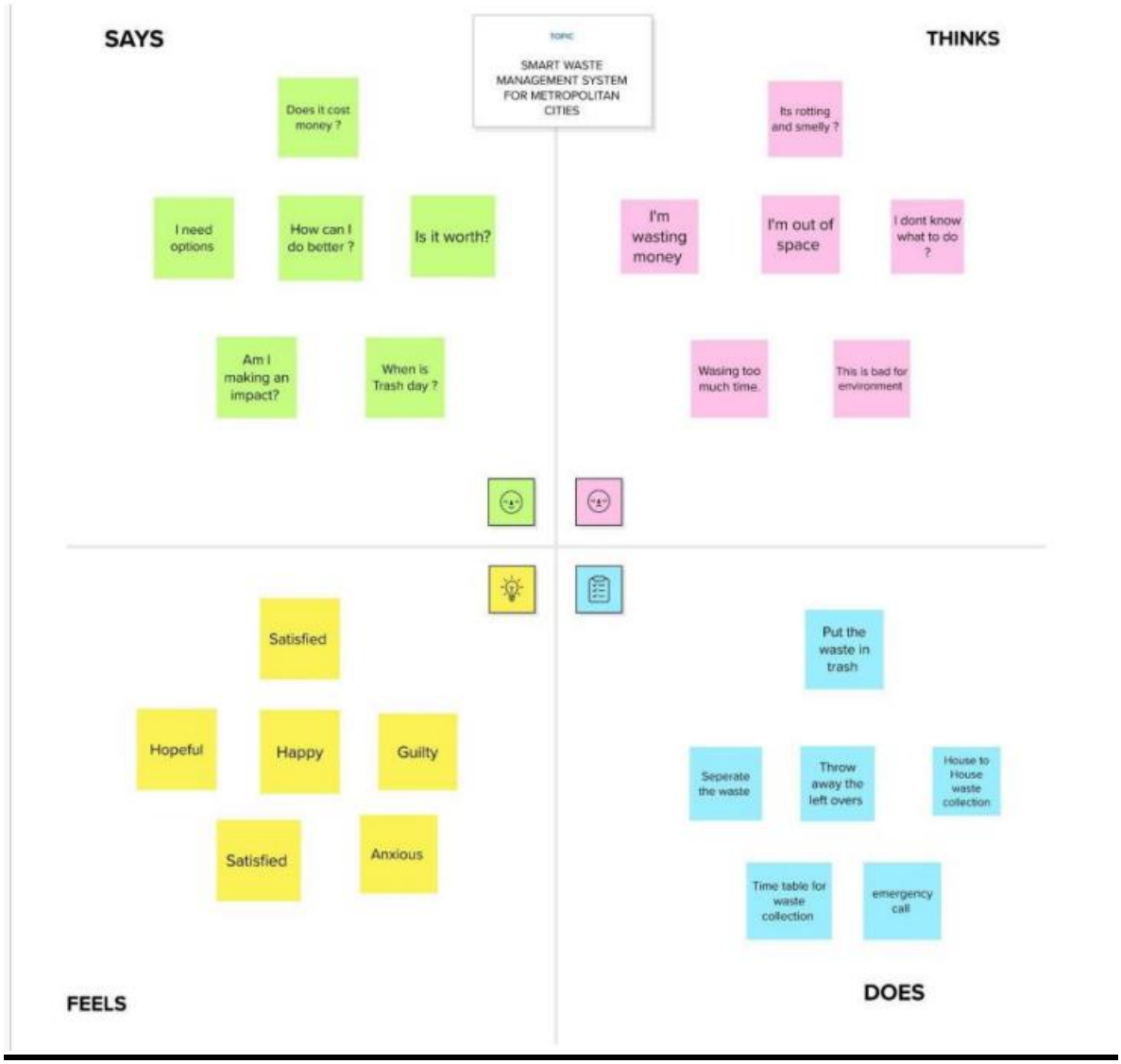
Reference: https://www.mdpi.com/2624-6511/4/3/53/pdf

Paper 3:

IOT enabled intelligent solid waste management system for smart city : a survey Publisher: https://www.irjet.net/archives/V5/i2/IRJET-V5I2118.pdf

IDEATION AND PROPOSED SOLUTION:

Empathy map:



BRAINSTORMING IDEAS

By **Mughilan V**, The idea is to produce a stable equipment of weighing sensors and other communication- iOT devices to create a best and efficient Smart-Waste Management System. The idea includes, initially-building a stable and durable stand to which the weighing and communication sensors/devices are added and are used to update and send the information to the nearest waste collector. The normal dustbins are inserted into the stand and removed as needed. The communication sensor consists of applications including giving notification to the waste collectors about the weight and capacity of the dustbin that is filled.

By **Nithish kanna V ,**Smart net bin is an ideology put forward which is a combination of hardware and software technologies i.e. connecting Wi-Fi system to the normal dustbin in order to provide free internet facilities to the user for a particular period of time. The technology awards the user for keeping the surrounding clean and thus work hand in hand for the proper waste management in a locality. Smart netbin uses multiple technologies firstly the technology for measuring the amount of trash dumped secondly the movement of the waste and lastly sending necessary signals and connecting the user to the Wi-Fi system. The proposed system will function on a client server model, a cause that will assure clean environment, good health, and pollution free society.

By **Rahul R**, The idea presents smart waste management using an IoT based waste bin for collection and monitoring the level of waste inside the bin. The system is implemented using two ultrasonic sensors which are controlled by Node MCU. One of the ultrasonic sensors detects the level of the waste in the bin and another detects the person approaching the bin to dispose of the waste. This detection helps in automatic opening and closing of the lid. Servo motor is connected to the lid which serves the action of closing and opening of the lid. In this system, the level of waste in the bin will be sent to concerned authorities. The IoT data is stored and monitored using the Blynk app. The proposed system is reliable, cost effective and can be easily implemented.

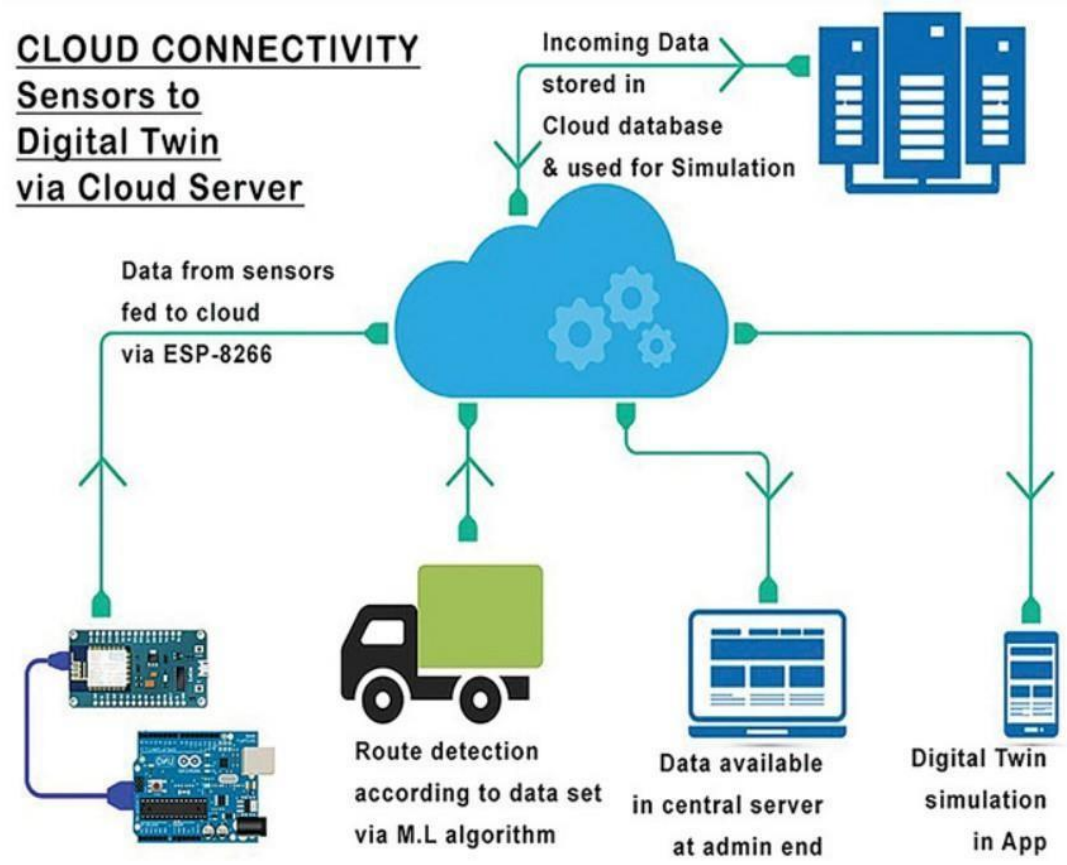
By **Pari Yogeshwaran**, A smart garbage monitoring system monitors the garbage bins and informs about the level of garbage in the garbage bins via an Android application. For this, the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bin's depth. The system makes use of GPS and Node MCU Esp8266(wi-fi) for sending data to the cloud. An Android Application is used to view the level of waste in the bins. The Application gives the location of garbage bins and highlights the marker when the bins are full

Proposed Solution

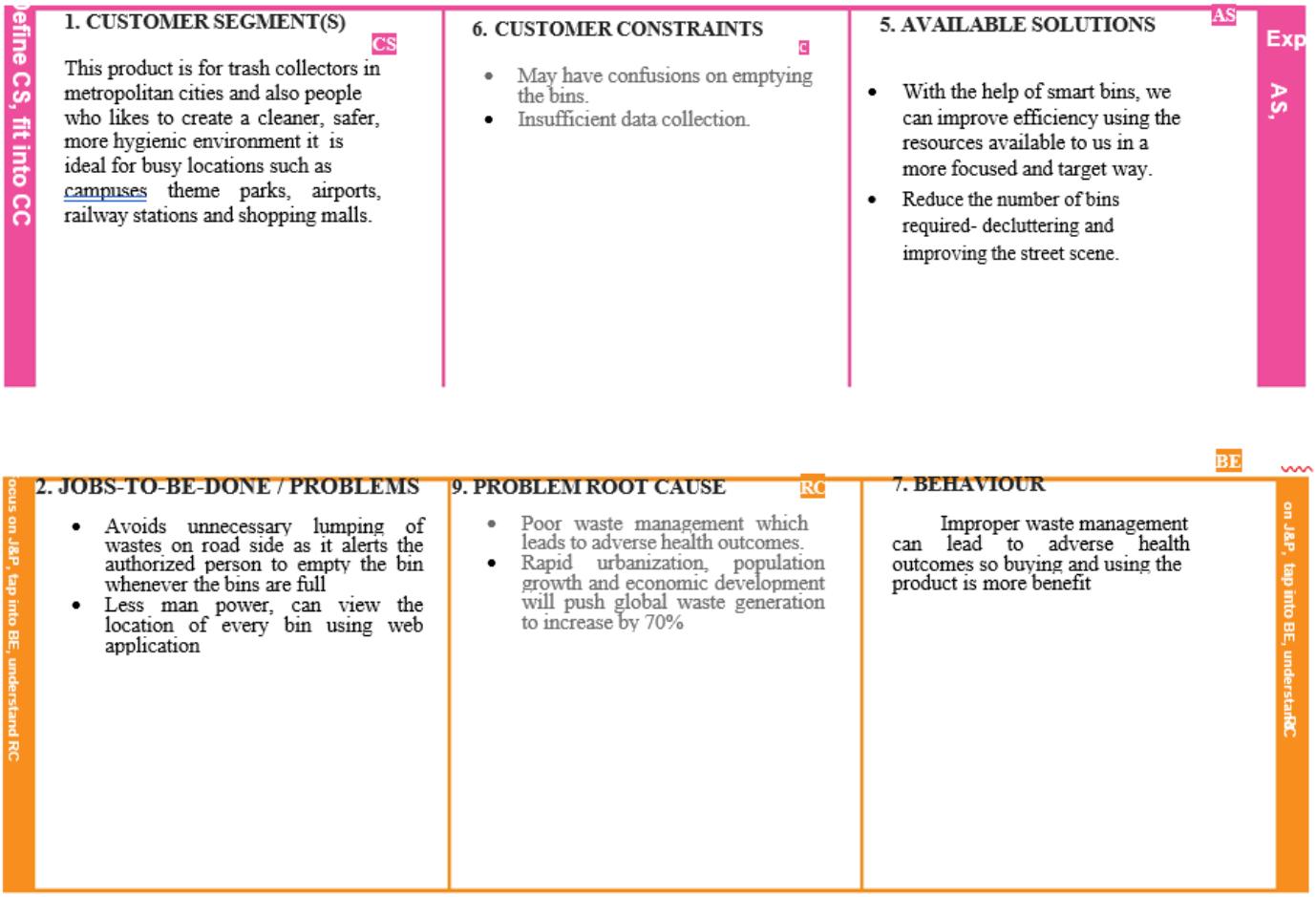
S.No.	parameter	description
1	**Problem Statement (Problem to be solved)**	A growing population and economy, which means increased volumes of waste is generated. This puts pressure on waste management facilities, which are already in short supply. Hence IOT Based smart net bins can be used to overcome this problem
2.	**idea / Solution description**	The idea is to produce a stable equipment of weighing sensors and other communication_iOT devices to create a best and efficient Smart-Waste Management System. The idea includes, initially-building a stable and durable stand to which the weighing and communication sensors/devices are added and are used to update and send the information to the nearest waste collector. The normal dustbins are inserted into the stand and removed as needed. The communication sensor consists of applications including giving notification to the waste collectors about the weight and capacity of the dustbin that is filled

3.	**Novelty / Uniqueness**	The existing system makes use of IOT devices and sensors for commuication. But inour model we have used **IBM Cloud services**data storage. **IBM Watson IoT platform** is used **as the mediator** to connect the web application to IoT devices, so create the IBM Watson IoT platform.
4.	**Social Impact / Customer Satisfaction**	The main impact of this smart bin is people don't have to wait for the waste collector. Theapp takes the information to the waste collector directly. This saves the time of the customer. The cost of the product is also lessso this will help all kinds of people to manage the waste properly .
5.	**Business Model (Revenue Model)**	This business model is to target all the residentials of the city to dispose of the wasteproperly. The total cost for producing the model using the is around 7000 - 8500. This smart bin is very efficient for day today use.
6.	**Scalability of the Solution**	Traditional means of waste management domore harm than good to the environment and human life. For a country like India where the huge population is already exerting tremendous pressure on the resources, sustainable waste management to reduce environmental impact is desperately needed. If we can add more

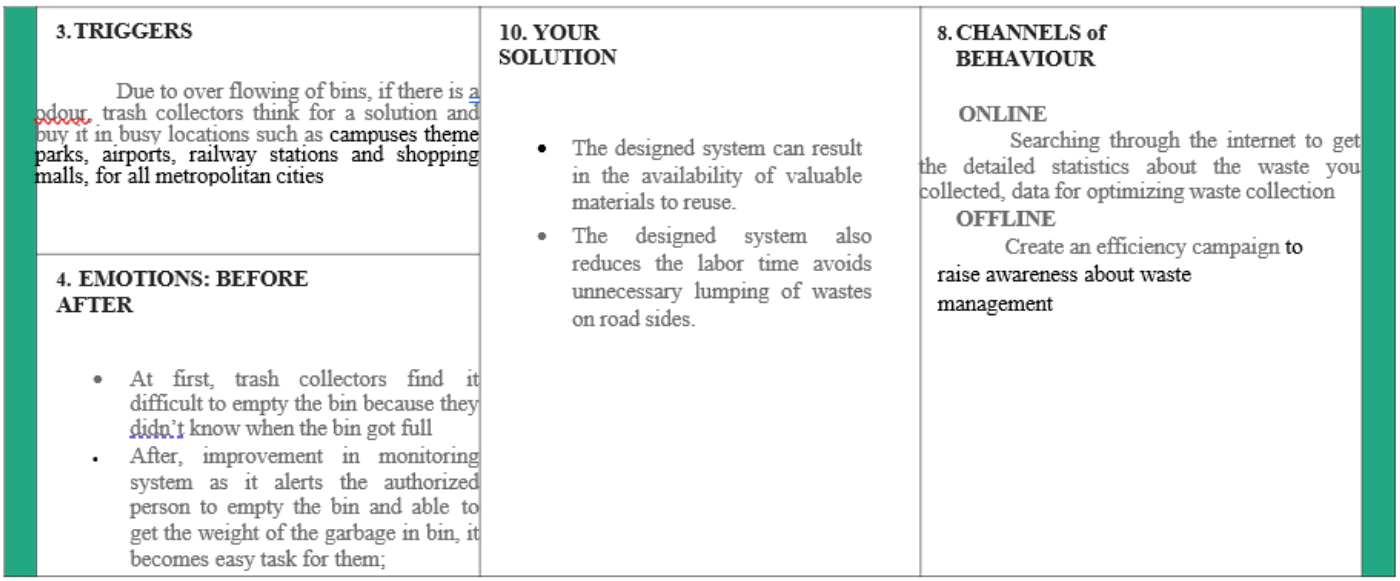
SOLUTION ARCHITECTURE



SOLUTION ARCHITECTURE



FIT:



Solution Architecture

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals areto:

Find the best tech solution to solve existing business problems.

Describe the structure, characteristics, behavior and other aspects of the softwareto project stakeholders.

Define features, development phases and solution requirements.

Provide specifications according to which the solution is defined, managed anddelivered.

FEATURES:

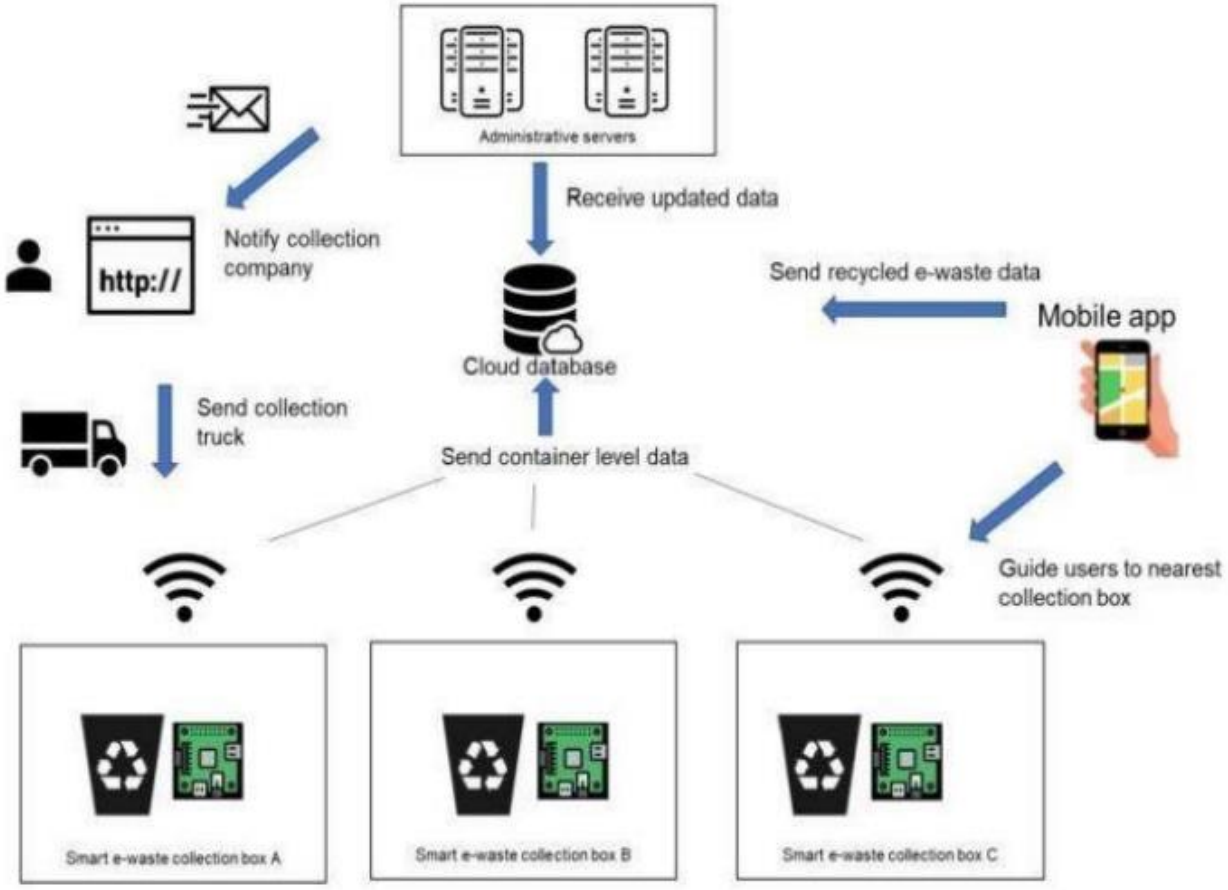
To produce a stable equipment of weighing sensors and other communicationiOTdevices to create a best and efficient Smart-Waste Management System.

1.Communication sensors
2.GPS
3.Notify Alert signal

SOLUTION:

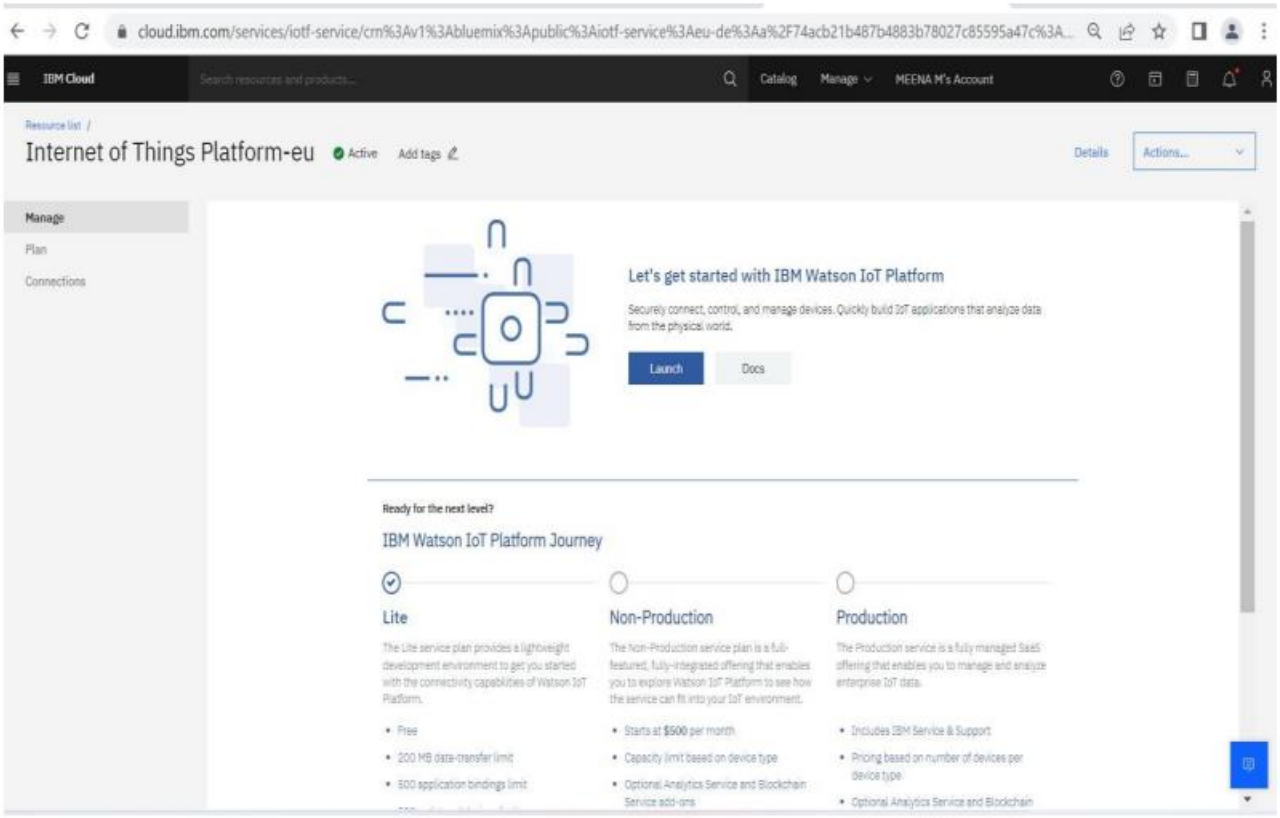
Building a stable and durable stand to which the weighing and communication sensors/devices are added and are used to update and send the information to the nearest waste collector. The normal dustbins are inserted into the stand and removed as needed. The communication sensor consists of applications including giving notification to the waste collectors about the weight and capacity of the dustbin that is filled.

Solution architecture

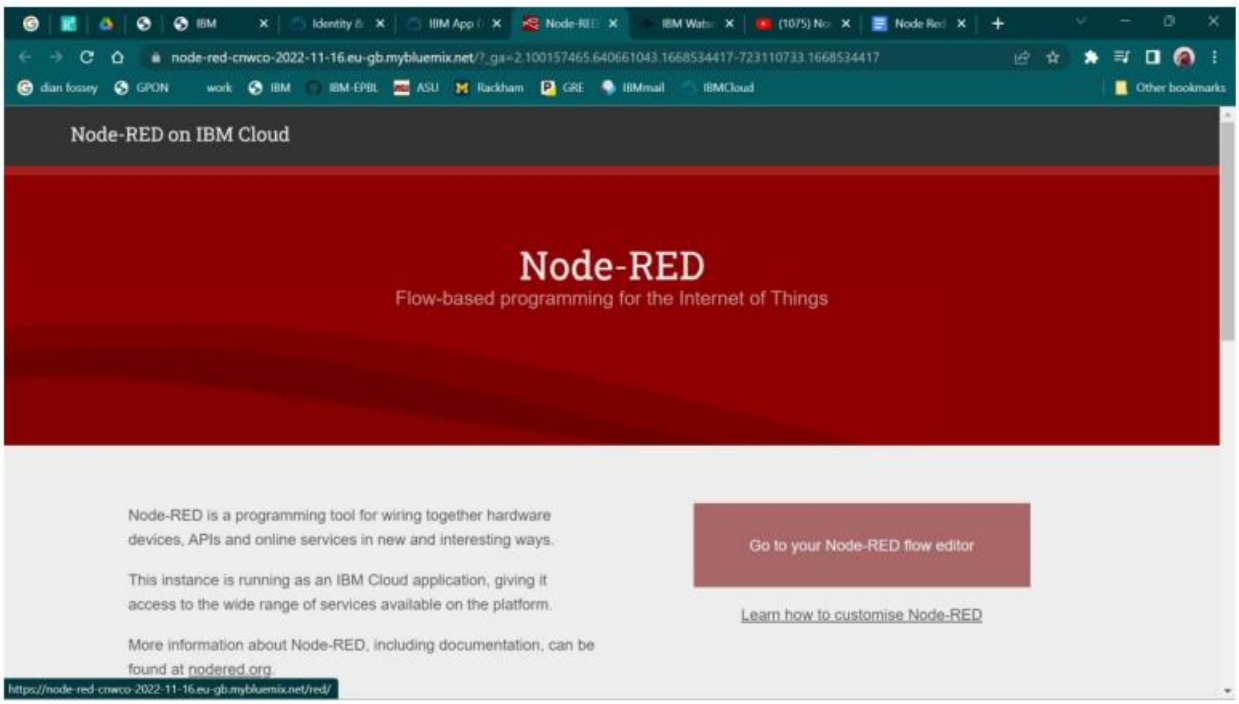


REQUIREMENT ANALYSIS :

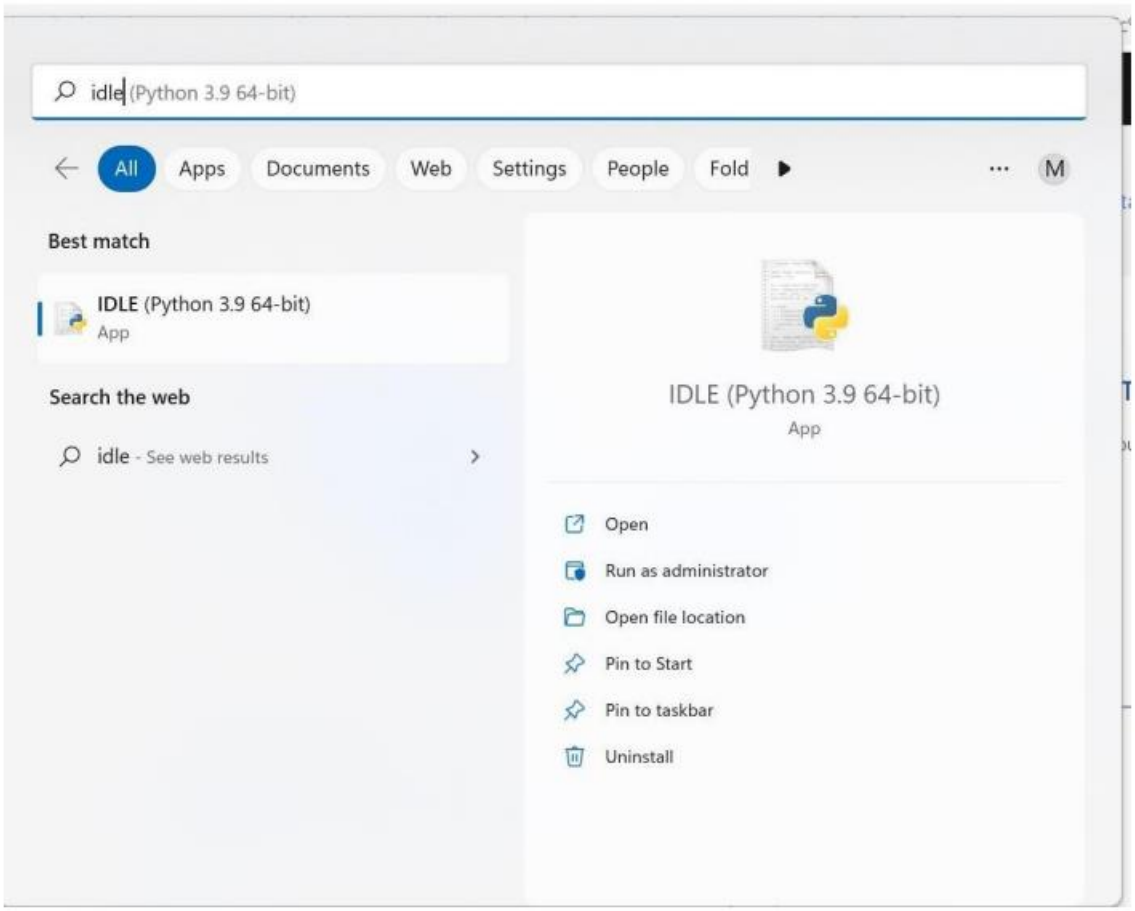
IBM ckoud platform is required at top priority level :



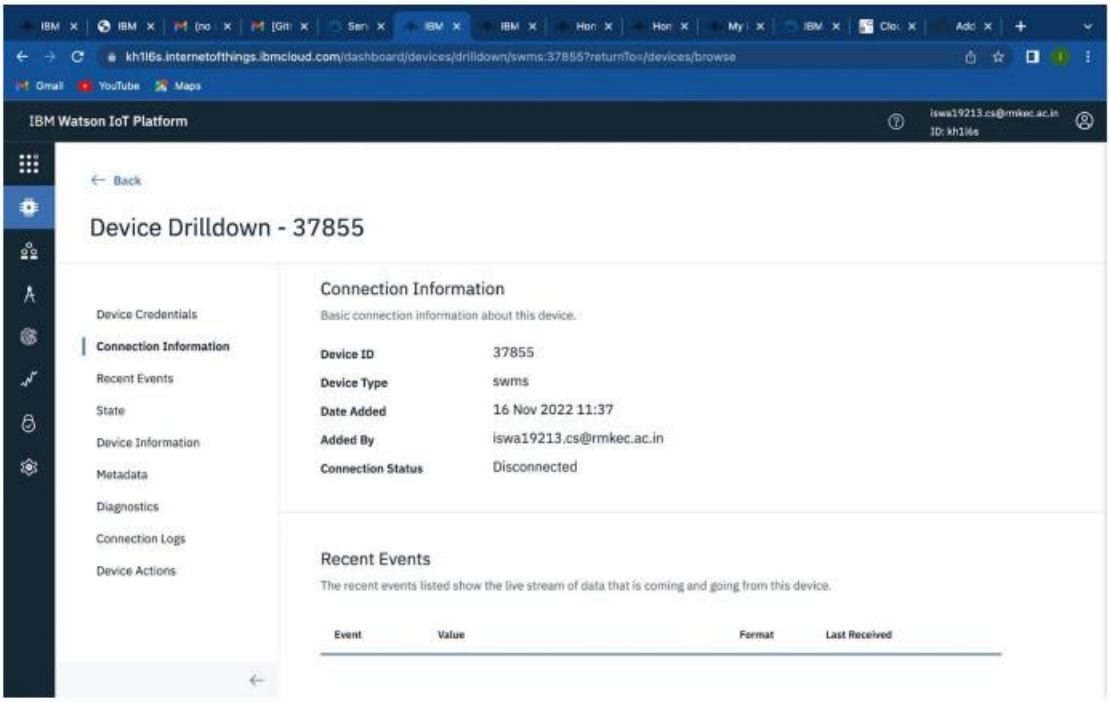
NODE-RED :



PYTHON LATEST VERION :



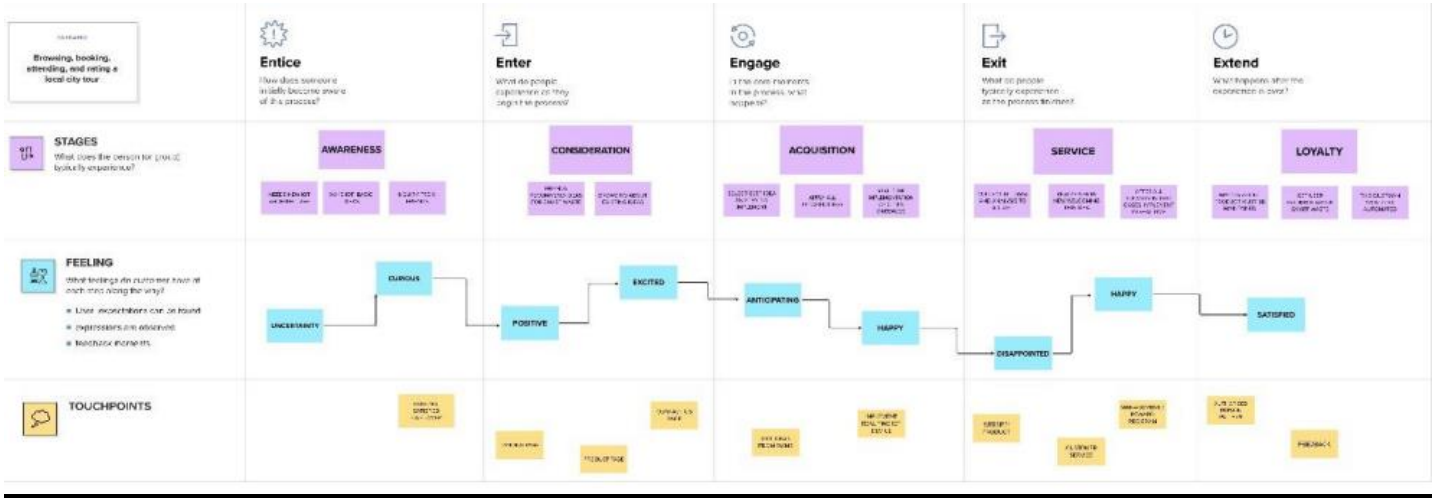
IOT WATSON platform :



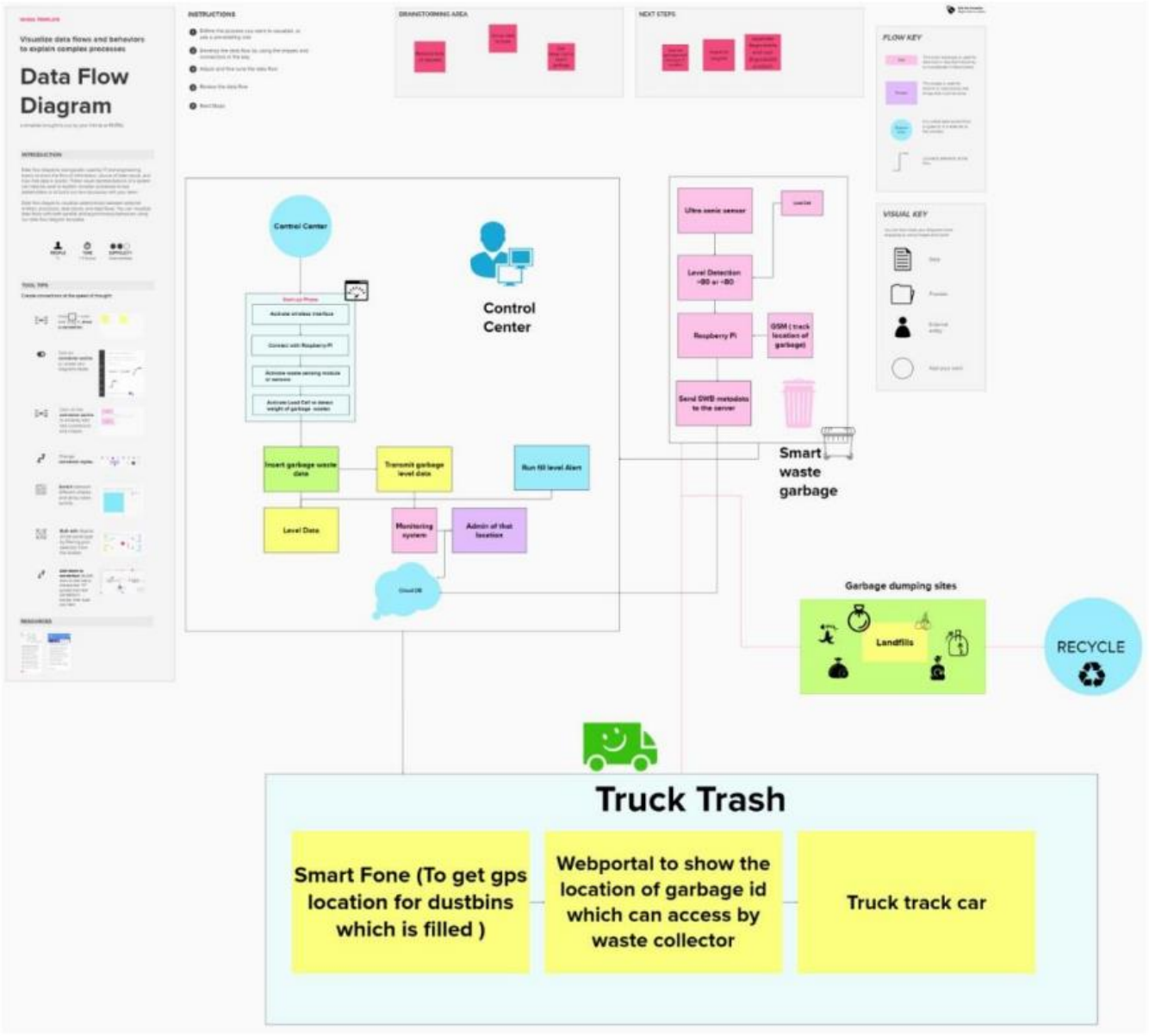
PROJECT DESIGN REPORT:

Here we design the project from the ideation phase this phase includes customer journey , data flow diagram and functional requirement.

CUSTOMER JOURNEY



Data flow diagram



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Functional Requirements :

Following are the functional requirements of the proposed solution.

FR NO	Functional Requirement (Epic)	Sub Requirement (Story / Sub Task)
FR-1	Detailed bin inventory	Bins or stands are visible on the map as green, orange or red circles. You can see bin details in the Dashboard – capacity, waste type, last measurement, GPS location and collection schedule or pick recognition.
FR-2	Real time bin monitoring.	The Dashboard displays real time data on fill-levels of bins monitored by smart sensors. In addition to the % of fill-level, based on the historical data, the tool predicts when the bin will become full, one of the functionalities that are not included even in the best waste managementsoftware.

FR-3	Expensive bins.	The tool considers the average distance depo-bindischarge in the area. The tool assigns bin a rating(1-10) and calculates distance from depo-bin discharge.
FR-4	Adjust bin distribution.	Based on the historical data, you can adjust bin capacity or location where necessary.

		Identify areas with either dense orsparse bin distribution.
FR-5	Eliminate unefficient picks.	Eliminate the collection of half empty bins. The sensors recognize picks. The report shows how full the bin was when picked. You immediately see any inefficient picks below 80% Full.
FR-6	Plan waste collection routes	The tool semi-automates waste collection route planning. Based on current bin fill-levels and predictions of reaching full capacity, you are ready to respond and schedule waste collection. You can compare planned vs. executed routes to identify any Inconsistencies.

Non functional requirements

FR NO.	Non-Functional Requirement	Description
NFR-1	**Usability**	IoT device verifies that usability is a special and important perspective to analyze user requirements, which can further improve the design quality. In the design process with user experience as the core, the analysis of users' product usability can indeed help designers better understand users' potential needs in waste management, behavior and experience.
NFR-2	**Security**	Usea reusable bottles Use reusable grocery bags Purchase wisely and recycle Avoid single use food and drink container.
NFR-3	**Reliability**	Smart waste management is also about creating better working conditions for waste collectors and drivers. Instead of driving the same collection routes and servicing empty bins, waste collectors will spend their time more efficiently, taking care of bins that need servicing .

:

NFR-4	**Performance**	Usinga variety of IoT networks (NB-IoT,GPRS), the sensors send the data to Sensono's Smart Waste Management Software System, a powerful cloud-based platform, for data driven daily operations, available also as a waste management app. Customers are hence provided data-driven decision making, and optimization of waste collection routes, frequencies, and vehicle loads resulting in route reduction by at least 30%.
NFR-5	**Availability**	By developing & deploying resilient hardware and beautiful software we empower cities, businesses, and countries to manage waste smarter.
NFR-6	**Scalability**	Using smart waste bins reduce the number of bins inside town , cities coz we able to monitor the garbage 24/7 more cost effect and scalability when we moves to smarter.

PROJECT DEVELOPMENT REPORT :

In sprint 1 we have developed the code for smart waste management and seen output in python idle.

```
# Project : Smart Waste Management
# Team ID : PNT2022TMID01046
import requests
import json
import ibmiotf.application
import ibmiotf.device
import time
import random
import sys

# watson device details

organization = "ms9s4l"
devicType =  "Project"
deviceId = "TMID01046"
authMethod= "token"
authToken= "13150415"

#generate random values for randomo variables for distance and loadcell


def myCommandCallback(cmd):
    global a
    print("command recieved:%s" %cmd.data['command'])
    control=cmd.data['command']
    print(control)

try:
        deviceOptions={"org": organization, "type": devicType,"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 "distance and loadcell" with value integer value into the cloud as a type of event for every 10 seconds
deviceCli.connect()

while True:

    distance= random.randint(10,70)
    loadcell= random.randint(5,15)
    data= {'dist':distance,'load':loadcell}


    if loadcell < 13 and loadcell > 15:
        load = "90 %"
```

```
Python 3.7.8 (tags/v3.7.8:4b47a5b6ba, Jun 28 2020, 08:53:46) [MSC v.1916 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:\Users\aksha\OneDrive\Desktop\bin4.py ==========
2022-11-12 14:34:04,621   ibmiotf.device.Client      INFO    Connected successfully: d:ms9s4l:Project:TMID01046
Chennai
published distance = 26  loadcell:12  lon = 78.135731  lat = 10.939091
0 %
Risk warning:dumpster is above 60%
alert :No need to collect right now
Chennai
published distance = 26  loadcell:12  lon = 78.135731  lat = 10.939091
0 %
Risk warning:dumpster is above 60%
alert :No need to collect right now
Chennai
published distance = 59  loadcell:8  lon = 78.135731  lat = 10.939091
0 %
Risk warning:40 %
alert :No need to collect right now
Chennai
published distance = 59  loadcell:8  lon = 78.135731  lat = 10.939091
0 %
Risk warning:40 %
alert :No need to collect right now
Chennai
published distance = 59  loadcell:8  lon = 78.135731  lat = 10.939091
0 %
Risk warning:40 %
alert :No need to collect right now
Chennai
published distance = 59  loadcell:8  lon = 78.135731  lat = 10.939091
0 %
Risk warning:40 %
alert :No need to collect right now
Chennai
published distance = 63  loadcell:15  lon = 78.135731  lat = 10.939091
0 %
Risk warning:17 %
alert :No need to collect right now
Chennai
published distance = 63  loadcell:15  lon = 78.135731  lat = 10.939091
0 %
Risk warning:17 %
alert :No need to collect right now
Chennai
published distance = 32  loadcell:12  lon = 78.135731  lat = 10.939091
```

In Sprint 2 we developed code for data transfer from sensors :

```
#include <WiFi.h>                //Library for WiFi #include
<PubSubClient.h>                 //Library for MQTT #include
<ArduinoJson.h>                  //Library for ArduinoJson


WiFiClient wifiClient;



//.....Credentials on IBM Account-.....


#define ORG "k6spbs"                //IBM Organisation ID
#define DEVICE_TYPE "MSD"   //Device mentioned in IBM Watson IOT Platform #define
```

```
DEVICE_ID "12345"                  //Device ID mentioned on IBM Watson IOT Platform
#define TOKEN "123456789"     //Token
#define speed 0.034

//-------------------------Customise above values-----------------------------------


char server[] = ORG ".messaging.internetofthings.ibmcloud.com";    //Server Namechar
publishTopic[] = "iot-2/evt/Data/fmt/json";
char topic[] = "iot-2/cmd/home/fmt/String";
char authMethod[] = "use-token-auth";                                        //Authentication Method

        char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;    //Client id

//-------------------------------------------------------------------------------


PubSubClient client(server, 1883, wifiClient);void
publishData();

const int trigpin=5; const int
echopin=18;String command;
String data="";
String lat="13.167558"; String
lon="80.244510";String
name="point2"; String
icon="fa-trash-o";String
color="green"; long duration;
int dist;

void setup()
{
  Serial.begin(115200);
  pinMode(trigpin, OUTPUT);
```

```
  pinMode(echopin, INPUT);
  wifiConnect(); mqttConnect();
 }

void loop() {
  publishData();
  delay(500);

  if (!client.loop()) {
   mqttConnect();
  }
 }

 //.....Retrieving to Cloud.....


 void wifiConnect() {
  Serial.print("Connecting to "); Serial.print("Wifi");
  WiFi.begin("Wokwi-GUEST", "", 6);
  while (WiFi.status() != WL_CONNECTED) {
   delay(500);
   Serial.print(".");
  }
  Serial.print("WiFi connected, IP address: "); Serial.println(WiFi.localIP());
 }

 void mqttConnect() {
  if (!client.connected()) {
   Serial.print("Reconnecting MQTT client to "); Serial.println(server);while
   (!client.connect(clientId, authMethod, token)) { Serial.print(".");
    delay(1000);
   }
   initManagedDevice();
```

```
   Serial.println();
}

void initManagedDevice() { if
  (client.subscribe(topic)) {
     Serial.println(client.subscribe(topic));
    Serial.println("subscribe to cmd OK");
  } else {
    Serial.println("subscribe to cmd FAILED");
  }
}

//.....Publish Smart Bin level.....


void publishData()
{
  digitalWrite(trigpin,LOW);
  digitalWrite(trigpin,HIGH);
  delayMicroseconds(10);
  digitalWrite(trigpin,LOW);
  duration=pulseIn(echopin,HIGH);
  dist=duration*speed/2; dist=dist/4;
  dist=100-dist; if(dist>80){
  icon="fa-trash";
  color="red";
  }else{
    icon="fa-trash-o";
    color="gree";
  DynamicJsonDocument doc(1024);String
  payload; doc["Name"]=name;
  doc["Latitude"]=lat; doc["Longitude"]=lon;
  doc["Icon"]=icon; doc["FillPercent"]=dist;
```

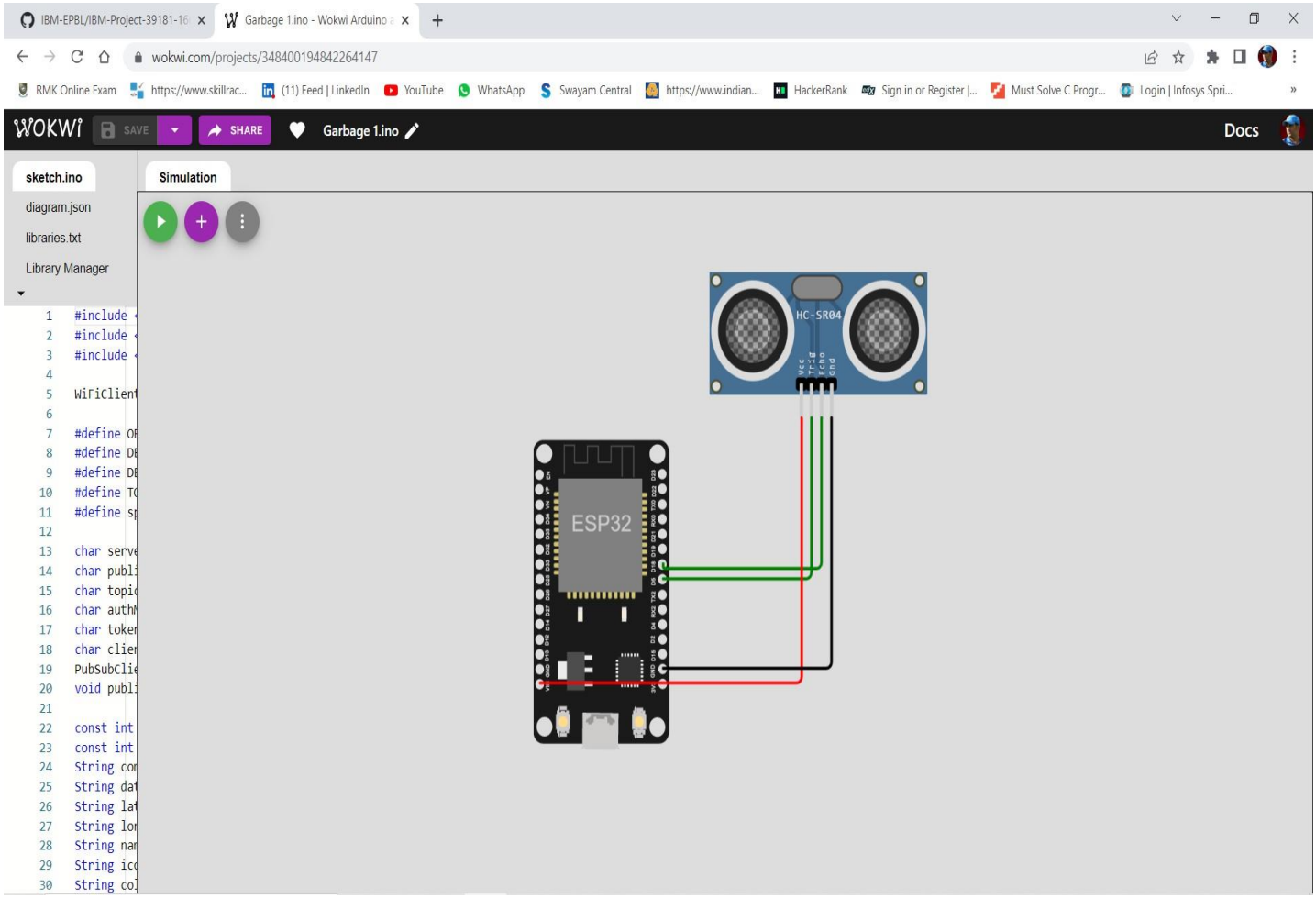
```
  doc["Color"]=color; serializeJson(doc,
  payload); delay(3000);

//.....Print on LCD.....

  Serial.print("\n"); Serial.print("Sending
  payload: ");Serial.println(payload);
  if (client.publish(publishTopic, (char*) payload.c_str())) {
    Serial.println("Publish OK");
  } else {
    Serial.println("Publish FAILED");
  }
}

//.....End of Program.....
```

CIRCUIT CONFIGURATION:



SPRINT 3:

In this Phase, I will explain about the flow of our project.

- **As we mentioned in the Data flow graph, we are first using an online simulation tool to send the level of the dustbin with the help of an ultrasonic sensor using the WOKWI platform and we also send the required data such as location, bin name etc...**

- This data is being sent to the IBM Watson IOT platform and with the help of IBM Watson IOT node we can get the data in node red.

- We designed few flows to make the data to be in a required format like maps, tables, gauge

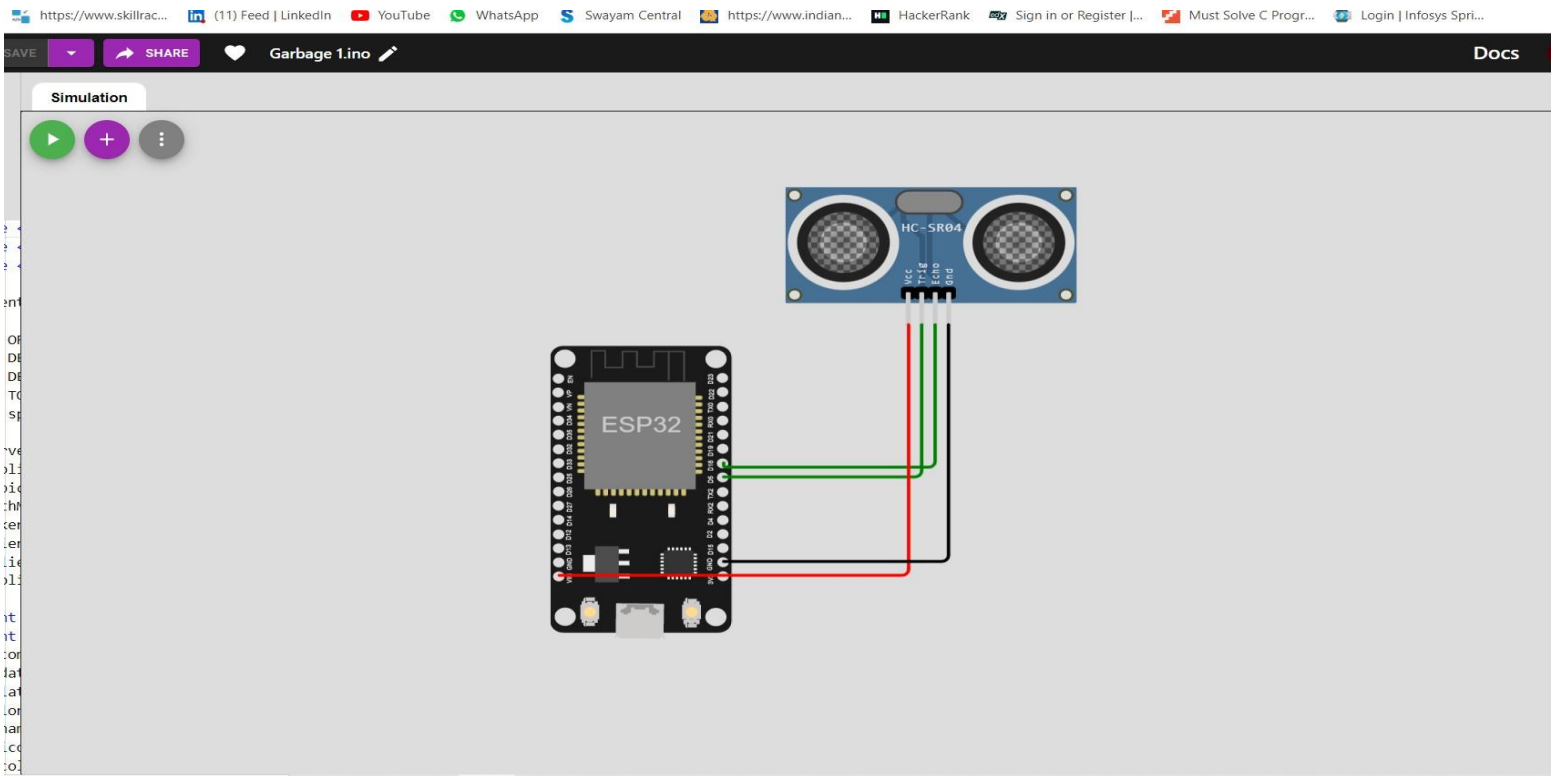
- Here we store the Admin, Co admin details in the database (Cloudant DB)

- We have also created a python script to generate random BIN values which can also be used instead of WOKWI to send data to the IBM Watson IOT platform.

- I've also added a few Screenshots of the things we have done.

- We used a world map node for displaying the latitude and longitude in the Map.

SCREENSHOTS:
WOKWI Platform



Python Code:

Here we can see the Python Code which is used to connect with IBM WatsonIOT platform.

ibm dustbin.py - C:\Users\Praveen\Desktop\ibm dustbin.py (3.7.4)

File Edit Format Run Options Window Help

```
#IBM Watson IOT Platform
#pip install wiotp-sdk
import wiotp.sdk
import time
import random
myConfig = {
    "identity": {
        "orgId": "k6spbs",
        "typeId": "MSD",
        "deviceId":"12345"
    },
    "auth": {
        "token": "123456789"
    }
}
lat="13.167589"
lon="80.248510"
name="point1"
icon="fa-trash-o"
color="green"
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()

while True:
    temp=random.randint(0,100)
    if temp>60:
        icon="fa-trash"
        color = "red"
    else:
        icon = "fa-trash-o"
        color = "green"
    myData={"Name":name,"Latitude":lat,"Longitude":lon,"Icon":icon,"FillPercent":temp,"Color":color}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully: %s", myData)
    client.commandCallback = myCommandCallback
    time.sleep(10)
client.disconnect()
```

Ln: 1 Col: 0

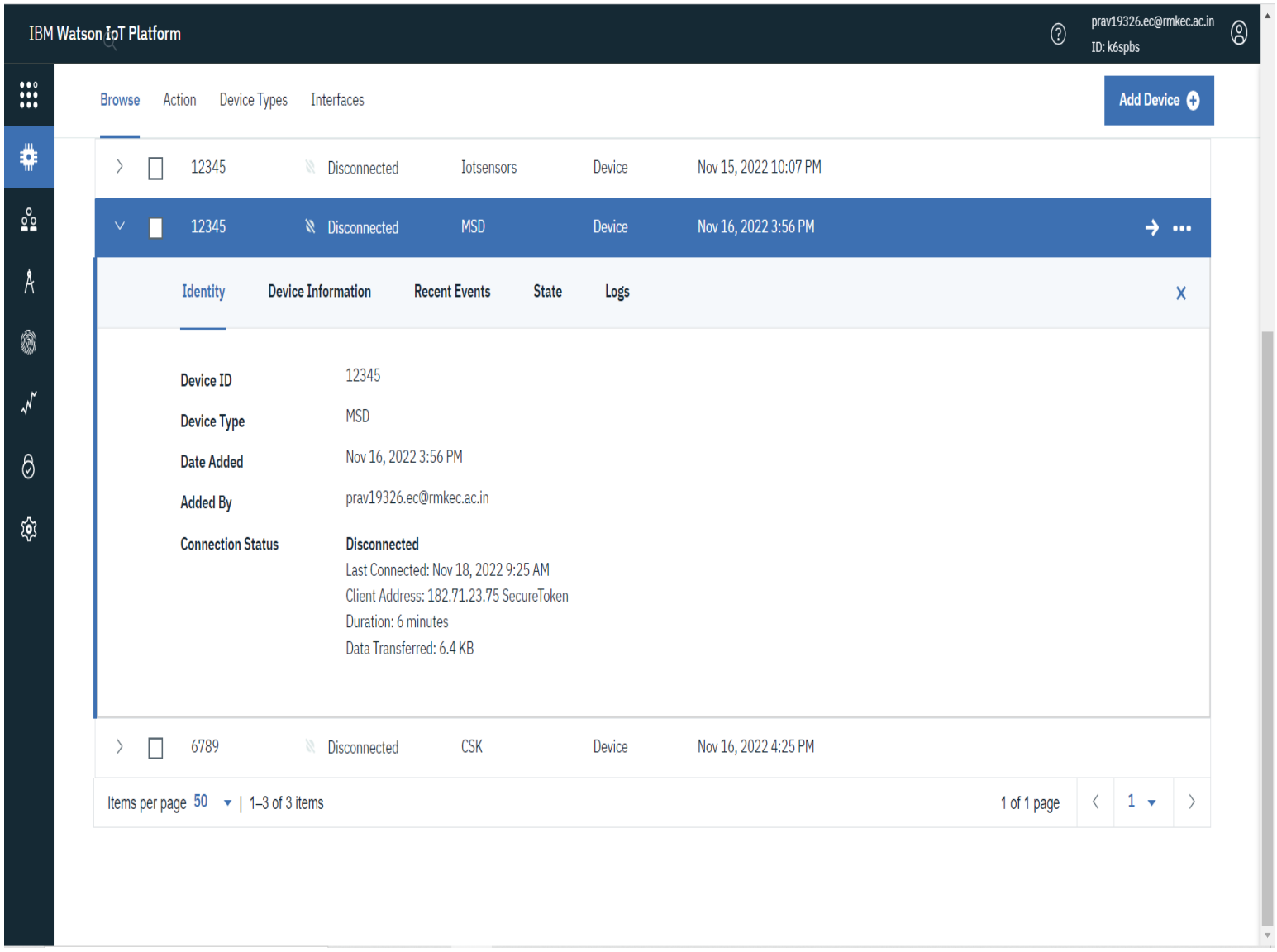
Cloudant **DB:**

IBM Watson IoT Platform:

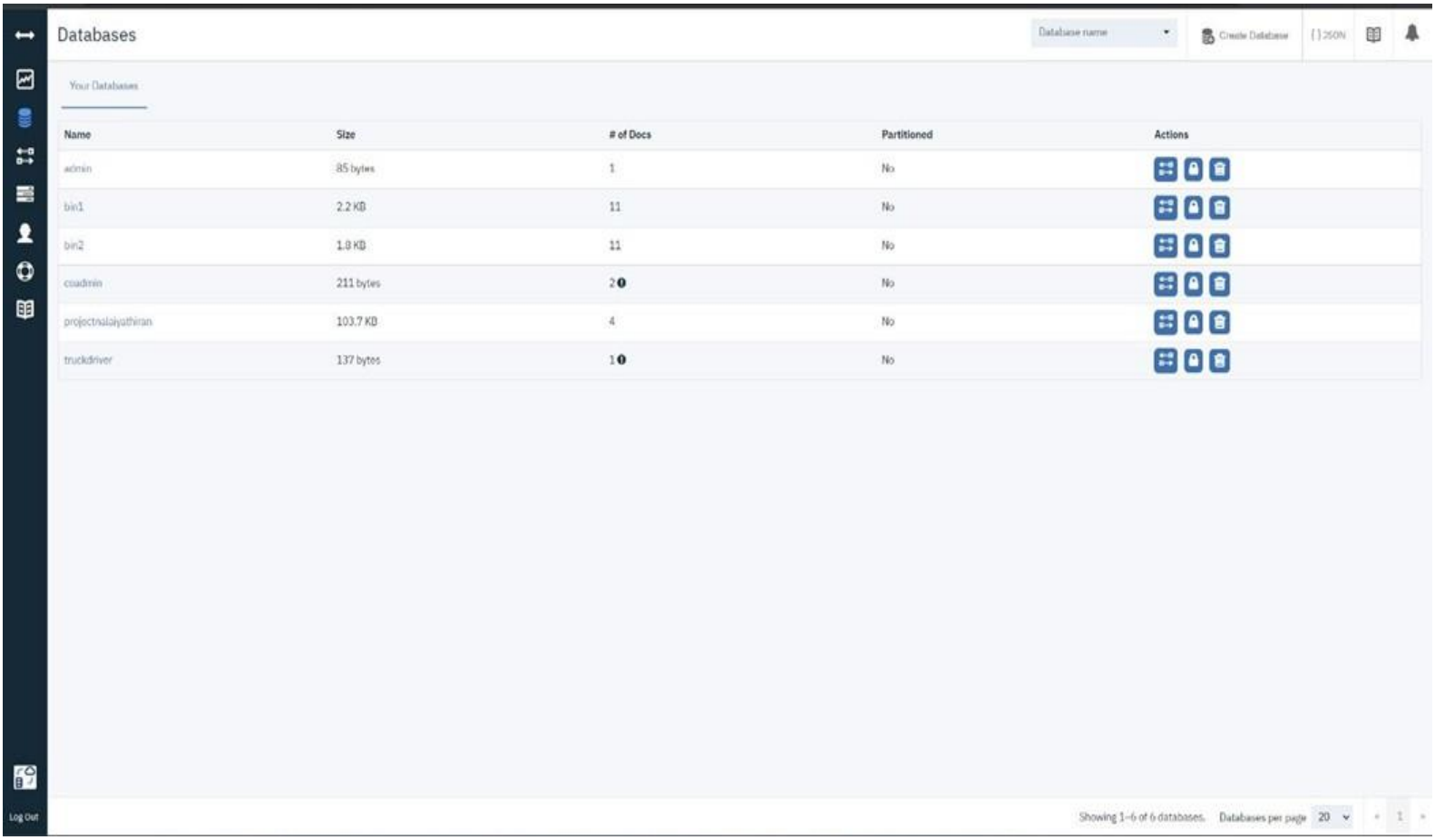
The information about the devices are being displayed here

- Here we can see the output which has been passed from WOKWI Platform or Python Script to IBM Watson IOT platform.

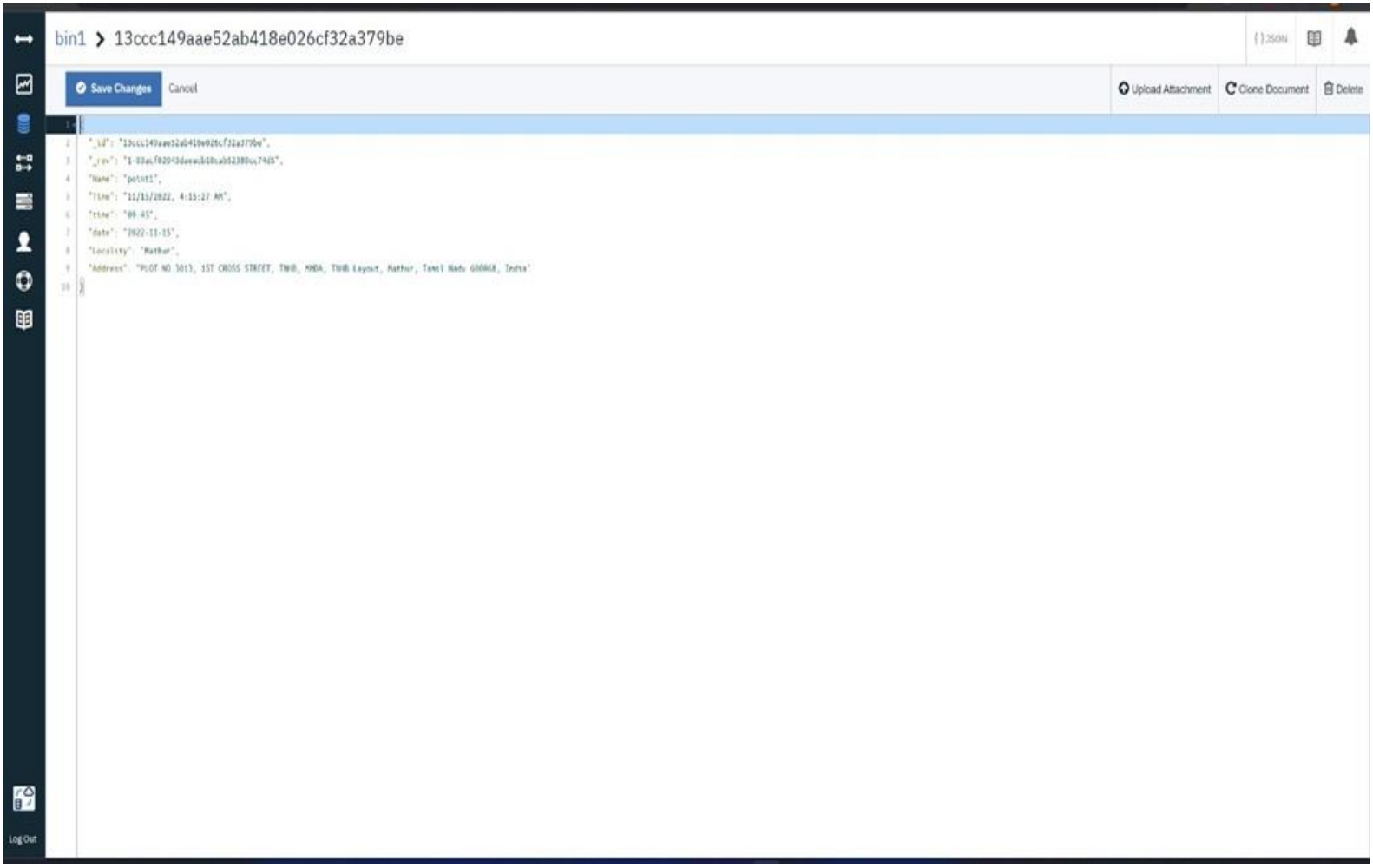
- It will provide the necessary information by the means of API Key. By placing this API Keys to the simulation devices source code, It will acts as an mediator between the simulator tool and the Node-Red platform



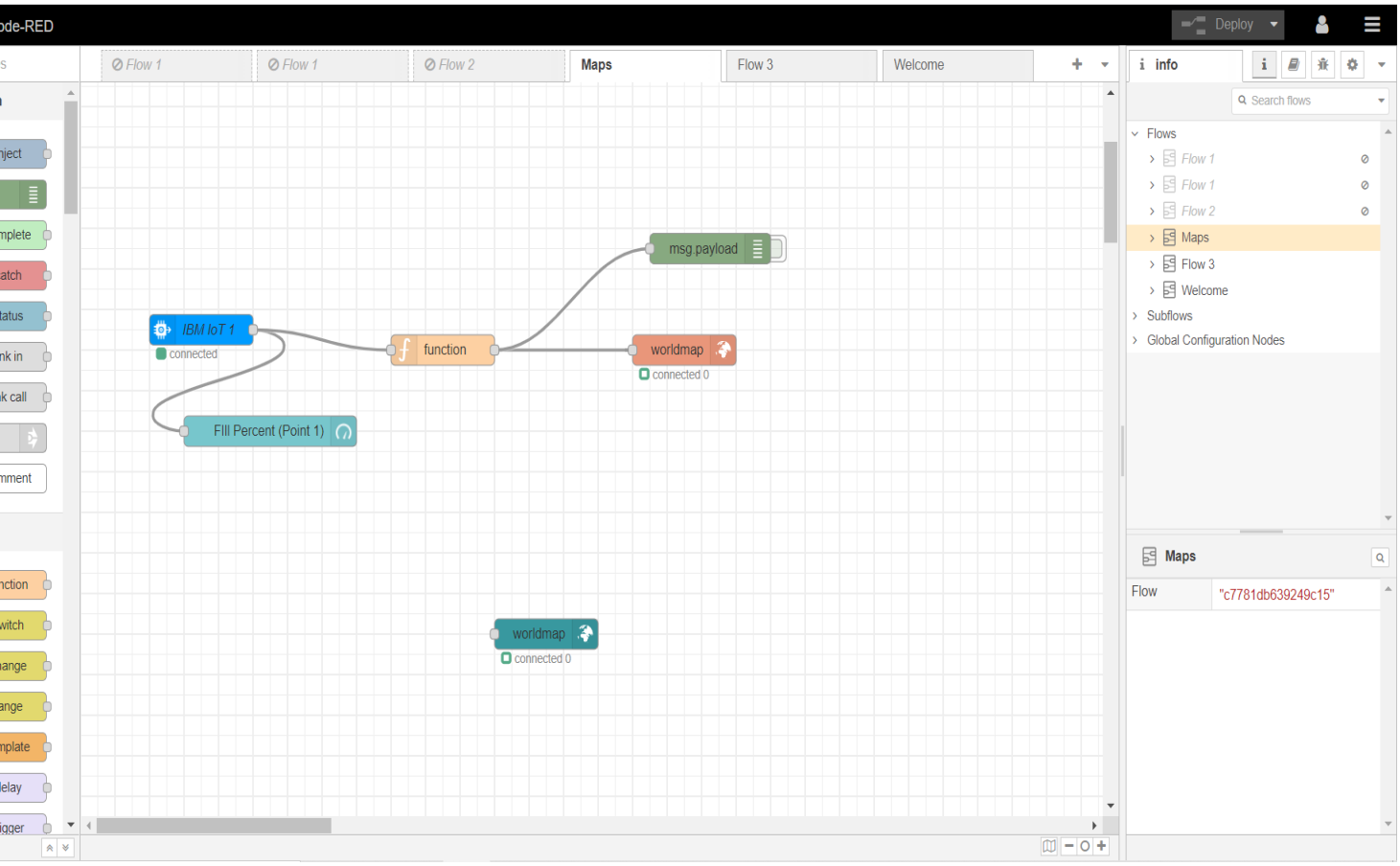
Cloudant **DB:**


Databases
Database name
Create Database
{ } JSON
Your Databases
Name
Size
# of Docs
Partitioned
Actions
admin
85 bytes
1
No
bin1
2.2 KB
11
No
bin2
1.8 KB
11
No
couchdb
211 bytes
2
No
projectnalaiyathiran
103.7 KB
4
No
truckdriver
137 bytes
1
No
Log Out
Showing 1–6 of 6 databases.
Databases per page
20
1

BIN **1 DATABASE:**

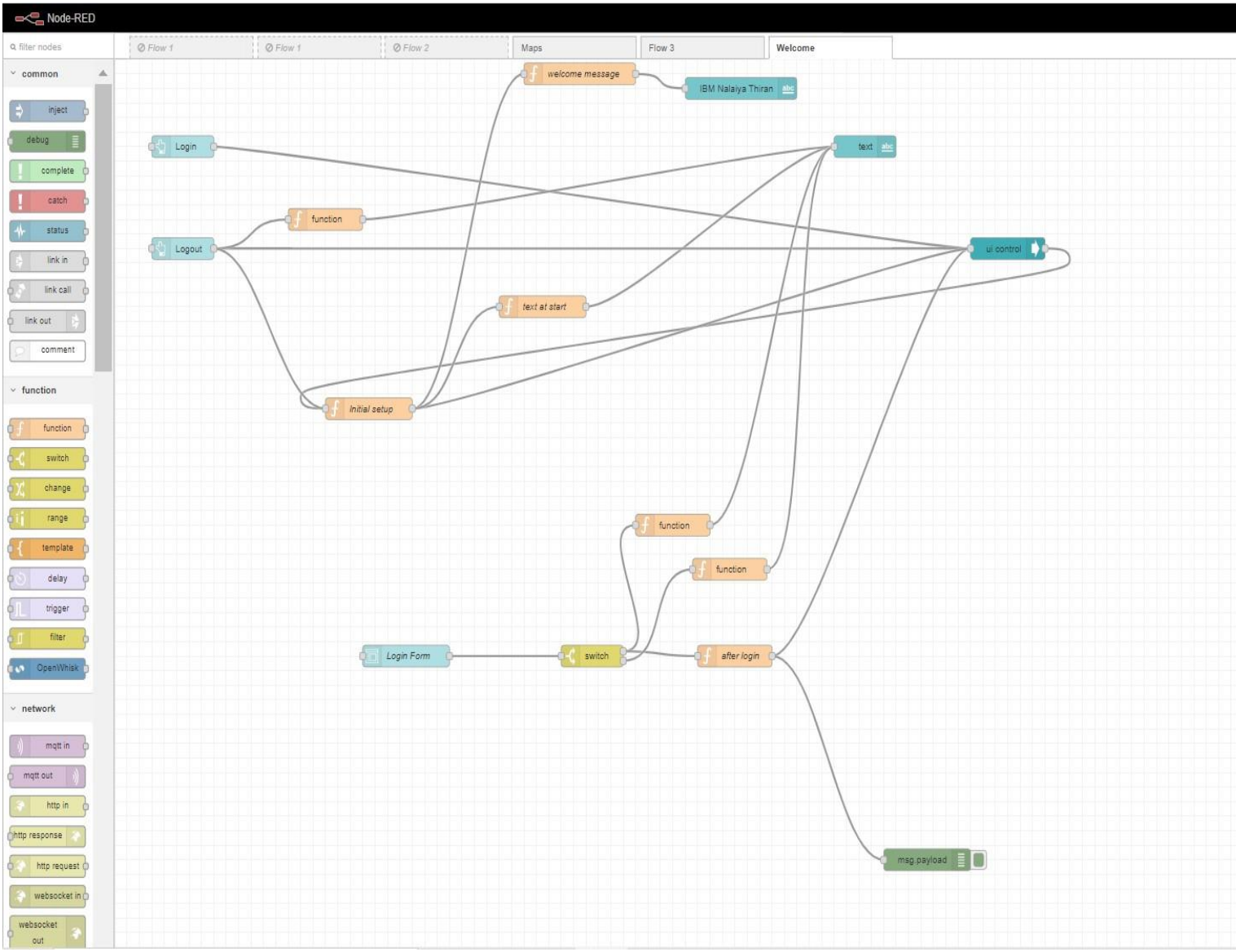


NODE **RED FLOW:**

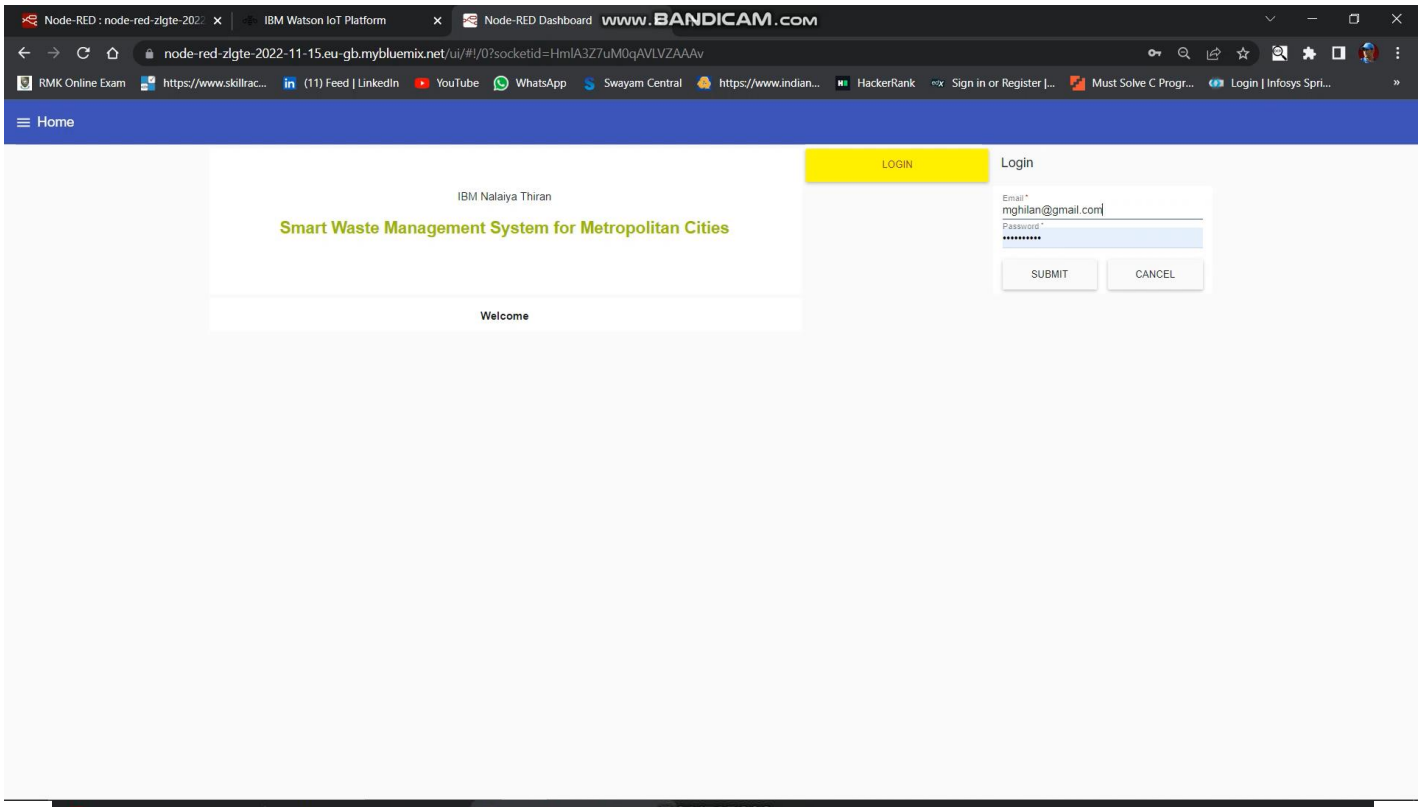


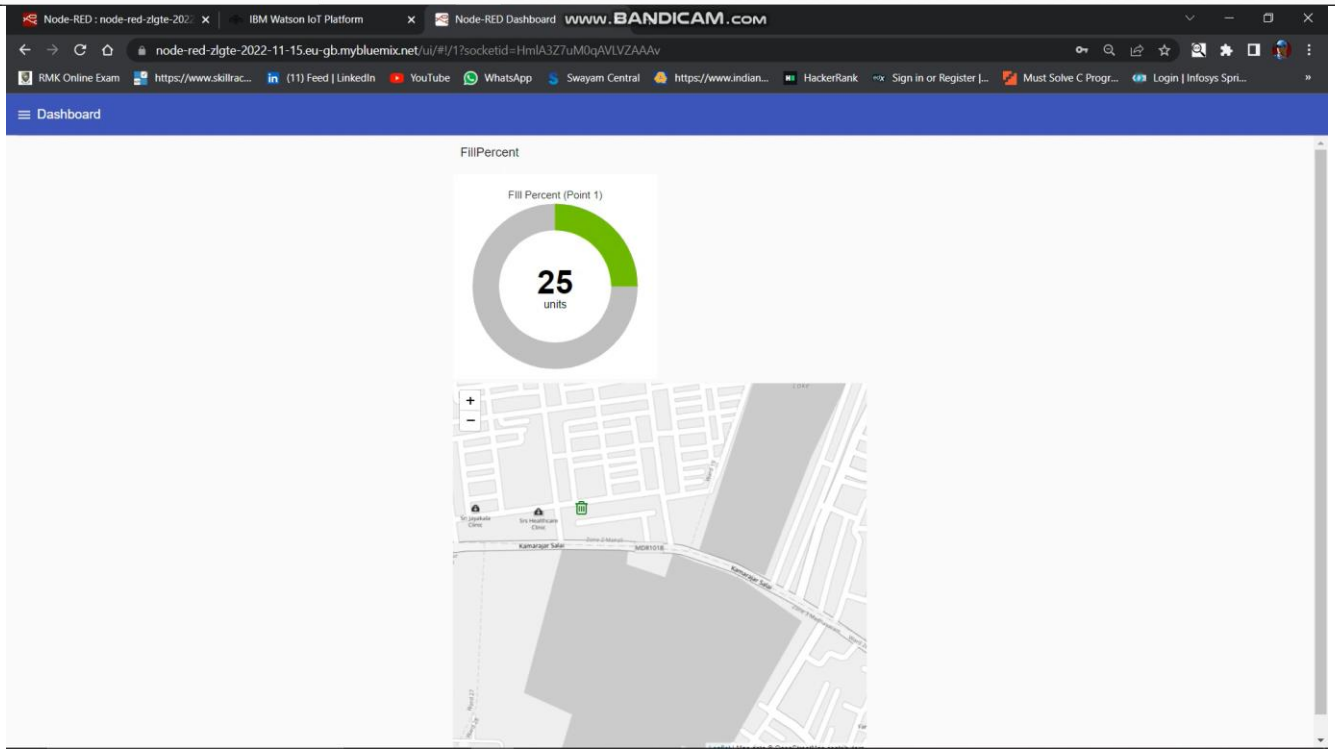
- This is the Node Red flow to connecting to the IBM Watson IoT Platform, It use IBM IoT 1 Node for the process of connecting to the simulator

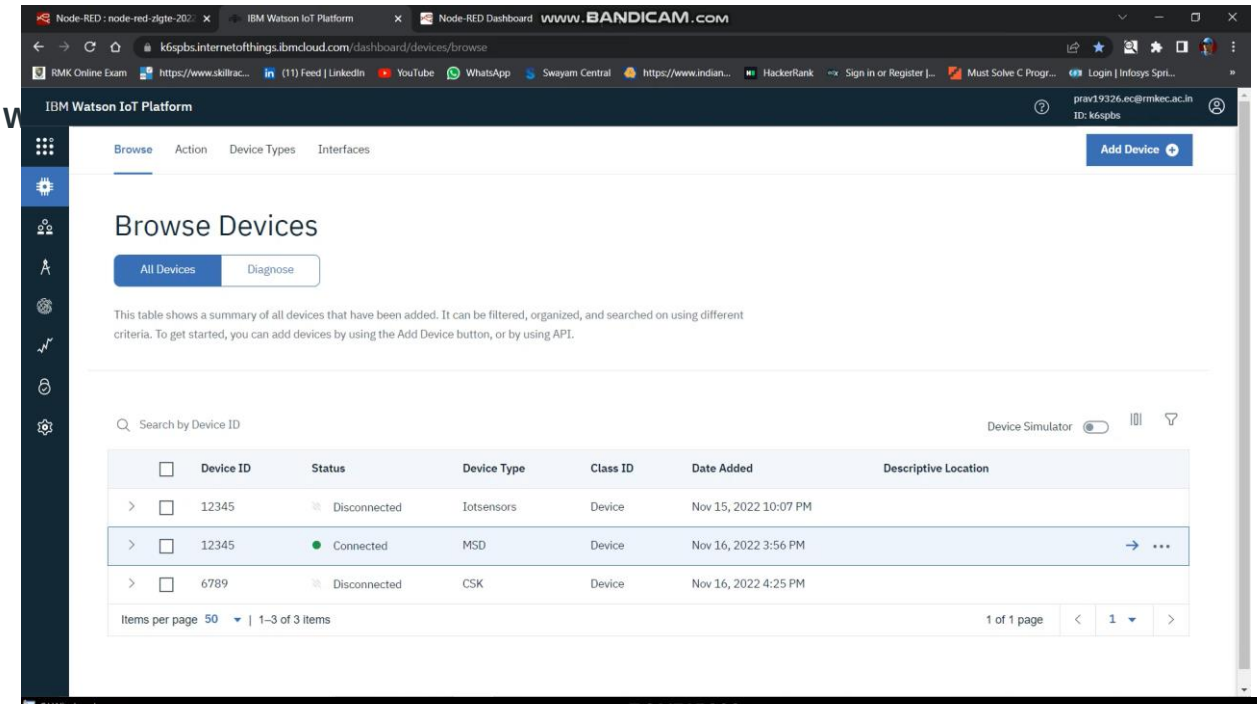
- The World Map node is used to show the geographical locations of eachsmart bins across the Smart Cities

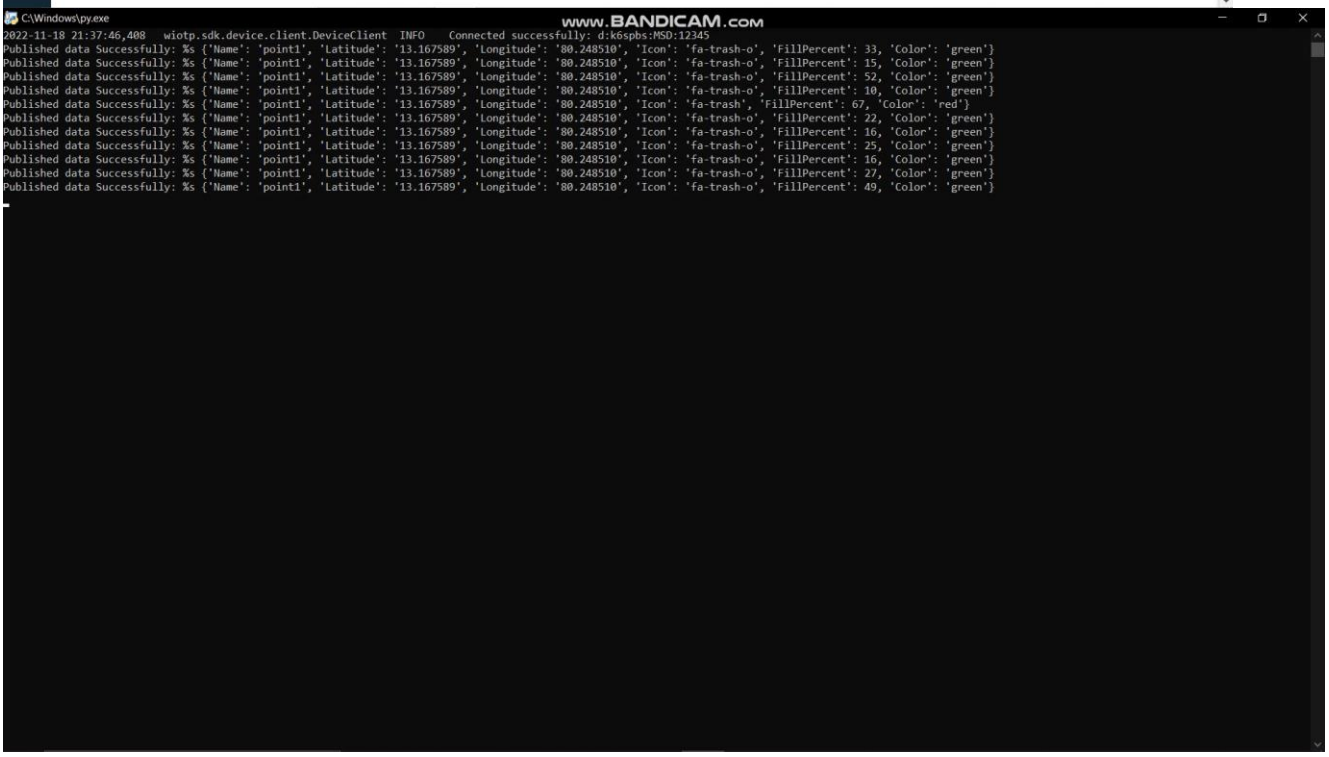


- This Node is used to create a Login page for our dashboard. This is a Non -functional requirement for our project used for authorization purposes.


Node-RED : node-red-zlgte-202
IBM Watson IoT Platform
Node-RED Dashboard
www.BANDICAM.com
node-red-zlgte-2022-11-15.eu-gb.mybluemix.net/ui/#!/0?socketid=HmlA3Z7uM0qAVLVZAAAv
RMK Online Exam
https://www.skillrac...
(11) Feed | LinkedIn
YouTube
WhatsApp
Swayam Central
https://www.indian...
HackerRank
Sign in or Register |...
Must Solve C Progr...
Login | Infosys Spri...
Home
IBM Nalaiya Thiran
Smart Waste Management System for Metropolitan Cities
Welcome
LOGIN
Login
Email *
mghilan@gmail.com
Password *
SUBMIT
CANCEL


Node-RED : node-red-zlgte-202
IBM Watson IoT Platform
Node-RED Dashboard
www.BANDICAM.com
node-red-zlgte-2022-11-15.eu-gb.mybluemix.net/ui/#!/1?socketid=HmlA3Z7uM0qAVLVZAAAv
RMK Online Exam
https://www.skillrac...
(11) Feed | LinkedIn
YouTube
WhatsApp
Swayam Central
https://www.indian...
HackerRank
Sign in or Register |...
Must Solve C Progr...
Login | Infosys Spri...
Dashboard
FillPercent
Fill Percent (Point 1)
25
units





Hence the output alert is correct , project works without error.

TESTING Scenarios:

- ❖ EMPTY bin
- ❖ Initial level filled test
- ❖ Max filled (100%)
- ❖ About the level which sensor should give signal
- ❖ Over-dumped level

Date	15-Nov-22
Team ID	PNT2022TMID16132
Project Name	Smart Waste Management System for Metropolitan Cities - IOT
Maximum Marks	4 marks

Test case ID	Feature Type-Bin Level	Component	Test Case Scenario	Pre-Requisite	Availability	Test Condition	Expected Result	Actual Result	Status	Comments	Accessed By
Test case 1	Empty	Ultrasonic Sensor	When Bin is empty	Ultrasoncic sensor PIR Motion Sensor Garbage Bins	Bin is accessible to users	Bin Level == 0	Displays Bin level and space left	Working as expected	Pass		User
Test case 1	Accessible	Ultrasonic Sensor	When bin level is below 50 %	Ultrasoncic sensor , PIR Motion Sensor , Garbage Bins	Bin is accessible to users	Bin Level < 50	Displays Bin level and space left	Working as expected	Pass		User
Test case 3	Accessible	Ultrasonic Sensor	When bin level is above 50	Ultrasoncic sensor , PIR Motion sensor , Garbage Bins	Bin is accessible to users and the admin gets warning about the bin level	Bin Level > 50	Displays Bin level and space left	Working as expected	Pass		User
Test case 4	Accessible	Ultrasonic Sensor	When bin level is below 75 %	Ultrasoncic sensor , PIR Motion sensor , Garbage Bins	Bin is accessible to users and the admin gets warning about the bin level	Bin Level < 75	Displays Bin level and space left	Working as expected	Pass		User
Test case 5	Limit exceeded	Ultrasonic Sensor	When bin level is above 75 %	Ultrasoncic sensor , PIR Motion sensor , Garbage Bins	Bin is not accessible to the users, the admin recieves High alert and seals the the bin to avoid overflow.	Bin Level > 75	Displays Bin is FULL and Seals the bin.	Working as expected	Pass	The system starts to sense the level once the Bin is emptied partially or fully	User/Admin

RESULT :

Hence the project "SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES" has successfully designed and delivered correctly . Using this system its easy for workers to find the level of garbage in different areas and they can act along with the efficiency of performance hence a lot of time is saved and it is a good approach to deliver right service at right time of need. This project help us from environmental pollution and keeps cities safe from disease.

IOT based system is fast in wireless communication hence with the help of cloud architecture to provide data support is what made this project special.

ADVANTAGES:

- Improves environmental quality.
- Efficient management and service in the city.
- Real time information distribution.
- Effective usage of garbage bin.
- Time consumption and labor distribution is efficient.

DISADVANTAGES:

- Limited memory size in sensor used.
- Hacking of data sensor is a possibility in some cases.
- It reduces manpower which may cause unemployment.
- Rough usage may damage the sensor.

Conclusion:

- ❖ Our project is real time based system hence it solves the needs in real time by giving insight of garbage bins full or not at all time.
- ❖ The expense in terms of petrol usage that is trips of trucks is efficiently reduced.
- ❖ Overall efficiency increased and the access of garbage bin status is anywhere accessible.

FUTURE SCOPE:

- The scope of this project is wide ranged as the users that is public might also get access to the information about the garbage level and they efficiently save their time going to the right empty bins.
- The wireless cloud IOT system can be upgraded to fast LORA (long range) systems for higher range specific regions.
- We can specify degradable and non-degradable garbage bins in future and give viewing access to the public to save energy of worker to separate wastes.

APPENDIX:SOURCE CODE : PYTHON CODE:

```
import wiotp.sdk
import time
import random
myConfig = {
    "identity": {
        "orgId": "k6spbs",
        "typeId": "MSD",
        "deviceId":"12345"
    },
    "auth": {
        "token": "123456789"
    }
}
lat="13.167589"
lon="80.248510"
name="point1"
icon="fa-trash-o"
color="green"
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()
```

```
while True:
    temp=random.randint(0,100)
    if temp>60:
        icon="fa-trash"
        color = "red"
    else:
        icon = "fa-trash-o"
        color = "green"

myData={"Name":name,"Latitude":lat,"Longitude":lon,"Icon":icon,"FillPercent":t
emp,"Color":color}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
    print("Published data Successfully: %s", myData)
    client.commandCallback = myCommandCallback
    time.sleep(10)
client.disconnect()
```

Wokwi Simulation Code:

```
#include <WiFi.h>
#include <PubSubClient.h>
#include <ArduinoJson.h>

WiFiClient wifiClient;

#define ORG "k6spbs"
#define DEVICE_TYPE "MSD"
#define DEVICE_ID "12345"
#define TOKEN "123456789"
#define speed 0.034

char server[] = ORG ".messaging.internetofthings.ibmcloud.com";
char publishTopic[] = "iot-2/evt/Data/fmt/json";
char topic[] = "iot-2/cmd/home/fmt/String";
char authMethod[] = "use-token-auth";
```

```
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;
PubSubClient client(server, 1883, wifiClient);
void publishData();

const int trigpin=5;
const int echopin=18;
String command;
String data="";
String lat="13.167558";
String lon="80.244510";
String name="point2";
String icon="fa-trash-o";
String color="green";
long duration;
int dist;

void setup()
{
  Serial.begin(115200);
  pinMode(trigpin, OUTPUT);
  pinMode(echopin, INPUT);
  wifiConnect();
  mqttConnect();
}

void loop() {

  publishData();
  delay(500);

  if (!client.loop()) {
    mqttConnect();
  }
}

void wifiConnect() {
  Serial.print("Connecting to "); Serial.print("Wifi");
  WiFi.begin("Wokwi-GUEST", "", 6);
  while (WiFi.status() != WL_CONNECTED) {
```

```
    delay(500);
    Serial.print(".");
  }
  Serial.print("WiFi connected, IP address: ");
Serial.println(WiFi.localIP());
}

void mqttConnect() {
  if (!client.connected()) {
    Serial.print("Reconnecting MQTT client to "); Serial.println(server);
    while (!client.connect(clientId, authMethod, token)) {
      Serial.print(".");
      delay(1000);
    }
    initManagedDevice();
    Serial.println();
  }
}

void initManagedDevice() {
  if (client.subscribe(topic)) {
     Serial.println(client.subscribe(topic));
    Serial.println("subscribe to cmd OK");
  } else {
    Serial.println("subscribe to cmd FAILED");
  }
}
void publishData()
{
  digitalWrite(trigpin,LOW);
  digitalWrite(trigpin,HIGH);
  delayMicroseconds(10);
  digitalWrite(trigpin,LOW);
  duration=pulseIn(echopin,HIGH);
  dist=duration*speed/2;
  dist=dist/4;
  dist=100-dist;
  if(dist>80){
    icon="fa-trash";
    color="red";
```

```
  }else{
    icon="fa-trash-o";
    color="green";
  }
  DynamicJsonDocument doc(1024);
  String payload;
  doc["Name"]=name;
  doc["Latitude"]=lat;
  doc["Longitude"]=lon;
  doc["Icon"]=icon;
  doc["FillPercent"]=dist;
  doc["Color"]=color;
  serializeJson(doc, payload);
  delay(3000);
  Serial.print("\n");
  Serial.print("Sending payload: ");
  Serial.println(payload);
  if (client.publish(publishTopic, (char*) payload.c_str())) {
    Serial.println("Publish OK");
  } else {
    Serial.println("Publish FAILED");
  }
}
```

VIDEO LINK :

https://drive.google.com/drive/folders/1MRzxkD7wY3wb3Ba-4GFP5mEqUJghlVj9