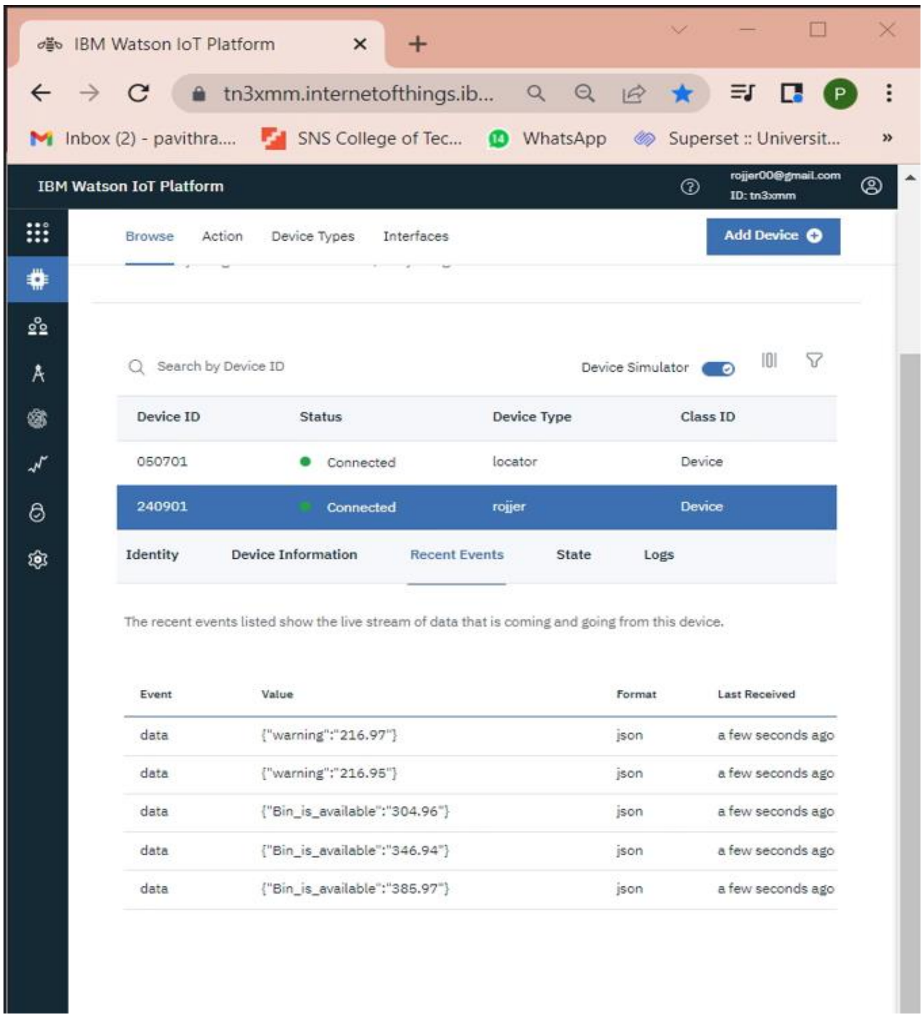
FINAL DELIVERABLES

Team ID	PNT2022TMID17949
Project Name	Project –Smart Waste management System
Date	17 November 2022

PROJECT OBJECTIVE :

- The GPS coordinates of the garbage bin will be sent to the IBM IoT platform
- The location of the bins along with bin status can be viewed in the Web Application
- Notifies the admin if the bin value crosses the threshold value

I. Output Screenshot - IBM Iot Watson Cloud

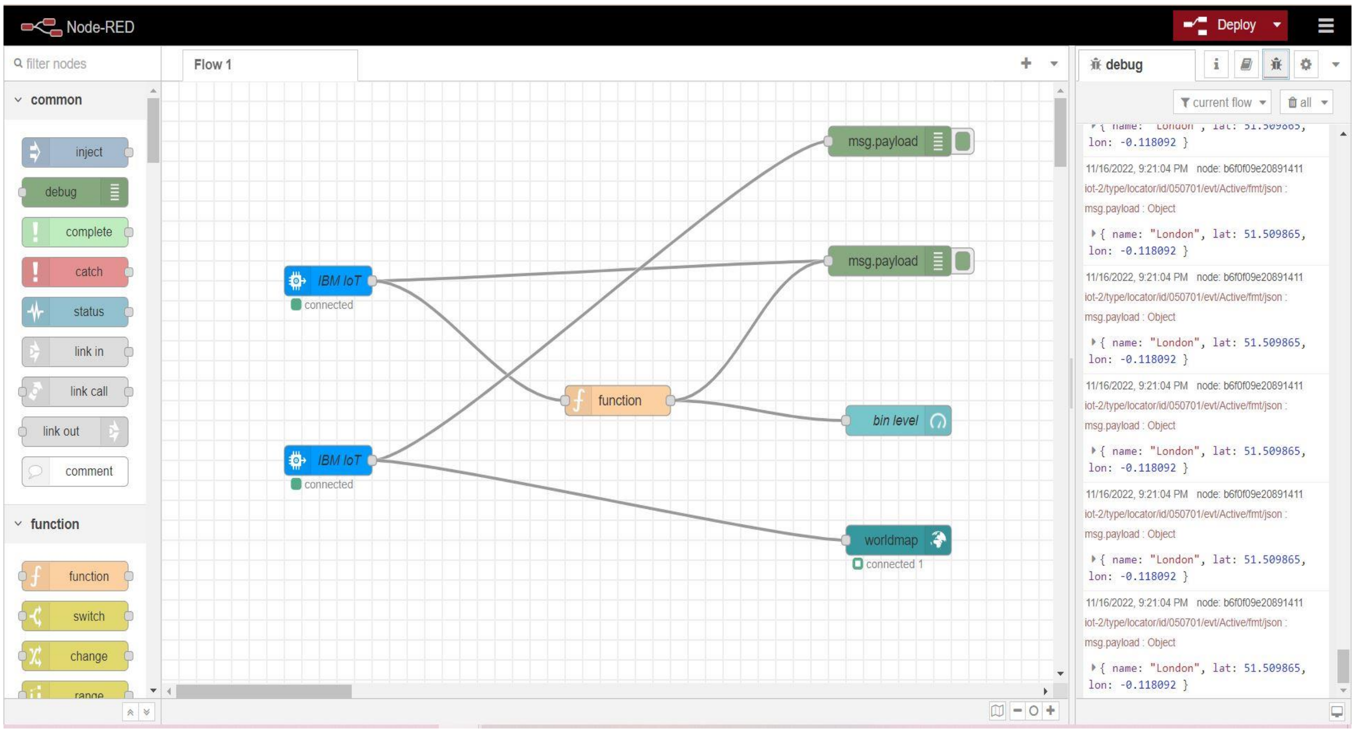


Device ID	Status	Device Type	Class ID
050701	● Connected	locator	Device
240901	● Connected	rojjer	Device

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

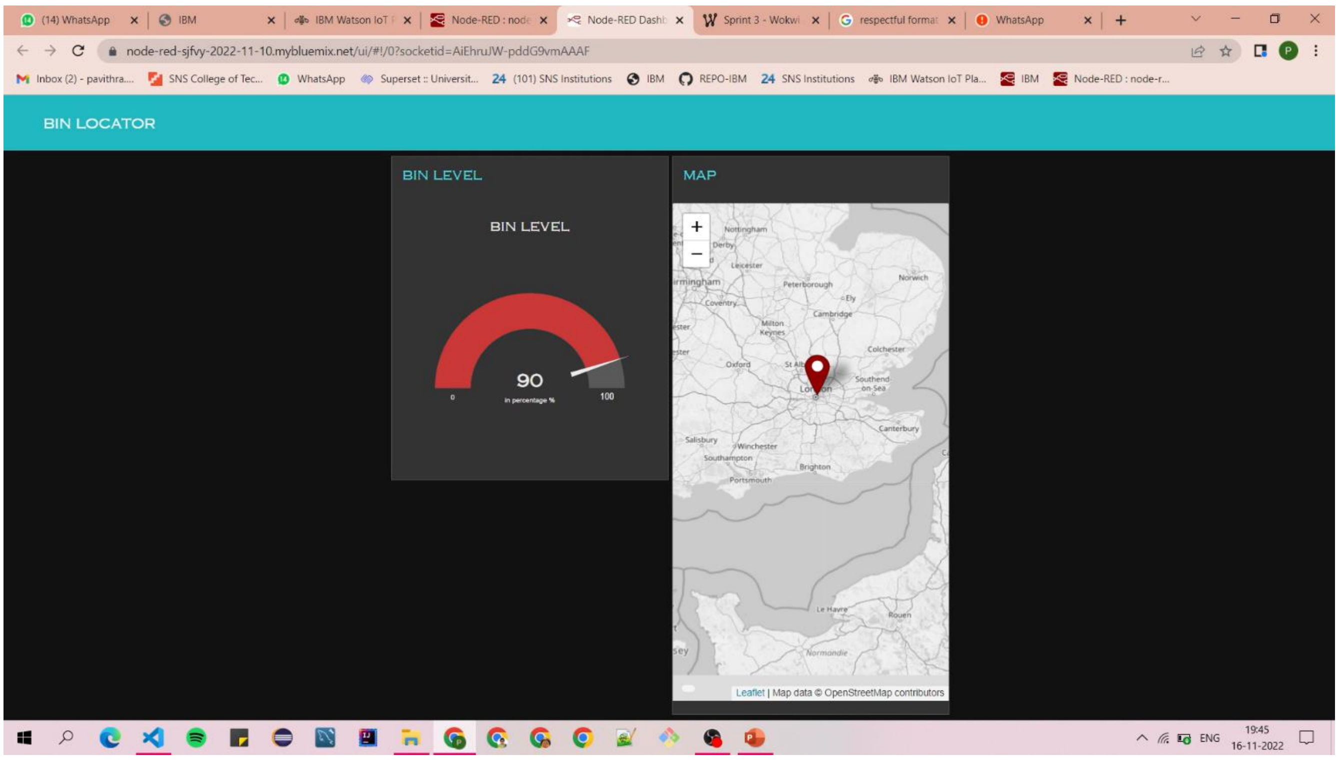
Event	Value	Format	Last Received
data	{"warning":"216.97"}	json	a few seconds ago
data	{"warning":"216.95"}	json	a few seconds ago
data	{"Bin_is_available":"304.96"}	json	a few seconds ago
data	{"Bin_is_available":"346.94"}	json	a few seconds ago
data	{"Bin_is_available":"385.97"}	json	a few seconds ago

II. Output Screenshot - Nod Red Flow



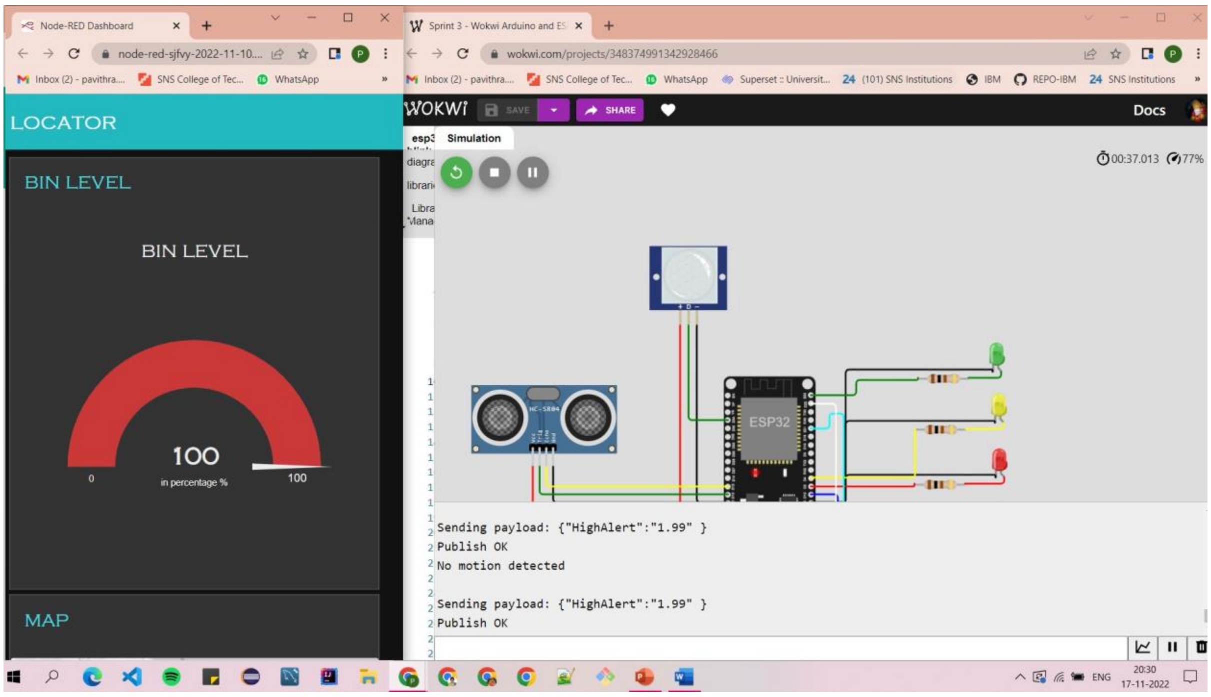
```
lon: -0.118092 }
11/16/2022, 9:21:04 PM   node: b6f0f09e20891411
iot-2/type/locator/id/050701/evt/Active/fmt/json :
msg.payload : Object
▸{ name: "London", lat: 51.509865,
lon: -0.118092 }
11/16/2022, 9:21:04 PM   node: b6f0f09e20891411
iot-2/type/locator/id/050701/evt/Active/fmt/json :
msg.payload : Object
▸{ name: "London", lat: 51.509865,
lon: -0.118092 }
11/16/2022, 9:21:04 PM   node: b6f0f09e20891411
iot-2/type/locator/id/050701/evt/Active/fmt/json :
msg.payload : Object
▸{ name: "London", lat: 51.509865,
lon: -0.118092 }
11/16/2022, 9:21:04 PM   node: b6f0f09e20891411
iot-2/type/locator/id/050701/evt/Active/fmt/json :
msg.payload : Object
▸{ name: "London", lat: 51.509865,
lon: -0.118092 }
11/16/2022, 9:21:04 PM   node: b6f0f09e20891411
iot-2/type/locator/id/050701/evt/Active/fmt/json :
msg.payload : Object
▸{ name: "London", lat: 51.509865,
lon: -0.118092 }
```

III. Output Screenshot - Dash-Board


node-red-sjfvy-2022-11-10.mybluemix.net/ui/#!/0?socketid=AiEhruJW-pddG9vmAAAF
BIN LOCATOR
BIN LEVEL
BIN LEVEL
90
in percentage %
0
100
MAP
London
Leaflet | Map data © OpenStreetMap contributors
19:45
16-11-2022

IV. Output Screenshot - Dash-board and Wokwi

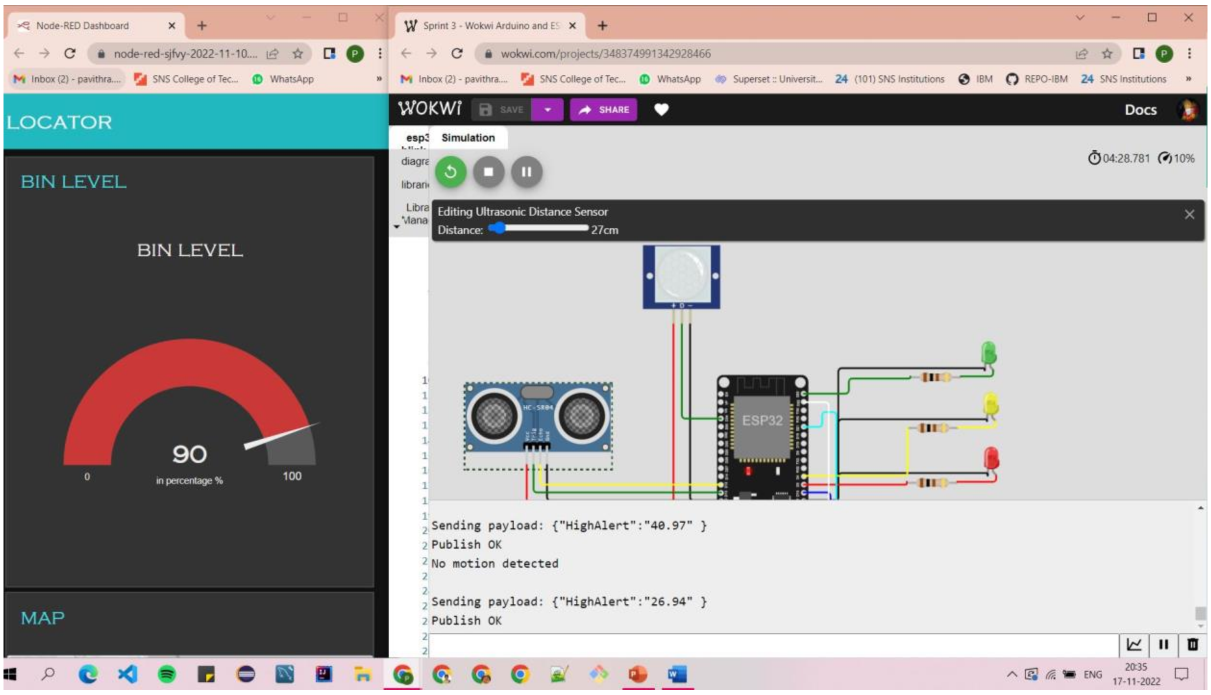
Bin Level in dash-board, when the bin is 100% filled



```
Sending payload: {"HighAlert":"1.99" }
Publish OK
No motion detected

Sending payload: {"HighAlert":"1.99" }
Publish OK
```

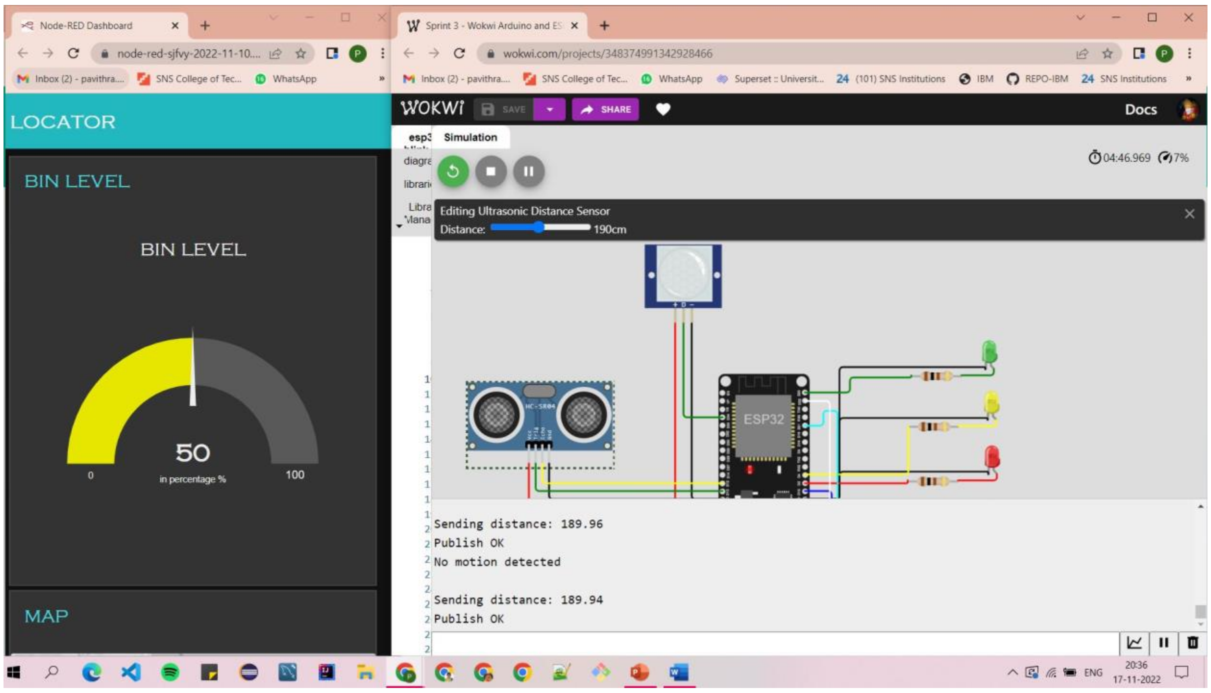
Bin Level in dash-board, when the bin is 90% filled



```
Sending payload: {"HighAlert":"40.97" }
Publish OK
No motion detected

Sending payload: {"HighAlert":"26.94" }
Publish OK
```

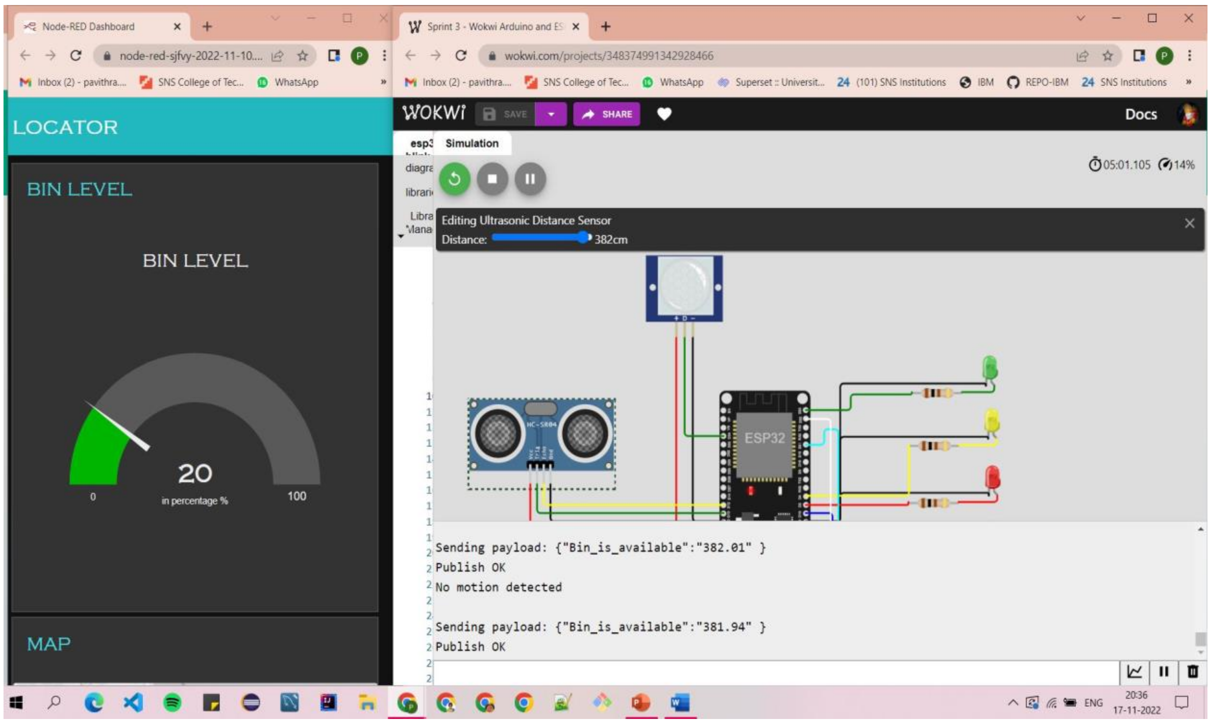
Bin Level in dash-board, when the bin is 50% filled



```
Sending distance: 189.96
Publish OK
No motion detected

Sending distance: 189.94
Publish OK
```

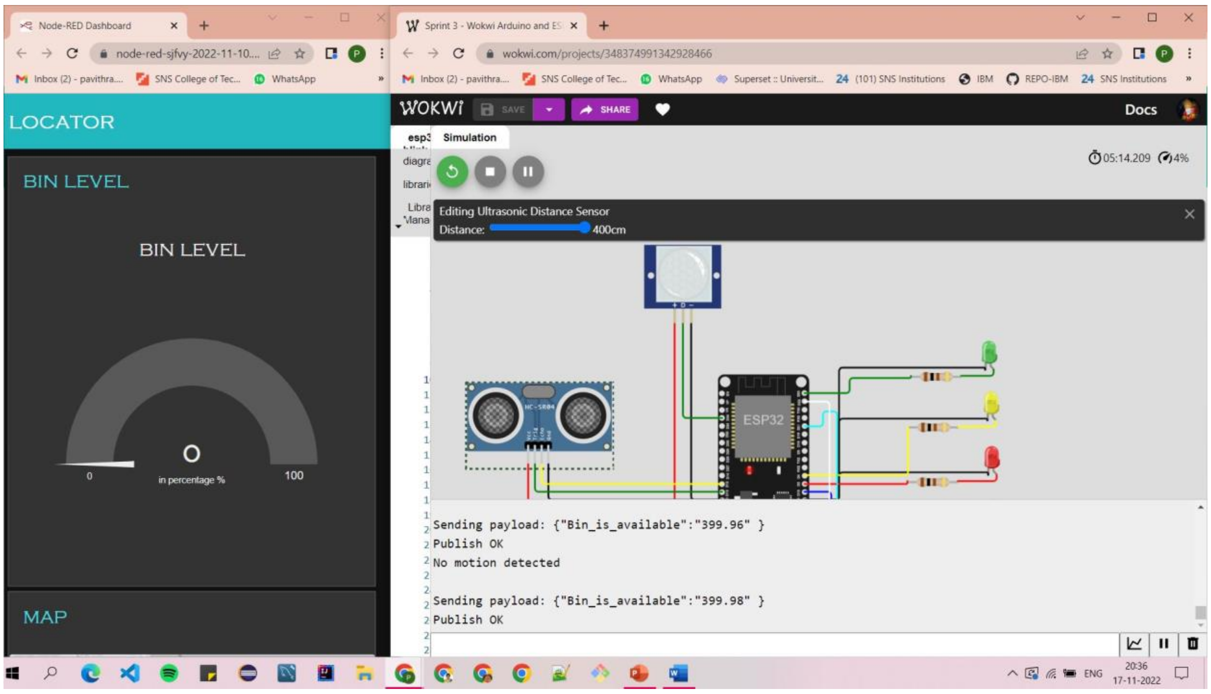
Bin Level in dash-board, when the bin is 20% filled



```
Sending payload: {"Bin_is_available":"382.01" }
Publish OK
No motion detected

Sending payload: {"Bin_is_available":"381.94" }
Publish OK
```

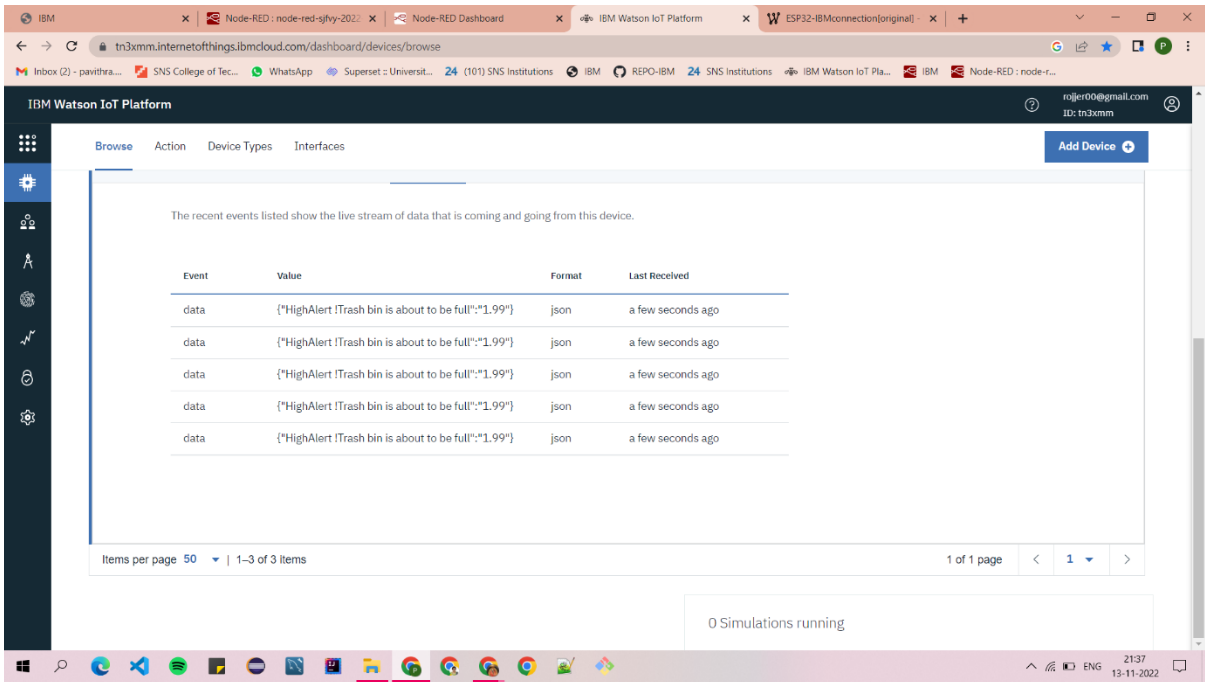
Bin Level in dash-board, when the bin is empty



```
Sending payload: {"Bin_is_available":"399.96" }
Publish OK
No motion detected

Sending payload: {"Bin_is_available":"399.98" }
Publish OK
```

V. High alert warning shown in the IBM Watson Platform



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

Event	Value	Format	Last Received
data	{"HighAlert !Trash bin is about to be full":"1.99"}	json	a few seconds ago
data	{"HighAlert !Trash bin is about to be full":"1.99"}	json	a few seconds ago
data	{"HighAlert !Trash bin is about to be full":"1.99"}	json	a few seconds ago
data	{"HighAlert !Trash bin is about to be full":"1.99"}	json	a few seconds ago
data	{"HighAlert !Trash bin is about to be full":"1.99"}	json	a few seconds ago

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0 Simulations running

VI. Ino code :

```
#include <WiFi.h>                            // library for wifi
#include <PubSubClient.h>                    // library for MQTT
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 20, 4);

//----------------------- credentials of IBM Accounts ------------------------------

#define ORG "tn3xmm"                    // IBM organisation id
#define DEVICE_TYPE "rojjer"              // Device type mentioned in ibm watson iot
platform
#define DEVICE_ID "240901"            // Device ID mentioned in ibm watson iot platform
#define TOKEN "dVDVCxWLOW7)W6vwa&"          // Token

//----------------------- customise above values -----------------------------------------------------

char server[] = ORG ".messaging.internetofthings.ibmcloud.com";             // server name
char publishTopic[] = "iot-2/evt/data/fmt/json";                      // topic name and type of
event perform and format in which data to be send
char topic[] = "iot-2/cmd/led/fmt/String";                          // cmd Represent type and
command is test format of strings
char authMethod[] = "use-token-auth";                               // authentication method
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;                //Client id

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

WiFiClient wifiClient;                                        // creating instance for wificlient
PubSubClient client(server, 1883, wifiClient);

#define ECHO_PIN 12
#define TRIG_PIN 13
float dist;

void setup()
{
  Serial.begin(115200);
  pinMode(LED_BUILTIN, OUTPUT);
  pinMode(TRIG_PIN, OUTPUT);
  pinMode(ECHO_PIN, INPUT);
  //pir pin
  pinMode(4, INPUT);

  //ledpins
  pinMode(23, OUTPUT);
  pinMode(2, OUTPUT);
  pinMode(4, OUTPUT);
  pinMode(15, OUTPUT);


  lcd.init();
  lcd.backlight();
  lcd.setCursor(1, 0);
  lcd.print("");
  wifiConnect();
  mqttConnect();
}

float readcmCM()
{
  digitalWrite(TRIG_PIN, LOW);
  delayMicroseconds(2);
  digitalWrite(TRIG_PIN, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIG_PIN, LOW);
  int duration = pulseIn(ECHO_PIN, HIGH);
  return duration * 0.034 / 2;
}

void loop()
 {

  lcd.clear();

  publishData();
  delay(500);
  if (!client.loop())
    {
      mqttConnect();                                  // function call to connect to IBM
    }
}


/* -------------------------------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(500);
          }
        initManagedDevice();
        Serial.println();
      }
  }
void initManagedDevice()
  {
    if (client.subscribe(topic))
      {
        Serial.println("IBM subscribe to cmd OK");
      }
    else
      {
        Serial.println("subscribe to cmd FAILED");
      }
  }
void publishData()
{
  float cm = readcmCM();

  if(digitalRead(34))                          //pir motion detection
  {
    Serial.println("Motion Detected");
    Serial.println("Lid Opened");
    digitalWrite(15, HIGH);

  }
  else
  {
    digitalWrite(15, LOW);
  }

 if(digitalRead(34)== true)
 {
  if(cm <= 100)                                //Bin level detection
  {
    digitalWrite(2, HIGH);
    Serial.println("High Alert!!!,Trash bin is about to be full");
    Serial.println("Lid Closed");
    lcd.print("Full! Don't use");
    delay(2000);
    lcd.clear();
    digitalWrite(4, LOW);
    digitalWrite(23, LOW);
  }
  else if(cm > 150 && cm < 250)
  {
    digitalWrite(4, HIGH);
    Serial.println("Warning!!,Trash is about to cross 50% of bin level");
    digitalWrite(2, LOW);
    digitalWrite(23, LOW);
  }
  else if(cm > 250 && cm <=400)
  {
    digitalWrite(23, HIGH);
    Serial.println("Bin is available");
    digitalWrite(2,LOW);
    digitalWrite(4, LOW);
  }
    delay(10000);
    Serial.println("Lid Closed");
 }
 else
 {
   Serial.println("No motion detected");
 }




  if(cm <= 100)
{
digitalWrite(21,HIGH);
String payload = "{\"HighAlert !Trash bin is about to be full\":\"";
payload += cm;
payload += "\" }";
Serial.print("\n");
Serial.print("Sending payload: ");
Serial.println(payload);

if (client.publish(publishTopic, (char*) payload.c_str()))
 // if data is uploaded to cloud successfully,prints publish ok else prints publish failed
{
Serial.println("Publish OK");
```

```
}
}
/////////////////////////

if(cm > 150 && cm < 250)
{
digitalWrite(22,HIGH);
String payload = "{\"warning! Trash is about to cross 50% of bin level\":\"";
payload += cm;
payload += "\" }";
Serial.print("\n");
Serial.print("Sending distance: ");
Serial.println(cm);
if(client.publish(publishTopic, (char*) payload.c_str()))
{
Serial.println("Publish OK");
}
else
{
Serial.println("Publish FAILED");
}
}
/////////////////////////

if(cm > 250 && cm <=400)
{
digitalWrite(21,HIGH);
String payload = "{\"Bin is available\":\"";
payload += cm;
payload += "\" }";
Serial.print("\n");
Serial.print("Sending payload: ");
Serial.println(payload);

if (client.publish(publishTopic, (char*) payload.c_str()))
 // if data is uploaded to cloud successfully,prints publish ok else prints publish failed
{
Serial.println("Publish OK");
}
}
///////////////////////////

  float inches = (cm / 2.54);                                   //print on lcd
  lcd.setCursor(0,0);
  lcd.print("Inches");
  lcd.setCursor(4,0);
  lcd.setCursor(12,0);
  lcd.print("cm");
  lcd.setCursor(1,1);
  lcd.print(inches, 1);
  lcd.setCursor(11,1);
  lcd.print(cm, 1);
  lcd.setCursor(14,1);
  delay(1000);
  lcd.clear();
}
```

VII. Json file :

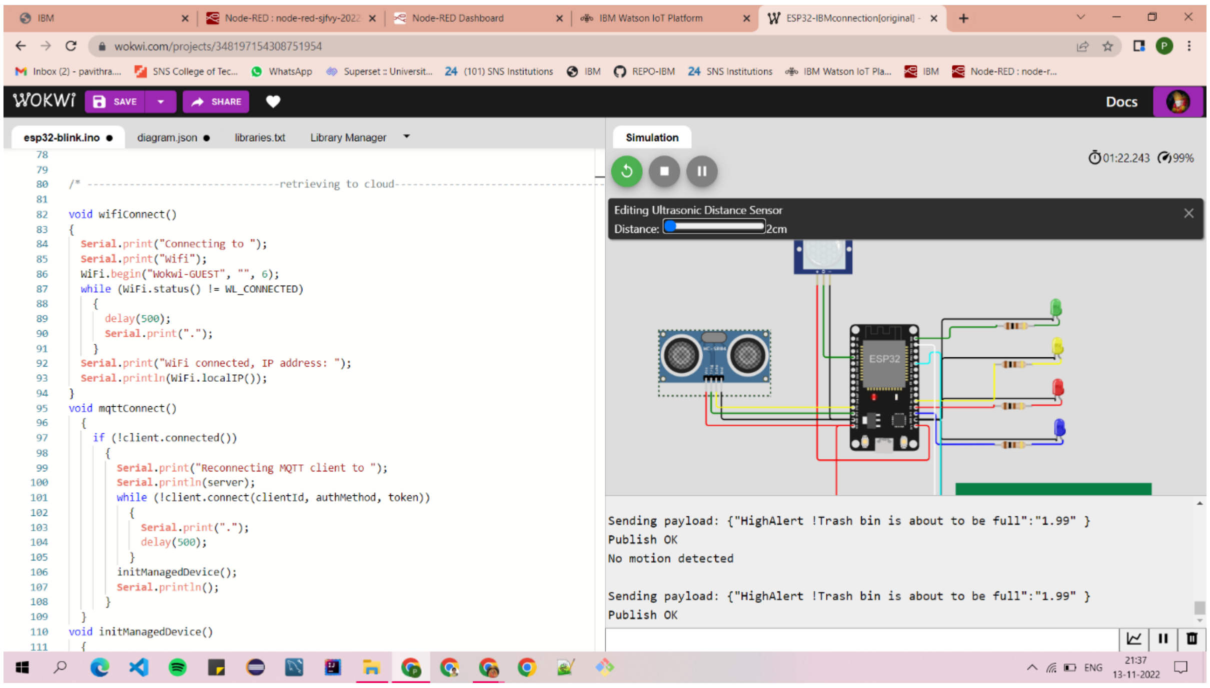
```
{
  "version": 1,
  "author": "Uri Shaked",
  "editor": "wokwi",
  "parts": [
    { "type": "wokwi-esp32-devkit-v1", "id": "esp", "top": 1.29, "left": -1.29, "attrs": {} },
    {
      "type": "wokwi-led",
      "id": "led1",
      "top": -43.97,
      "left": 296.62,
      "attrs": { "color": "limegreen" }
    },
    {
      "type": "wokwi-led",
      "id": "led2",
      "top": 15.48,
      "left": 299.36,
      "attrs": { "color": "yellow" }
    },
    {
      "type": "wokwi-led",
      "id": "led3",
      "top": 140.83,
      "left": 302.1,
      "attrs": { "color": "blue" }
    },
    {
      "type": "wokwi-led",
      "id": "led4",
      "top": 79.19,
      "left": 300.24,
      "attrs": { "color": "red" }
    },
    {
      "type": "wokwi-resistor",
      "id": "r1",
      "top": -3.9,
      "left": 224.81,
      "attrs": { "value": "100" }
    },
    {
      "type": "wokwi-resistor",
      "id": "r2",
      "top": 55.55,
      "left": 221.42,
      "attrs": { "value": "100" }
    },
    {
      "type": "wokwi-resistor",
      "id": "r3",
      "top": 179.36,
      "left": 221.1,
      "attrs": { "value": "100" }
    },
    {
      "type": "wokwi-resistor",
      "id": "r4",
      "top": 119.28,
      "left": 220.77,
      "attrs": { "value": "100" }
    },
    {
      "type": "wokwi-lcd1602",
      "id": "lcd1",
      "top": 248.08,
      "left": 161.61,
      "attrs": { "pins": "i2c" }
    },
    {
      "type": "wokwi-hc-sr04",
      "id": "ultrasonic1",
      "top": 13.99,
      "left": -295.33,
      "attrs": { "distance": "248" }
    },
    {
      "type": "wokwi-pir-motion-sensor",
      "id": "pir1",
      "top": -147.86,
      "left": -88.23,
      "attrs": {}
    }
  ],
  "connections": [
    [ "esp:TX0", "$serialMonitor:RX", "", [] ],
    [ "esp:RX0", "$serialMonitor:TX", "", [] ],
    [ "led1:A", "r1:2", "green", [ "v0" ] ],
    [ "led2:A", "r2:2", "yellow", [ "v0" ] ],
    [ "led4:A", "r4:2", "red", [ "v0" ] ],
    [ "led3:A", "r3:2", "blue", [ "v0" ] ],
    [ "led1:C", "esp:GND.1", "black", [ "v-2.56", "h-170.98", "v116.48" ] ],
    [ "led2:C", "esp:GND.1", "black", [ "v-2.24", "h-173.72", "v91.96" ] ],
    [ "led4:C", "esp:GND.1", "black", [ "v-3.11", "h-174.6", "v27.59" ] ],
    [ "led3:C", "esp:GND.1", "black", [ "v-1.92", "h-177.99", "v-32.18" ] ],
    [ "r1:1", "esp:D23", "green", [ "v2.63", "h-71.91", "v19.92" ] ],
    [ "r3:1", "esp:D15", "blue", [ "v0.22", "h-89.65", "v-53.64" ] ],
    [ "lcd1:GND", "esp:GND.1", "black", [ "h-26.5", "v-129.82" ] ],
    [ "pir1:VCC", "esp:3V3", "red", [ "v268.96", "h172.77", "v-55.17" ] ],
    [ "pir1:GND", "esp:GND.2", "black", [ "v0" ] ],
    [ "pir1:OUT", "esp:D34", "green", [ "v0" ] ],
    [ "ultrasonic1:GND", "esp:GND.2", "black", [ "v0" ] ],
    [ "ultrasonic1:ECHO", "esp:D12", "yellow", [ "v0" ] ],
    [ "ultrasonic1:TRIG", "esp:D13", "green", [ "v0" ] ],
    [ "ultrasonic1:VCC", "esp:VIN", "red", [ "v0" ] ],
    [ "r4:1", "esp:D2", "red", [ "v0" ] ],
    [ "r2:1", "esp:D4", "yellow", [ "v0" ] ],
    [ "lcd1:SDA", "esp:D21", "cyan", [ "h-27.12", "v-252.33", "h-16.71", "v17.15" ] ],
    [ "lcd1:SCL", "esp:D22", "white", [ "h-36.27", "v-3.67" ] ],
    [ "lcd1:VCC", "esp:VIN", "red", [ "h-187.87", "v-129.69" ] ]
  ]
}
```

VIII. Libraries file:

```
# Wokwi Library List
# See https://docs.wokwi.com/guides/libraries

WiFi
PubSubClient
LiquidCrystal I2C
```

IX. Output on cloud, when Bin is fulled/ about to get filled

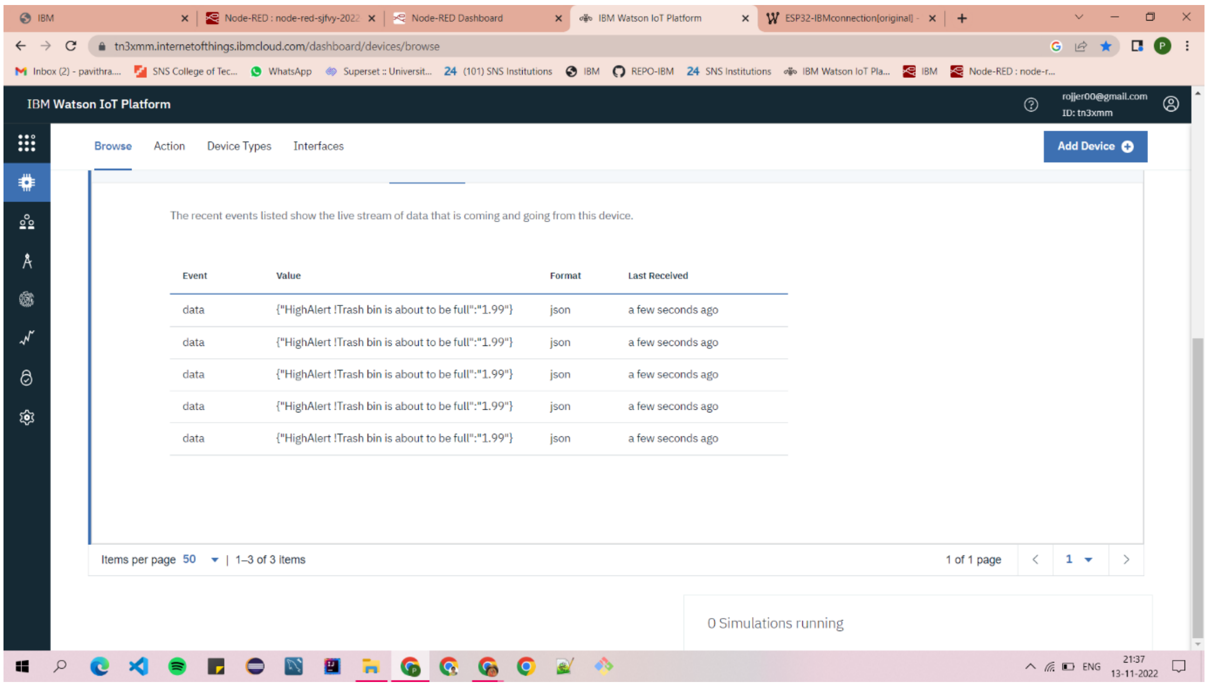


```
/* -------------------------------retrieving to cloud------------------------------

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(500);
    }
    initManagedDevice();
    Serial.println();
  }
}
void initManagedDevice()
{
```

```
Sending payload: {"HighAlert !Trash bin is about to be full":"1.99" }
Publish OK
No motion detected

Sending payload: {"HighAlert !Trash bin is about to be full":"1.99" }
Publish OK
```



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

Event	Value	Format	Last Received
data	{"HighAlert !Trash bin is about to be full":"1.99"}	json	a few seconds ago
data	{"HighAlert !Trash bin is about to be full":"1.99"}	json	a few seconds ago
data	{"HighAlert !Trash bin is about to be full":"1.99"}	json	a few seconds ago
data	{"HighAlert !Trash bin is about to be full":"1.99"}	json	a few seconds ago
data	{"HighAlert !Trash bin is about to be full":"1.99"}	json	a few seconds ago

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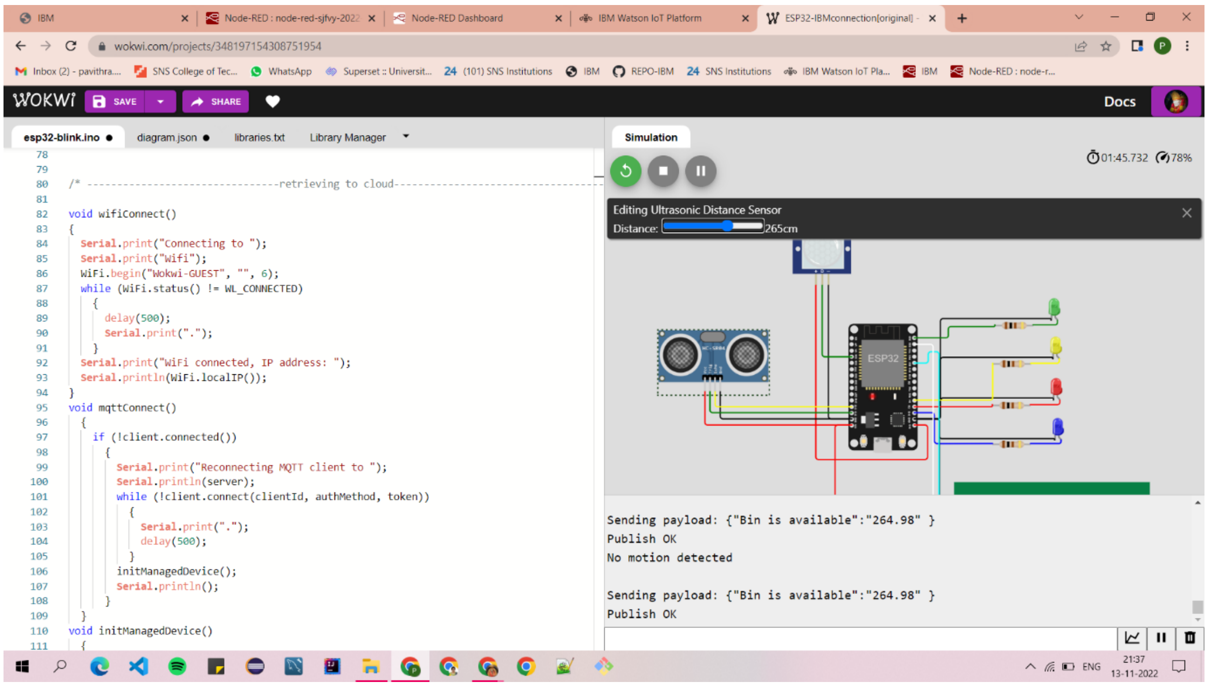
0 Simulations running

X. Output on cloud, when Bin is Empty

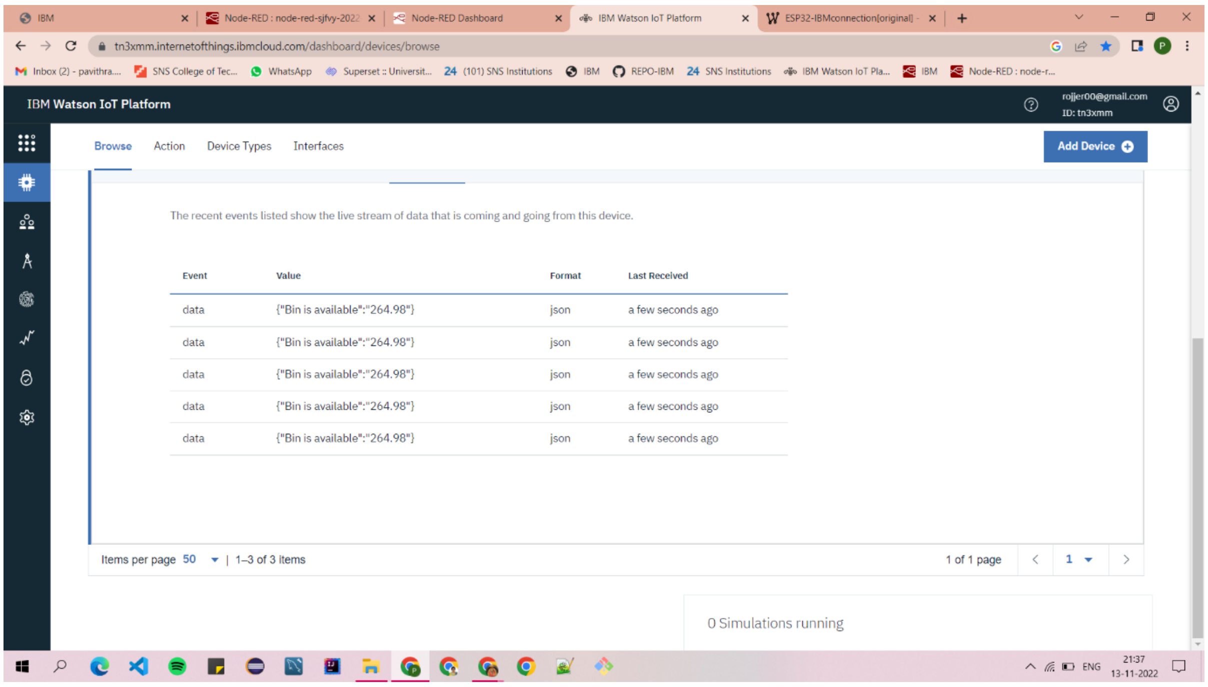


```
/* ------------------------------retrieving to cloud-------------------------------

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(500);
          }
        initManagedDevice();
        Serial.println();
      }
  }
void initManagedDevice()
  {
```

```
Sending payload: {"Bin is available":"264.98" }
Publish OK
No motion detected

Sending payload: {"Bin is available":"264.98" }
Publish OK
```



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

Event	Value	Format	Last Received
data	{"Bin is available":"264.98"}	json	a few seconds ago
data	{"Bin is available":"264.98"}	json	a few seconds ago
data	{"Bin is available":"264.98"}	json	a few seconds ago
data	{"Bin is available":"264.98"}	json	a few seconds ago
data	{"Bin is available":"264.98"}	json	a few seconds ago

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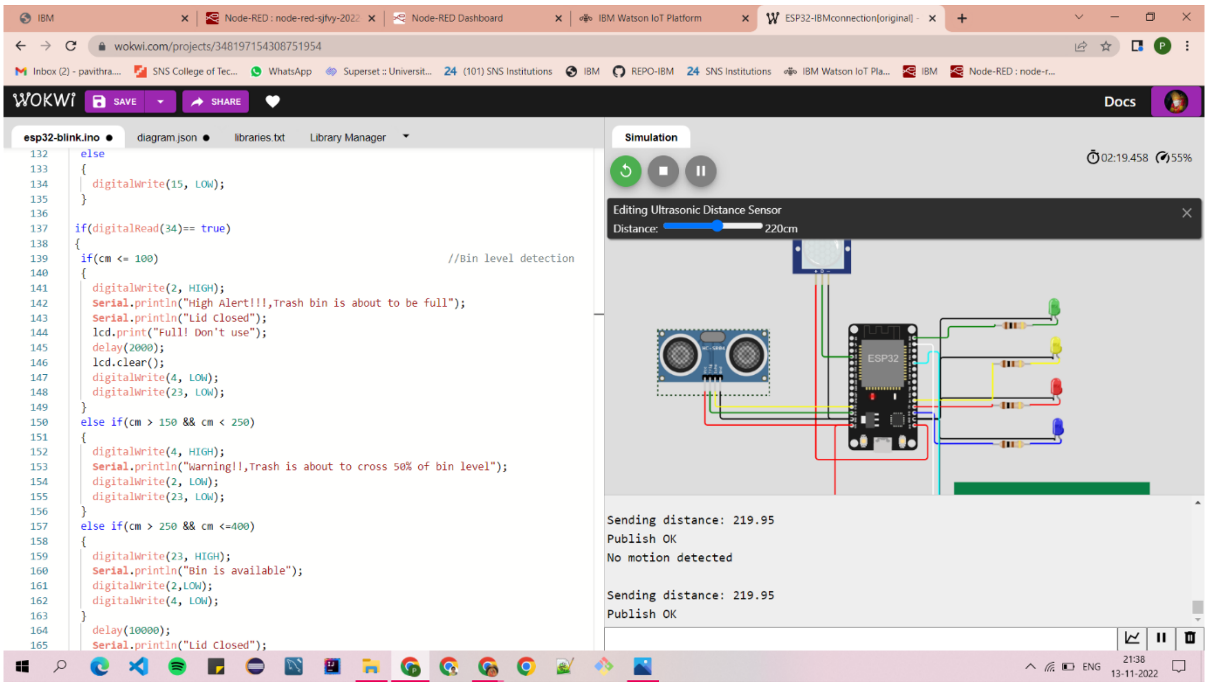
0 Simulations running

XI. Output on cloud, when Bin is about to cross 50% of storage

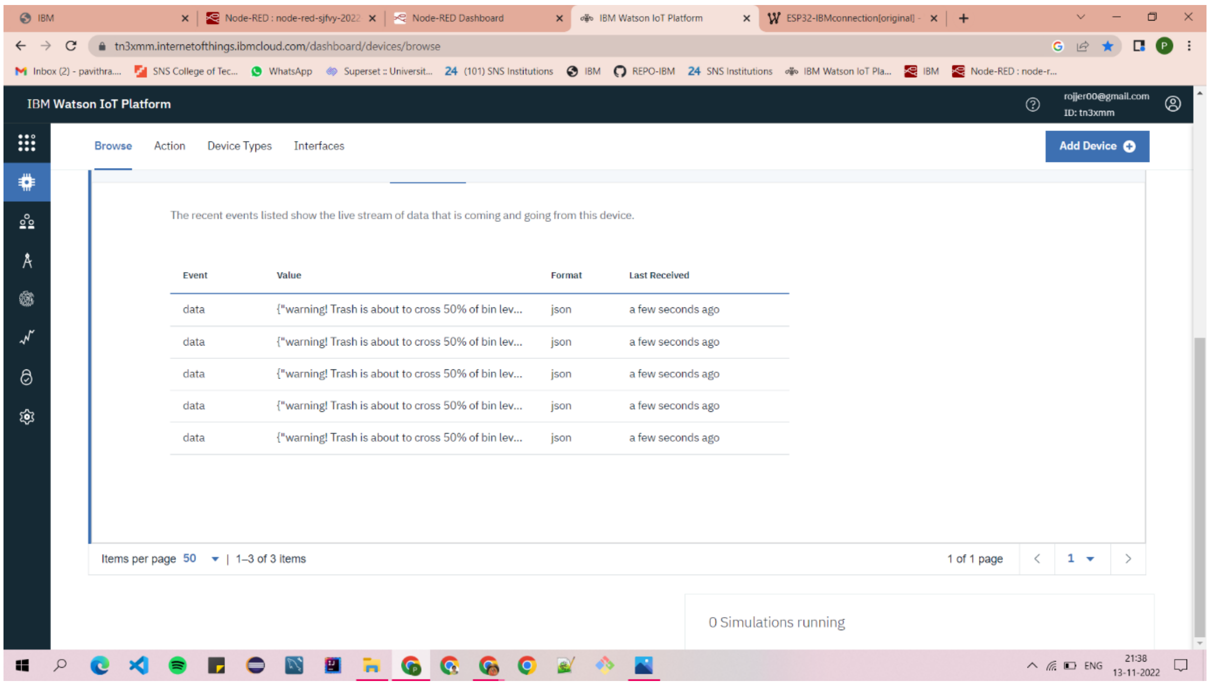


```
 else
 {
   digitalWrite(15, LOW);
 }

if(digitalRead(34)== true)
{
 if(cm <= 100)                                  //Bin level detection
 {
   digitalWrite(2, HIGH);
   Serial.println("High Alert!!!,Trash bin is about to be full");
   Serial.println("Lid Closed");
   lcd.print("Full! Don't use");
   delay(2000);
   lcd.clear();
   digitalWrite(4, LOW);
   digitalWrite(23, LOW);
 }
 else if(cm > 150 && cm < 250)
 {
   digitalWrite(4, HIGH);
   Serial.println("Warning!!,Trash is about to cross 50% of bin level");
   digitalWrite(2, LOW);
   digitalWrite(23, LOW);
 }
 else if(cm > 250 && cm <=400)
 {
   digitalWrite(23, HIGH);
   Serial.println("Bin is available");
   digitalWrite(2,LOW);
   digitalWrite(4, LOW);
 }
   delay(10000);
   Serial.println("Lid Closed");
```

```
Sending distance: 219.95
Publish OK
No motion detected

Sending distance: 219.95
Publish OK
```



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

Event	Value	Format	Last Received
data	{"warning! Trash is about to cross 50% of bin lev...	json	a few seconds ago
data	{"warning! Trash is about to cross 50% of bin lev...	json	a few seconds ago
data	{"warning! Trash is about to cross 50% of bin lev...	json	a few seconds ago
data	{"warning! Trash is about to cross 50% of bin lev...	json	a few seconds ago
data	{"warning! Trash is about to cross 50% of bin lev...	json	a few seconds ago

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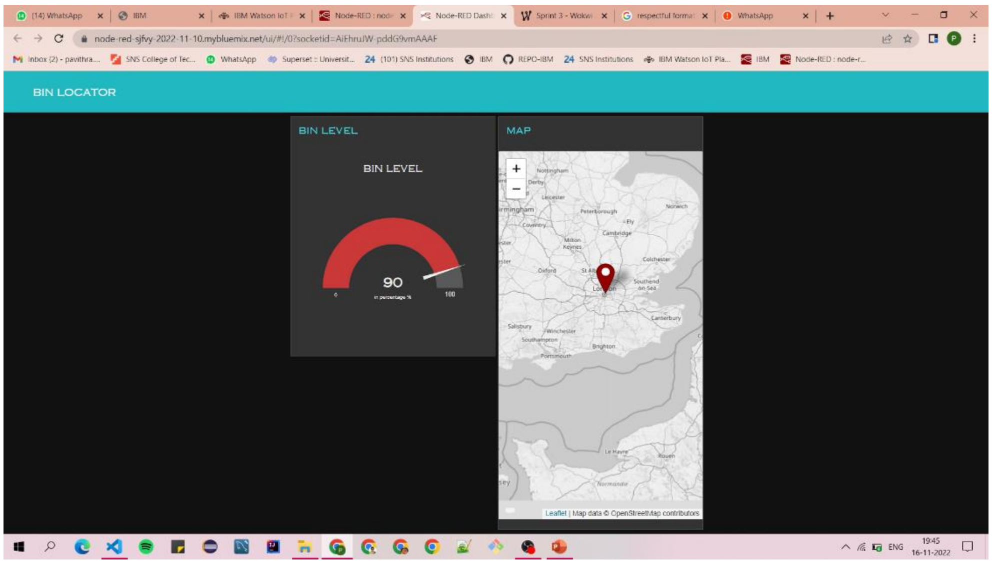
XII. Python Code to show the bin location

```
import json
import time

import wiotp.sdk.device

myconfig = {
    "identity" : {
        "orgId": "tn3xmm",
        "typeId": "locator",
        "deviceId": "050701"
    },
    "auth" : {
        "token" : "12345678"
    }
}
client = wiotp.sdk.device.DeviceClient(config=myconfig, logHandlers=None)
client.connect()

while True:
    city = "London"
    lat = 51.509865
    long = -0.118092

    data = {'name':city, 'lat':lat, 'lon':long}
    client.publishEvent(eventId="Active", msgFormat="json", data=data, qos=0,
onPublish=None)
    print("Data Updated to IBM Platform: ", data)
    time.sleep(60)

client.disconnect()
```

XIII. Dashboard output


BIN LOCATOR
BIN LEVEL
MAP
BIN LEVEL
90
0
100
in percentage %
Leaflet | Map data © OpenStreetMap contributors