



# **SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES**



## **NALAIYA THIRAN PROJECT BASED LEARNING ON PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP**

### **A PROJECT REPORT**

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**ADHI COLLEGE OF ENGINEERING AND TECHNOLOGY**  
(An ISO Certified Institution Approved by the AICTE,  
New Delhi & Affiliated by Anna University)  
**KANCHIPURAM-631502**

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## ABSTRACT

Traditional waste management system operates based on daily schedule which is highly inefficient and costly. The existing recycle bin has also proved its ineffectiveness in the public as people do not recycle their waste properly. With increase in population and industrialization of nation throughout the globe, waste has become great concern for all of us. With the development of Internet of Things (IoT) the traditional waste management system can be replaced with smart sensors embedded into the system to perform real time monitoring and allow for better waste management. The aim of this research is to develop a smart waste management system using LoRa communication protocol and Tensor Flow based deep learning model. The system also adapt with network environment, to manage all information from waste management. The GPS module is used to locate the system for easy pickup and to track the bin by using GPS and the very bins are provided with the ID name. Object detection and the waste classification is done in TensorFlow framework with pre-trained object detection model. Ultrasonic sensor is embedded into each waste compartment to monitor the filling level of the waste. RFID module is embedded for the purpose of waste management personnel identification. As the result we proposed a prototype of smart waste-bin that suitable for many kind of conventional waste-bin.

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# SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES

## 1.INTRODUCTION

Internet of things (IoT) is a communication paradigm that able to cater to the long-distance communication needed by the waste management system while sacrificing on the rate of data envisions a future paradigm where everyday life objects will be transmission. Studies in the field of wireless communication equipped with a microcontroller and some form of communication in IoT have also been accelerating. Conversely, communication protocol . IoT is the smart city, technology such as Bluetooth, Wi-Fi, and offer better data which can be defined as a city with smart technology, smart people, transmission rates, but these are limited by their data transmission and smart collaboration . IoT shall transparently and seamlessly ranges incorporate a large number of heterogeneous end systems while Waste management is a costly operation as it takes up a great providing open access to select subsets of data for the development deal of resources and labor. One major topic within the authorities to improve waste management systems by setting up the smart city is smart waste management. The communication technology such as LoRa and SigFox, that the initiatives taken previously were not effective and that a which operate on a low power, wide-area network are smart waste management system needs to be developed to replace the existing infrastructures. It comes the existing waste management system. Sensors implementation in with three compartments, each with its own function monitoring, which is absent in the existing waste management The second compartment consists of an IR sensor and moisture system. Data such as filling level, humidity, and any sensor to detect dry and wet waste. The last compartment is necessary data can be collected from the sensors. IoT application in the waste bin is one step towards smart city.

## 2.OBJECTIVE:

- Monitoring the level and weight of waste is the one of the process and it is done by through weight sensor and code is generated for it.
- The main requirement is RAM-Minimum 4GB Processor-Min. Configuration OS-Windows/Linux/MAC.
- The process is Garbage level detection in bins. Getting the weight of the garbage in the bin. Alerts the authorized person to empty the bin whenever the bins are full. Garbage level of the bins can be monitored through a web App. We can view the location of every bin in the web application by sending GPS location from the device.
- The software requirement is python IDLE, IBM cloud, IBM IoT platform, Node-RED platform, web UI.

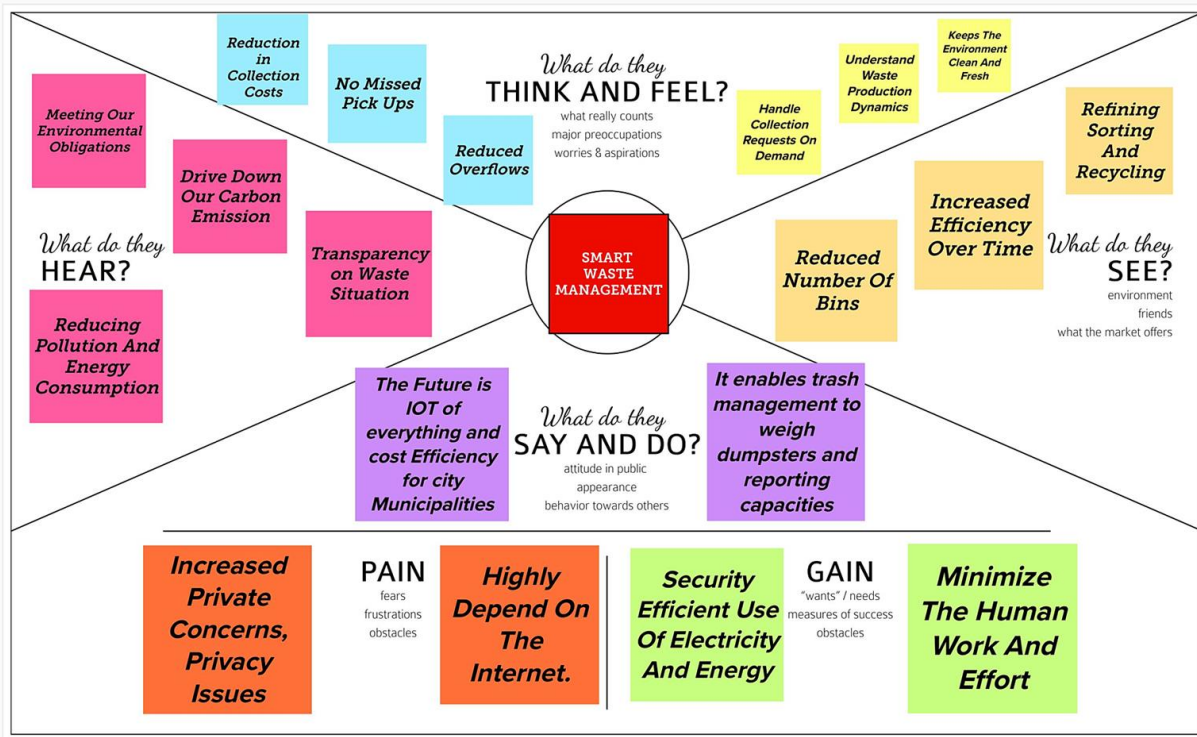
### 3. IDEATION PHASE

#### 3.1 LITERATURE SURVEY:

Our proposed smart waste-bin system can be adapted into general waste-bin and it consists of the sensing units, a blue tooth and GSM Module for data transmission, and a mobile application and web-based monitoring for interfacing and communication with the waste department for waste management. Load cell is a measuring device used to measure loads either directly or indirectly. To measure the level of waste in the waste-bin we used ultrasonic sensor attached in the top side of waste-bin. A GSM module is used to communicate with server.

The proposed architecture will have a master slave configuration of dustbins. This would overcome the connectivity issues in remote areas. These slave dustbins communicate their information with their corresponding master dustbins. Each master dustbin shall be equipped with a micro-controller.

### 3.2 EMPATHY MAP:



### 3.3 IDEATION:





### 3.4 BRAINSTROMING:

**Brainstorm & idea prioritization**

Use this template in your own brainstorming sessions as your team can unleash their imagination and even shaping concepts even if you're not sitting in the same room.

10 minutes to prepare  
1 hour to set ideas  
8-9 people recommended

TEAM ID:  
PNT2022MID37762

**Define your problem statement**

Write down why ideas that come to mind may address your problem statement.

10 minutes

**Prioritize**

Your team shares, maps, and prioritizes ideas. Once all sticky notes have been grouped, give each a sentence like "later." If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

30 minutes

**Smart garbage maintenance sever**

lot alert authorized person when bins are going to fill

collect only degradable and non degradable wastes

Transparency and sustainable solution than normal garbage bins

**Smart garbage bin**

The level of the bin is measured by using ultrasonic sensor.

Waste generation analyzes to understand the cities usage.

The proposed system would be able to automate the solid waste and monitor the process management using (IoT)

Visual fill status indicators on top of bins

## 4. PROJECT DESIGN PHASE 1

### 4.1 PROPOSED SOLUTION:

S.NO	Parameter	Description
1	<b>Problem Statement (Problem to be solved)</b>	This project deals with the problem of waste management in cities, when the garbage collection system is not optimized. This system allows the authorised person to know the fill level of each garbage bin in a locality or city at all times and time saving to the truck drivers.
2	<b>Idea / Solution description</b>	<ul style="list-style-type: none"><li>• In the proposed system, whenever the waste bins gets filled this is the acknowledged by placing the circuit at the waste bin ,which transmit it to the receiver at the desired place in the area .</li><li>• The received signal indicates the waste bin status at monitoring and controlling system.</li><li>• The solution of this project is , it should be energy efficient ,able to communicate and share information across the extended area coverage. The smart bin using LoRa technology for long transmission . GSM Communication is used to perform data transmission to the server. Android application are developed to monitor the bin.</li><li>• The overall process is done by interfacing various modules such as GPS, CAMERA, BUZZER, and SENSORS.</li></ul>
3	<b>Novelty / Uniqueness</b>	This paper presented the smart waste management system by implementing sensors to monitor the status of bin, LoRa communication protocol for low power and long range data transmission and Tensor

		<p>flow based object detection to perform waste identification and classification. The segregation of waste is interfaced and coordinated well between the object detection can be done using Raspberry pi</p>
5	<b>Business Model (Revenue Model)</b>	<p>Waste Management organizes its operations into two reportable business segments:</p> <ul style="list-style-type: none"> <li>• <b>Solid Waste</b>, comprising the Company's waste collection, transfer, recycling and resource recovery, and disposal services, which are operated and managed locally by the Company's various subsidiaries, which focus on distinct geographic areas.</li> <li>• <b>Corporate and Other</b>, comprising the Company's other activities, including its development and operation of landfill gas-to-energy facilities in the US, and its recycling brokerage services, as well as various corporate functions.</li> </ul>
6	<b>Scalability of the Solution</b>	<p>This paper presented an efficient IoT -based and real-time waste management model for improving the living environment in cities. The proposed system uses sensors and communication technologies where waste data is collected from the smart bin ,in real time and then transmitted to an online platform where the authorized person can access and check the availability of the compartment scattered around the city.</p>

## 4.2 PROBLEM SOLUTION FIT:

<p><b>1. CUSTOMER SEGMENT(S)</b></p> <p>Who is your customer?</p> <p>The aim the research is to make the society clean the smart waste management perform a important role. The major concern of the environment that impact on the health and well being of society by smart waste management</p>	<p><b>5. AVAILABLE SOLUTIONS</b></p> <p>Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros &amp; cons do these solutions have?</p> <p>The main solution is to empty the bin on time by using GPS location, weight monitoring sensor and bin level monitoring sensor. The cons are cost and the proper internet connection.</p>	<p><b>8. CUSTOMER CONSTRAINTS</b></p> <p>What constraints prevent your customers from taking action or limit their choices</p> <p>A lack staff capability, local architecture, much need of manpower and lack of standard process for data collection and analysis. There is usage of sensor in bins, the user may cause damages to the sensors. And proper maintenance by peoples.</p>
<p><b>2. JOBS-TO-BE-DONE / PROBLEMS</b></p> <p>Which jobs-to-be-done (or problems) do you address for your customers?</p> <p>In this era the waste level of the bin is not indicated to the authorized person in frequent manner. By this smart waste management the level of the bin, location by the ID name of the bin and the weight of the bin.</p>	<p><b>6. PROBLEM ROOT CAUSE</b></p> <p>What is the real reason that this problem exists? What is the back story behind the need to do this job?</p> <p>Lack of Public Awareness. Refusal to Learn About Compliance. Insufficient Investment in Waste Management. Lack of Proper Machinery.</p>	<p><b>9. BEHAVIOUR</b></p> <p>What does your customer do to address the problem and get the job done?</p> <p>Municipalities are the responsible for organizing the management if waste generated in dwellings and by service function. As a practice, waste management should be a responsible and a duty of each citizen.</p>

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

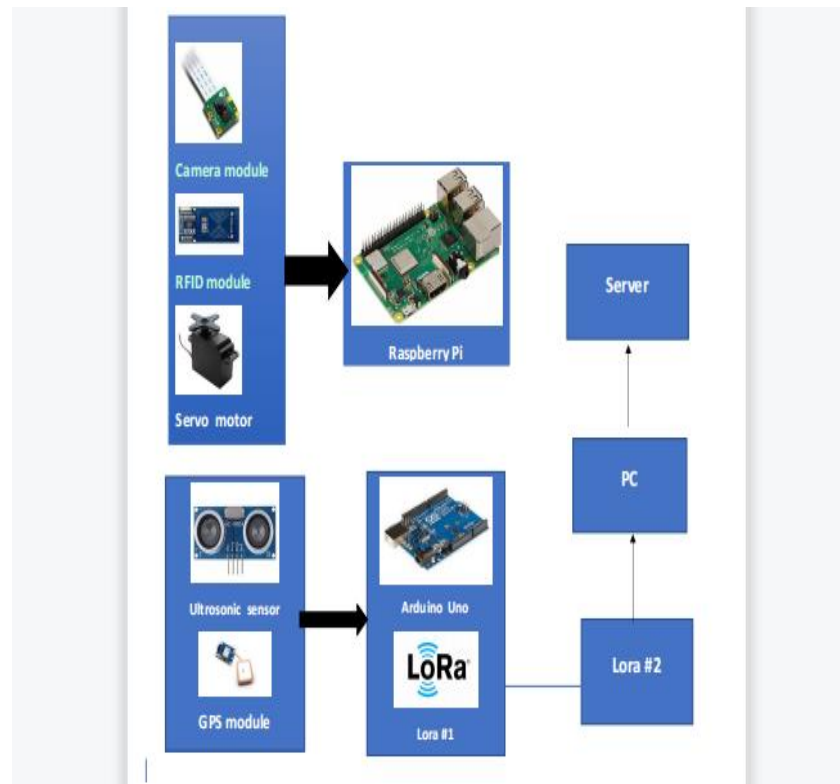
Focus on J&P, tap into BE, understand RC

<p><b>3. TRIGGERS</b></p> <p>What triggers customers to act?</p> <p>The pickup the bin is on correct time. If the bin filled, the alarm is used is to indicate the nearby authorized person.</p> <p><b>4. EMOTIONS: BEFORE / AFTER</b></p> <p>How do customers feel when they face a problem or a job and afterwards?</p> <p>Before introducing this project the customer faced many problems they have no solution for it. After introducing this project their problems are cleared.</p>	<p><b>7. YOUR SOLUTION</b></p> <p>The solution of this project is , it should be energy efficient, able to communicate, share information across the extended coverage. GSM communication is used to perform data transmission to the server. Android application are developed to monitor the bin. The smart bin using LoRa technology for long range transmission. The process is done by interfacing various modules such as GPS , camera, buzzer and sensors.</p>	<p><b>10. CHANNELS of BEHAVIOUR</b></p> <p><b>ONLINE</b></p> <p>What kind of actions do customers take online?</p> <p>By creating a web application through this the peoples can able to post their queries , and the organizing person should solve their problems.</p> <p><b>OFFLINE</b></p> <p>What kind of actions do customers take offline? use them for customer development.</p> <p>Waste management methods are different in different environment , while the waste produced by the industries, management, and living areas is their responsibilities and managed by themselves. And they will maintain the proposed solution by their municipalities.</p>
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### 4.3 SOLUTION ARCHITECTURE:



## 5.PROJECT DESIGN PHASE-2:

### 5.1 Customer journey:

### User journey

by the Design Team of Accenture Interactive NL

User journey and user flow are two tools that are used to describe the process of interaction between a user and a product. Many designers consider user journey and user flow the same thing. While both tools are used to communicate your designs through the lens of your users' goals, they aren't synonyms because they focus on different aspects of created products.

People  
2-3

Time  
30 min

Difficulty  
Beginner

Creating a user journey is a quick way to help you and your team gain a deeper understanding of who you're designing for, aka the stakeholder in your project. The information you add here should be representative of the observations and research you've done about your users. [JD](#)

	<div><div>Awareness</div><div>Consideration</div><div>Conversion</div><div>Retention</div><div>Advocacy</div></div> <div>The 5 Stages of Customer Journey</div> <div></div>	
<b>3 Steps</b> Detailed actions your user has to perform		
<b>2 Feelings</b> What your user might be thinking and feeling at the moment		
<b>4 Pain points</b> Problems your user runs into	<p>The process is not always cost effective. The practice is not done in uniformly. The sites are often dangerous. System requires more number of dustbins for the separation. Sensor node used in dustbin have limited memory.</p>	
<b>5 Opportunities</b> Potential improvements or enhancements to the experience	<p>Proper segregating and minimizing waste . Educating and training your staff. Implement sustainable waste container. Circulate safety data sheets. Create an emergency readiness. Review compliance. Perform regular audits on waste management and disposal. Look opportunities for recycle.</p>	

Accenture Inter

## 5.2 Solution Requirements:

### Functional Requirements:

Following are the functional requirements of the proposed solution.

FR NO	FUNCTIONAL REQUIREMENT (EPIC)	SUB REQUIREMENT(Story/ sub task)11
FR-1	Expensive bins.	Depends upon the average waste collected in areas, we can help you identify bins that drive up your collection costs. The tool calculates a rating for each bin in terms of collection costs. The tool considers the average distance discharge in the area. The tool assigns biarating(110) and calculates distance from discharge.
FR-2	Real time bin monitoring	The percentage 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 management software. It displays real- time data on fill-levels of bins monitored by smart sensors.
FR-3	Detailed about the bin monitoring.	All monitored bins and stands can be seen on the map, and you can visit them at anytime via the Street View feature from Google. 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-4	Bin distribution	Ensure the most optimal distribution of bins. Identify areas with either dense or sparse bin distribution. Make sure all trash types are represented within a stand. Based on the historical data, you can adjust bin capacity or location where necessary.

#### Non functional requirements:

The following are the non-functional requirements of the proposed solution.

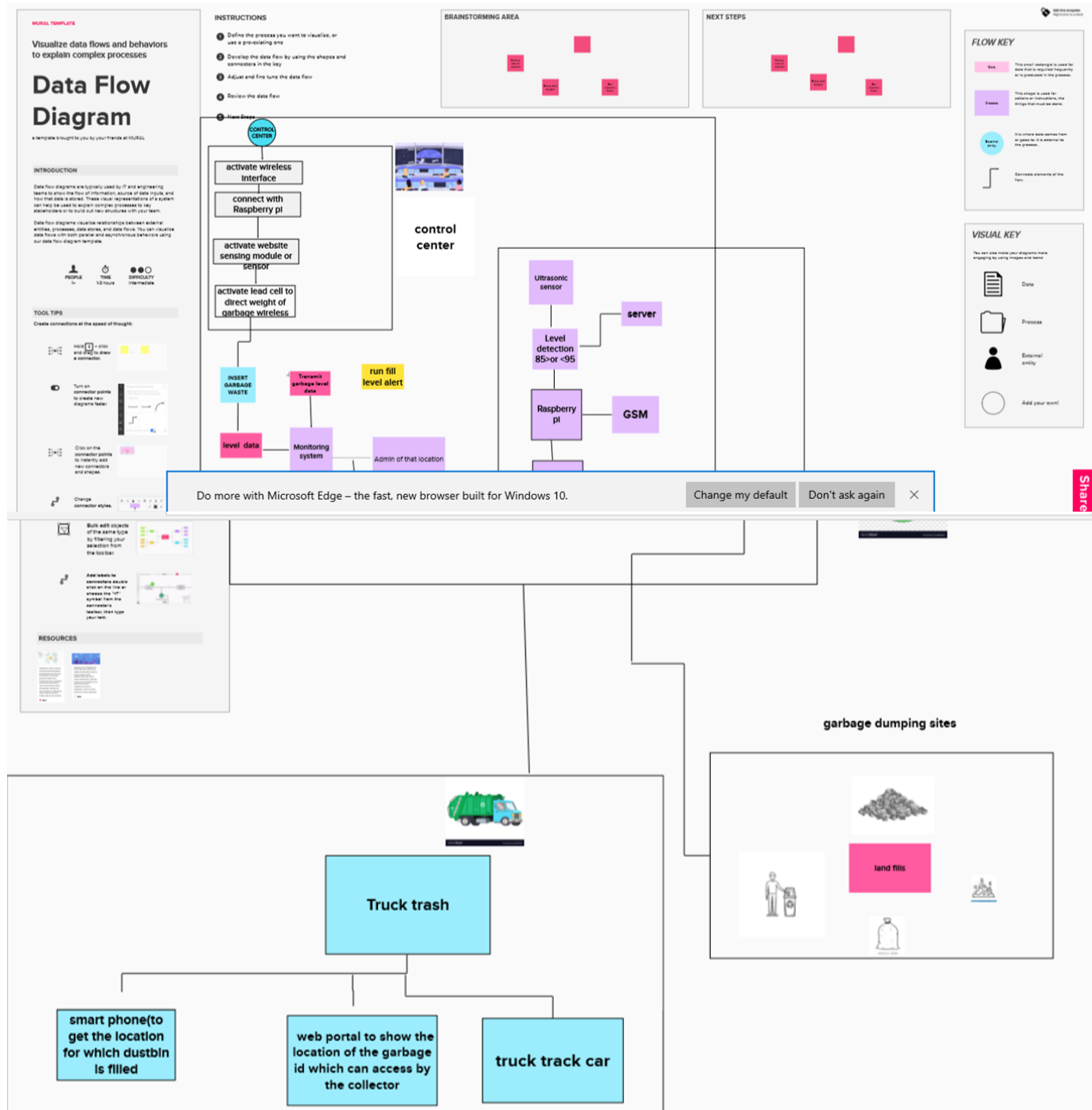
FR NO	NON-FUNCTIONAL REQUIREMENTS	DESCRIPTION
NFR-1	Usability	IoT device verifies that usability is a special and important perspective to analyze user requirements, which can further improve the design quality. In the design process with user experience as the core, the analysis of users product usability can indeed help designers better understand users potential needs in



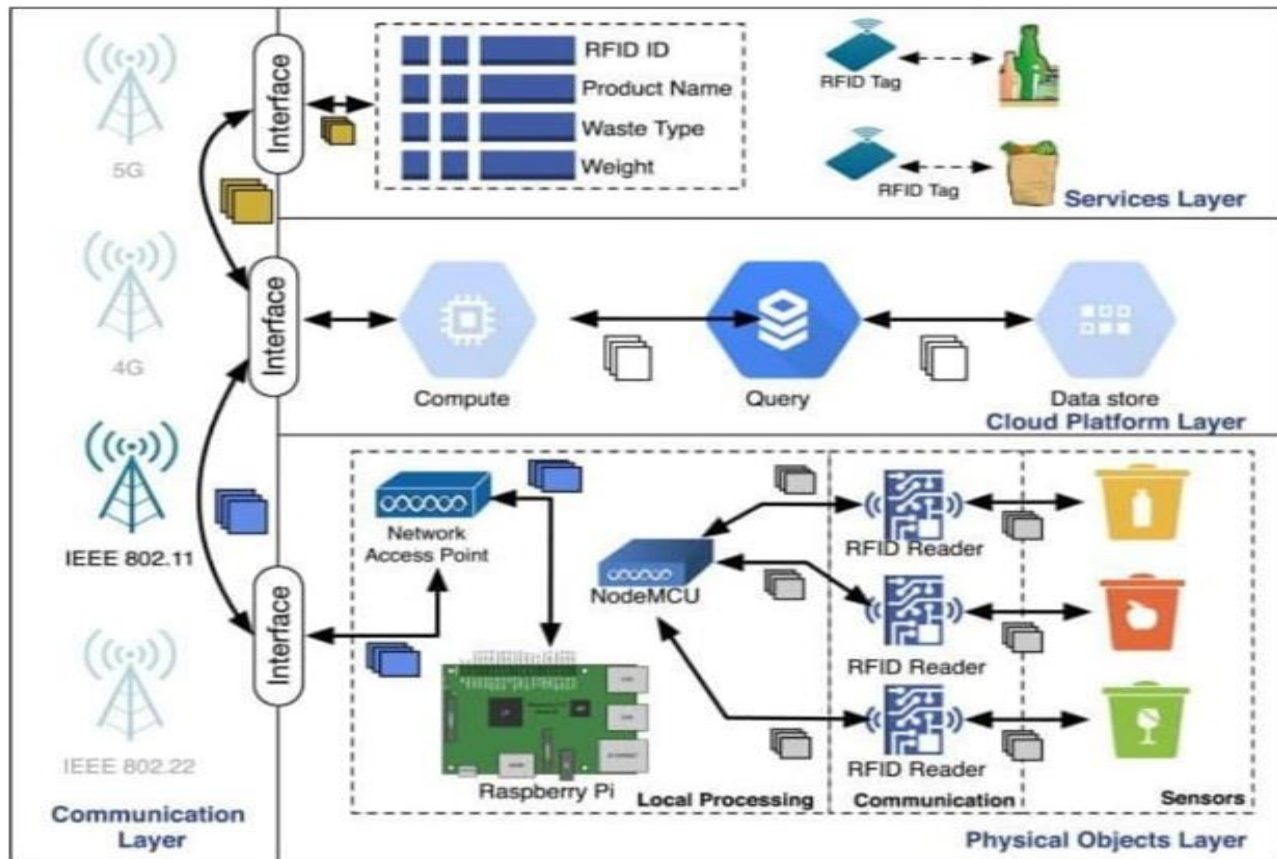
		waste management, behaviour and experience.
NFR-2	<b>Availability</b>	By developing & deploying resilient hardware and beautiful software we empower cities, its businesses, and countries to manage waste smarter.
NFR-3	<b>Performance</b>	<p>The Smart Sensors use ultrasound technology to measure the fill levels (along with other data) in bins several times a day. Using a variety of IoT networks (GPRS), the sensors send the data to Sensors Smart Waste Management Software System, a powerful cloud-based platform, for data driven daily operations, available also as a waste management app.</p> <p>Customers are hence provided data-driven decision making, and optimization of waste collection routes, and frequencies, and vehicle loads resulting in route reduction by at least 30%.</p>
NFR-4	<b>Security</b>	<p>Use reusable grocery bags</p> <p>Avoid single use food and</p>

		drink containers. Use a reusable bottles Purchase wisely and recycle
NFR-5	<b>Scalability</b>	Using smart waste bins reduce the number of bins inside town , cities because we able to monitor the garbage 24/7 more cost effect and scalability when we moves to smarter.

## 5.3 DATA FLOW DIAGRAM:



## 5.4 TECHNOLOGY STACK:



## 6.PROJECT PLANNING PHASE:

### 6.1 Prepare Milestone Activity List:

TITLE	DESCRIPTION	DATE
Literature Survey &gathering information	Literature survey on the selected project & gathering information by referring the, technical papers research publications etc..	11th October 2022
Prepare empathy map	Prepare Empathy map canvas to capture the user Pains & Gains, Prepare list of problem statements	11th October 2022
Ideation	List the by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance	11th October 2022
Proposed solution	Prepare the Proposed solution document, which includes the Novelty, feasibility of idea.	16th October 2022
Solution Architecture	Prepare an solution architecture	17th October 2022
Customer journey	Prepare the customer Journey maps to understand the user interactions & experiences with the application(entry to exit	21st October 2022
Functional requirements	Prepare the functional and non functional document	19th October 2022

Data flow diagram	Draw the data flow diagram and submit for review	20th October 2022
Technology Architecture	Prepare the technology architecture diagram.	20th October 2022
Prepare an Milestone Activity list	Prepare the milestone & activity list of the project	28th October 2022
Sprint delivery plan list	Prepare an sprint delivery plan list	28th October 2022
Sprint Delivery plan	Develop & submit the developed code by testing it	29-17 November 2022

## 6.2 SPRINT DELIVERY PLAN:

### Product Backlog ,Sprint ,scheduled Estimation

Sprint	Functional Requirements	User Story Number	User story /Stack	Story Points	Priority	Team Members
Sprint-1	Log in	USN-2	As a Co-Admin, I'll control the waste level by monitoring them via real time web portal. Whenever the bin is filled, I'll notify trash truck with location of bin with bin ID	10	High	Tamilpriya

Sprint-2	Dashboard	USN-3	As a Truck Driver, I'll follow Co-Admin's Instruction to reach the filling bin in short roots and save time	20	Medium	Vani
Sprint-3	Dashboard	USN-4	As a Local Garbage Collector, I'll gather all the waste from the garbage, load it onto a garbage truck, and deliver it to Landfills	20	Medium	Sarulatha
Sprint-4	Dashboard	USN-5	As a Municipality officer, I'll make sure everything is proceeding as planned and without any problems	20	High	Srivani

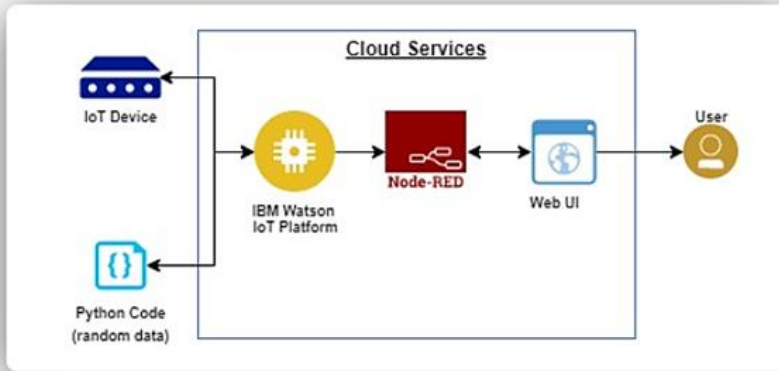
## Project Tracker, Velocity & Burndown Chart:

SPRINT	TOTAL STORY POINTS	DURATON	SPRINT START DATE	SPRINT END DATE	STORY POINTS COMPLETED	SPRINT RELEASED DATE
SPRINT-1	20	6 Days	24 Oct 2022	24 Oct 2022	20	29 Oct 2022
SPRINT-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
SPRINT-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
SPRINT-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	14 Nov 2022

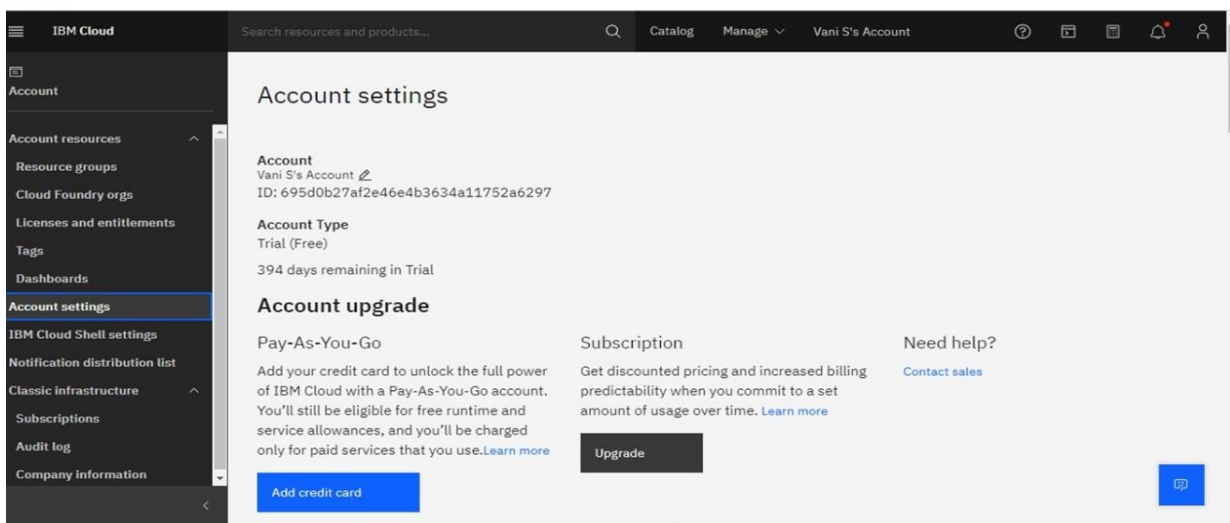


## 7.PROJECT DEVELOPMENT PHASE:

### 7.1 Project Development-Delivery of Sprint-1: Basic Block Diagram



### STEP 1: Creation of IBM cloud



## Step-2: Configure IBM Watson Platform

The screenshot shows the IBM Cloud console interface. At the top, there's a header with 'team git', 'IBM Cloud', a search bar, and navigation links like 'Catalog', 'Manage', and 'Vani S's Account'. Below the header, the main content area is titled 'Internet of Things Platform-ef' with a green 'Active' status and 'Add tags' link. A sidebar on the left has 'Manage' selected, with sub-links for 'Plan' and 'Connections'. The main content area features a large graphic of a central node connected to various devices, followed by the text 'Let's get started with IBM Watson IoT Platform' and a description: 'Securely connect, control, and manage devices. Quickly build IoT applications that analyze data from the physical world.' Below this are 'Launch' and 'Docs' buttons. Further down, a section titled 'Ready for the next level?' shows the 'IBM Watson IoT Platform Journey' with three stages: 'Lite' (checked), 'Non-Production', and 'Production'.

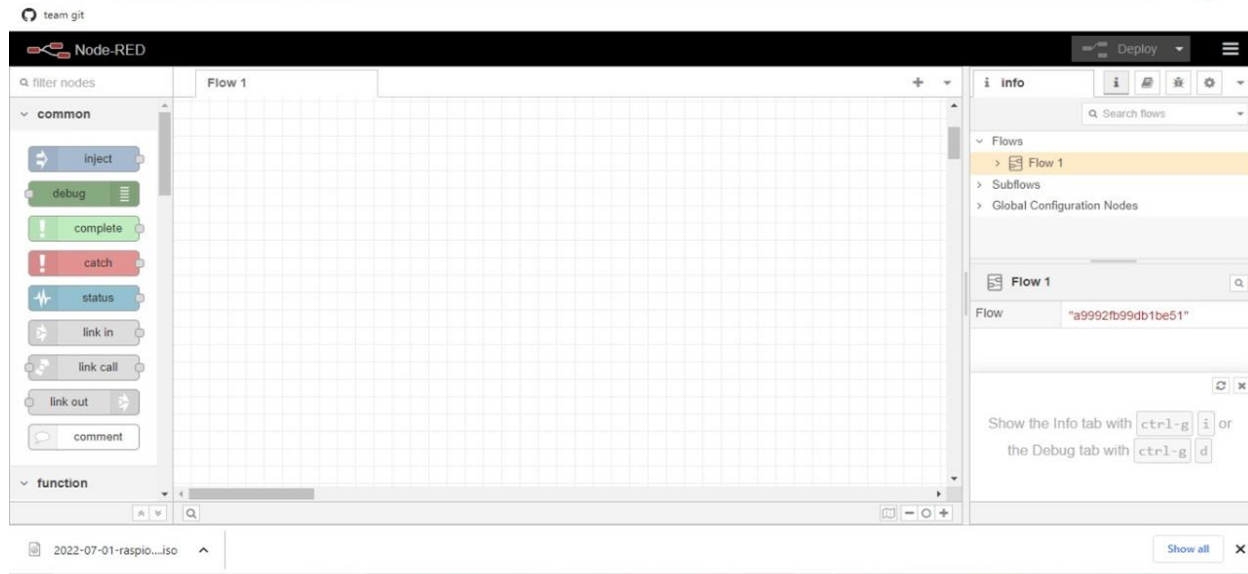
## Step-3: Create the device in IBM platform and get device credentials

The screenshot shows the IBM Watson IoT Platform console. The top header includes 'IBM Watson IoT Platform', a user profile for 'vniash266@gmail.com' with ID 'bbzx4u', and a 'Back' button. The main content area is titled 'Device Drilldown - 123456789'. On the left, a sidebar lists navigation options: 'Device Credentials' (selected), 'Connection Information', 'Recent Events', 'State', 'Device Information', 'Metadata', 'Diagnostics', 'Connection Logs', and 'Device Actions'. The 'Device Credentials' section displays the following information:

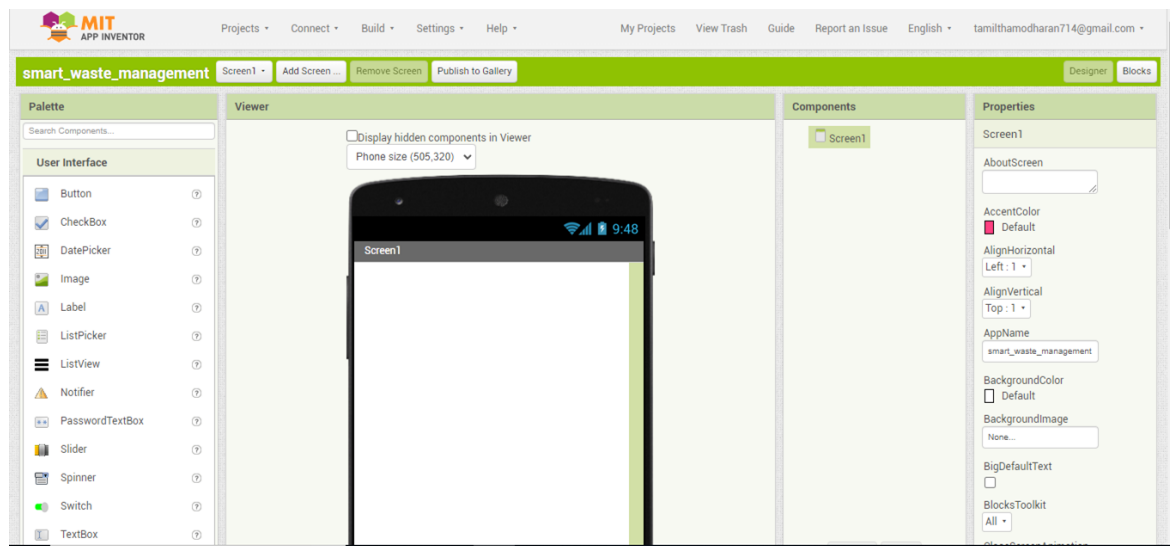
Organization ID	bbzx4u
Device Type	esp32_rasp
Device ID	123456789
Authentication Method	use-token-auth
Authentication Token	pnZ4GltX5m&Jt@P(gv

Below the table, a warning icon and text state: 'Authentication tokens are non-recoverable. If you misplace this token, you will need to re-register the device to generate a new authentication token.' A link 'Find out how to add these credentials to your device' is provided. At the bottom, a file upload bar shows two items: '2022-09-22-ras...img.xz' and '2022-07-01-raspio...iso' (labeled 'Canceled'). A 'Show all' button is on the right.

## Step-4: Creation of Node-RED



## Step-5 : MIT App inventor



## 7.2 Project Development -Delivery of Sprint-2:

### Python code:

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

organization = "bbzx4u"
deviceType = "esp32_rasp"
deviceId = "123456789"
authMethod= "token"
authToken= "pnZ4GITK5m&t@P(gV"
def myCommandCallback(cmd):
    global a
    print("command recieved:%s" %cmd.data['command'])
control=cmd.data['command']
    print(control)
try:
    deviceOptions= {"org": organization, "type": deviceType,"id": deviceId,"auth-
method":authMethod,"authToken":authToken}
    deviceClient = ibmiotf.device.Client(deviceOptions)
except Exception as e:
    print("caught exception connecting device %s" %str(e))
    sys.exit()

#connect and send a datapoint "temp" with value integer value into the cloud as a type
of event for every 20 seconds
deviceClient.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 %"
Elif loadcell < 8 and loadcell > 12:
```

```

    load = "60 %"
elif loadcell < 4 and loadcell > 7:
    load = "40 %"
else:
    load = "0 %"

if distance < 15:
    dist = 'Risk warning:' 'Dumpster poundage getting high, Time to collect :) 90 %'

elif distance < 40 and distance >16:
    dist = 'Risk warning:' 'dumpster is above 60%'

elif distance < 60 and distance > 41:
    dist = 'Risk warning:' '40 %'

else:
    dist = 'Risk warning:' '17 %'

If load == "90 %" or distance == "90 %":
    warn = 'alert : ' ' Dumpster poundage getting high, Time to collect :)'
Elif load == "60 %" or distance == "60 %":
    warn = 'alert : ' 'dumpster is above 60%' else :warn = 'alert : ' 'No need to collect right
now '

def myOnPublishCallback(lat=12.678991,long=87.177731):    print("Chennai, Porur")
print("published distance = %s " %distance, "loadcell:%s " %loadcell, "lon = %s "
%s,long,"lat = %s" %lat)
print(load)
print(distance)
print(warn)

time.sleep(20)

success=deviceClient.publishEvent("IoTSensor","json",warn,qos=0,on_publish=
myOnPublishCallback)

if not success:
    print("not connected to ibmiot")

time.sleep(40)

```

```
deviceClient.commandCallback=myCommandCallback
```

```
#disconnect the device  
deviceClient.disconnect
```

## OUTPUT IN PYTHON IDLE



```
File Edit Shell Debug Options Window Help  
Risk warning:10 %  
alert :No need to collect right now  
Puliyur, Karur  
published distance = 48 loadcell:7 lon = 75.135731 lat = 10.939091  
0 %  
Risk warning:40 %  
alert :No need to collect right now  
Puliyur, Karur  
published distance = 18 loadcell:9 lon = 75.135731 lat = 10.939091  
0 %  
Risk warning:dumpster is above 60%  
alert :No need to collect right now  
Puliyur, Karur  
published distance = 18 loadcell:9 lon = 75.135731 lat = 10.939091  
0 %  
Risk warning:dumpster is above 60%  
alert :No need to collect right now  
Puliyur, Karur  
published distance = 35 loadcell:13 lon = 75.135731 lat = 10.939091  
0 %  
Risk warning:dumpster is above 60%  
alert :No need to collect right now  
Puliyur, Karur  
published distance = 38 loadcell:13 lon = 75.135731 lat = 10.939091  
0 %  
Risk warning:dumpster is above 60%  
alert :No need to collect right now
```

## 7.3 Project Development -Delivery of Sprint 3: PROGRAM

```
#include <cstdlib>  
#include <time.h>  
#include <WiFi.h>  
#include <PubSubClient.h>  
#define ORG "zuhtbq"  
#define DEVICE_TYPE "Rasp"  
#define DEVICE_ID "12345"  
#define TOKEN "12345678"  
#define speed 0.034  
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";  
char publishTopic[] = "iot-2/evt/data/fmt/json";
```

```
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;
WiFiClient wifiClient;
PubSubClient client(server, 1883, wifiClient);
int weight = 0;
[6:25 AM, 11/19/2022] Priya: String location = "Coimbatore";
String status = "";
void setup() {
  Serial.begin(99900);
  wifiConnect();
  mqttConnect();
}
void loop() {
  srand(time(0));
  int p;
  weight = random(0,80);
  if(weight > 0 && weight < 25){
    p = 0;
  }
  else if(weight > 25 && weight < 50){
    p = 1;
  }
  else{
    p = 2;
  }
  switch (p) {
    case 0:
      status = "Low";
      break;
    case 1:
      status = "Half";
      break;
    case 2:
      status = "Full";
      break;
  }
  String payload = "{";
  payload+="\"Weight \":";
  payload+=weight;
  payload+=",";
```

```
payload+="\"Loaction\":";
payload+="Coimbatore";
payload+=",";
payload+="\"Status\":"\""+status+"\"";
Serial.println(payload);
if(client.publish(publishTopic, (char*) payload.c_str()))
{
    Serial.println("Publish OK");
}
else{
    Serial.println("Publish failed");
}
delay(1000);
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(500);
        }
    }
}
```



```
}  
Serial.println();  
}  
}
```

OUTPUT :

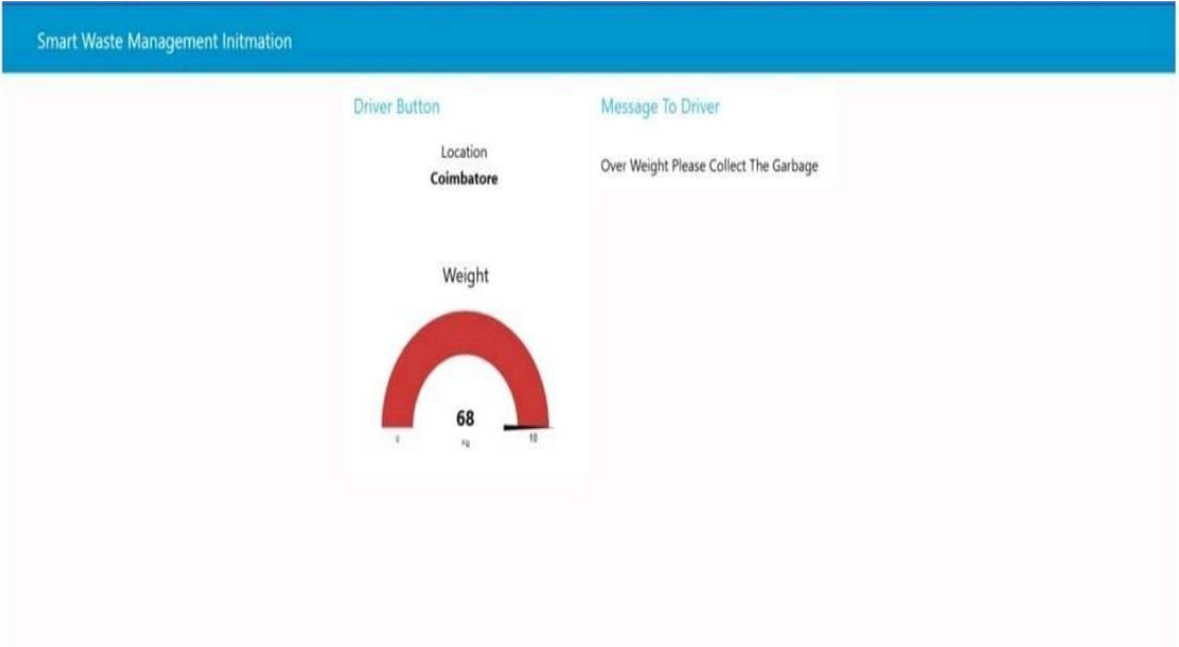


## 7.4 Project Development-Delivery of Sprint-4:

INTIMATION FROM DRIVER:



INTIMATION TO DRIVER:



## CONCLUSION

Monitoring the fullness of bins through the use of sensors, it is possible to achieve a more efficient system than the current existing. Our idea of "Smart waste management system", mainly concentrates on Monitoring the waste management, providing a smart technology for waste system, avoiding human intervention, reducing human time and effort and which results in healthy and waste ridden environment. The proposed idea can be implemented for smart cities where the residents would be busy enough with their hectic schedule and wouldn't have enough time for managing waste. The bins can be implemented in a city if desired where there would be a large bin that can have the capacity to accumulate the waste of solid type for a single apartment. The cost could be distributed among the residents leading to cheaper service provision

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