

**SMART WASTE MANAGEMENT SYSTEM FOR  
METROPOLITAN CITIES**

**TEAM ID: PNT2022TMID07013**

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PANDIYAN M  
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# INTRODUCTION

## 1.1 PROJECT OVERVIEW

Project Name : **Smart Waste Management System For Metropolitan Cities.**

Category : **Internet Of Things.**

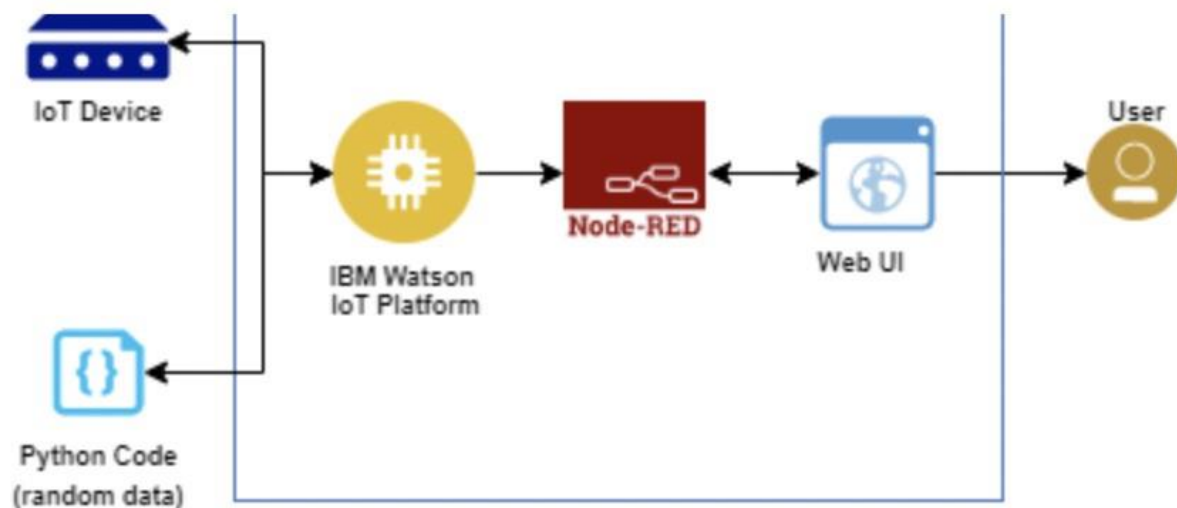
Project Description:

- 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.

Skills Required :

Python,IOT Cloud Platform ,IBM Cloud,Node- RED,IBM IoT Platform,IBM Nodered,IBM Cloudant DB

Technical Architecture :



## 1.2 PROJECT PURPOSE

The main aim of the project is to automate the waste managing process, smartly, using the Internet of Things. In the proposed system, we aim to measure the fill level of dry and wet dustbin and send a notification to the garbage collector if the fill level exceeds 75% mark.

Smart waste management is an idea where we can control lots of problems which disturbs the society in pollution and diseases. The waste management has to be done instantly else it leads to irregular management which will have adverse effects on nature. Smart waste management is compatible mainly with the concept of smart cities.



### **Main objectives :**

1. Monitoring the waste management.
2. Providing smart technology for waste systems.
3. Avoiding human intervention.
4. Reducing human time and effort
5. Resulting in a healthy and waste ridden environment.

# LITERATURE SURVEY

## 2.1 EXISTING PROBLEM

The waste collection process is a critical aspect for the service providers. The traditional way of manually monitoring the wastes in waste bins is a complex, cumbersome process and utilizes more human effort, time and cost which is not compatible with the present day technologies. Irregular management of waste typically domestic waste, industrial waste and environmental waste is a root cause for many of the human problems such as pollution, diseases and has adverse effects on the hygiene of living beings. In order to overcome all these problems, we are proposing the idea of a smart waste management system which helps in auto-management of waste without human interaction in order to maintain a clean environment.

## 2.2 REFERENCES

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

**Publisher:**

[https://www.semanticscholar.org/paper/IoT-Enabled-Intelligent-Solid-Waste-Management-for-De wangan/6fbe2679732dbcff5132ed75114137e00dcc53beishe](https://www.semanticscholar.org/paper/IoT-Enabled-Intelligent-Solid-Waste-Management-for-De-wangan/6fbe2679732dbcff5132ed75114137e00dcc53beishe)

## 2.3 PROBLEM STATEMENT DEFINITION

Garbage Management and Collection in Cities, Town and Villages is a major concern and emerging problem in the Smart City paradigm. Also lack of proper resource distribution in the process of Garbage collection is a great risk to sanitation, cleanliness and health. Theme: Internet of Things

Technologies: LoRa, Smart Mesh, RF, WiFi

## IDEATION & PROPOSED SOLUTION

### 3.1 EMPATHY MAP CANVAS

#### Kritheebhan B

Easy to Design	Light weight and reliable	Cost Effective
Use wireless Sensor	Time Consumption	To check garbage level using srnsor

#### Ragavan M

Waste is cleared	Easy to design	Low power Consumption
Cost Effective	Use Wireless Sensor	Determine the garbage level

#### Venkatesan C

Use Wireless Sensor	No External Storage	Cost Effective
Share the location to garbage collector	Easy to design	Effective system

#### Pandayan M

Cost Effective	High Accuracy	Monitoring is easy
Efficient system	Check the garbage level using sensor	Use wireless sensor

### **3.2 IDEATION AND BRAINSTORMING**

#### **IDEA 1:**

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.

#### **IDEA 2:**

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 net bin 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.

#### **IDEA 3:**

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.

#### **IDEA 4:**

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	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.
3.	Novelty / Uniqueness	The existing system makes use of IOT devices and sensors for communication. But in our 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. The app takes the information to the waste collector directly. This saves the time of the customer. The cost of the product is also less so 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 waste properly. 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 do more 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

### **3.3 PROBLEM SOLUTION FIT**

#### **1. CUSTOMER SEGMENT(S):**

This product is for trash collectors in metropolitan cities and also people who like to create a cleaner, safer, more hygienic environment. It is ideal for busy locations such as campuses, theme parks, airports, railway stations and shopping malls.

#### **2. JOBS-TO-BE-DONE / PROBLEMS :**

Avoids unnecessary lumping of wastes on the side as it alerts the authorized person to empty the bin whenever the bins are full. Less manpower, I can view the location of every bin using a web application.

#### **3. TRIGGERS :**

Due to overflowing bins, if there is an odor, trash collectors think of a solution and buy it in busy locations such as campuses, theme parks, airports, railway stations and shopping malls, for all metropolitan cities.

#### **4. EMOTIONS: BEFORE AFTER :**

At first, trash collectors found it difficult to empty the bin because they didn't know when the bin got full. After improvement in the monitoring system as it alerts the authorized person to empty the bin and is able to get the weight of the garbage in the bin, it becomes an easy task for them.

#### **5. AVAILABLE SOLUTIONS :**

With the help of smart bins, we can improve efficiency using the resources available to us in a more focused and target way. Reduce the number of bins required- decluttering and improving the street scene.

#### **6. CUSTOMER CONSTRAINTS:**

- May have confusions on emptying the bins
- Insufficient data collection.

#### **7. BEHAVIOR :**

Improper waste management can lead to adverse health outcomes so buying and using the product is more beneficial.

#### **8. CHANNELS OF BEHAVIOR:**



- ONLINE Searching through the internet to get the detailed statistics about the waste you collected, data for optimizing waste collection
- OFFLINE Create an efficiency campaign to raise awareness about waste management.

## **9. PROBLEM ROOT CAUSE:**

- Poor waste management which leads to adverse health outcomes.
- Rapid urbanization, population growth and economic development will push global waste generation to increase by 70%.

## **10. YOUR SOLUTION :**

The designed system can result in the availability of valuable materials to reuse. The designed system also reduces the labor time and avoids unnecessary lumping of wastes on road sides.

### **Solution Architecture :**

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

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior and other aspects of the software to project stakeholders.
- Define features, development phases and solution requirements.
- Provide specifications according to which the solution is defined, managed and delivered.

### **Features :**

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

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

# REQUIREMENT ANALYSIS

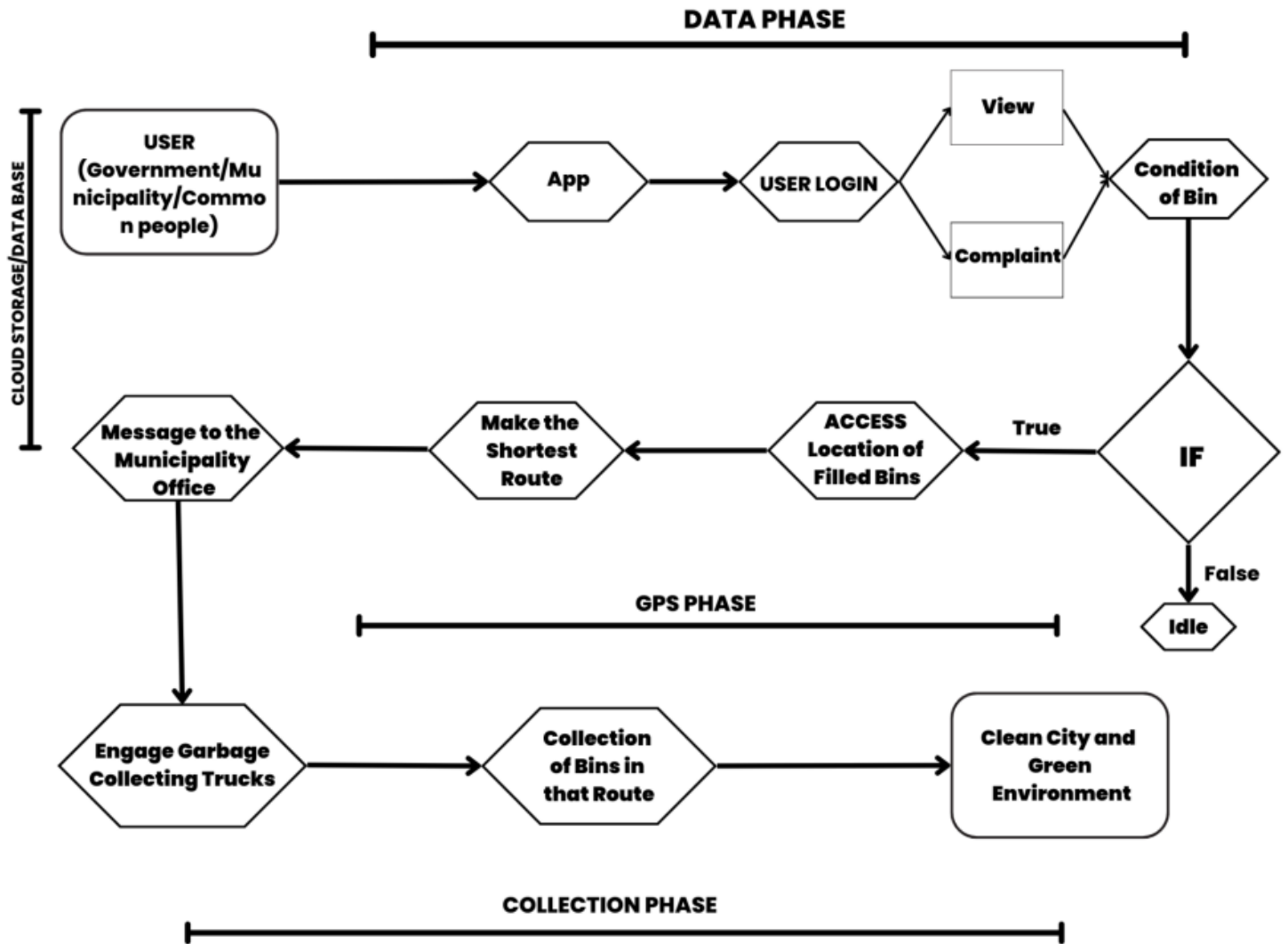
## 4.1 FUNCTIONAL REQUIREMENT(FR)

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 management software.
FR-3	Expensive bins	The tool considers the average distance to depo-bin discharge 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 or sparse bin distribution.
FR-5	Eliminate inefficient 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-automated 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.

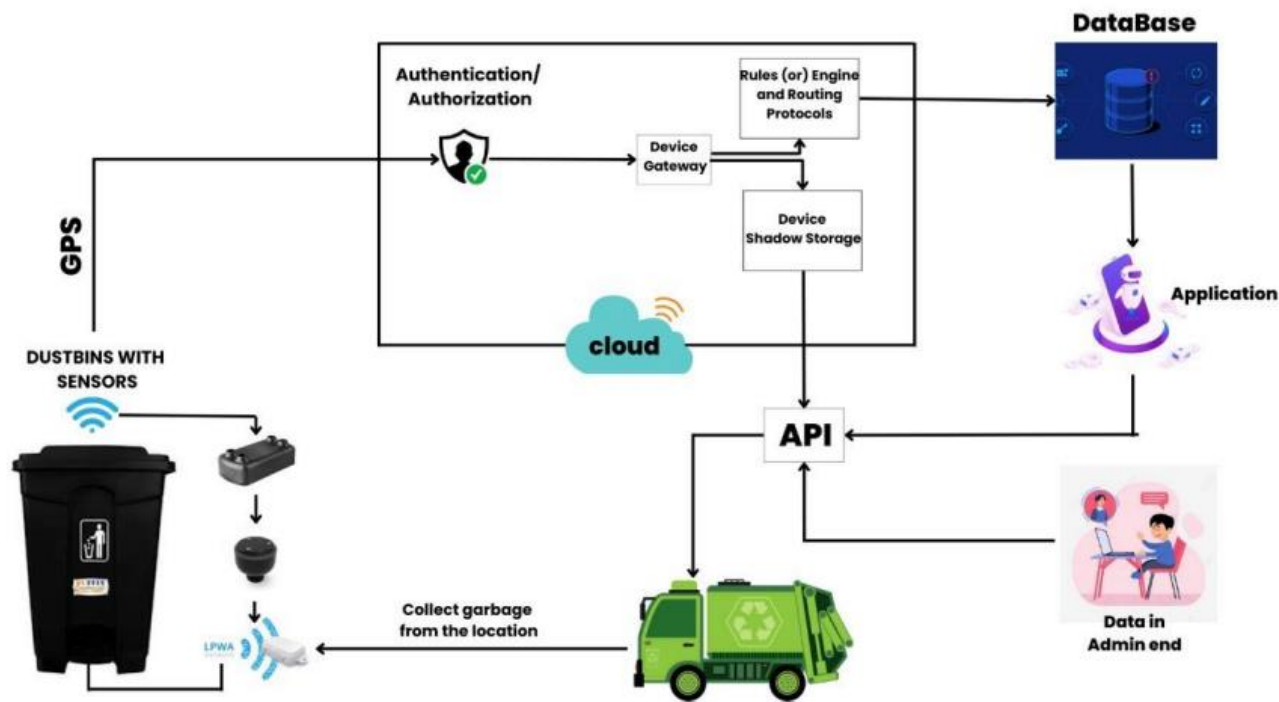
NFR NO.	Non- functional Requirements	Description
NFR-1	Usability	IoT devices verifies that usability is a special and important perspective to analyze user requirements, which can further improve the design quality. In the design process with user experience as the core, the analysis of users' product usability can indeed help designers better understand users' potential needs in waste management, behavior and experience.
NFR-2	Security	User reusable bottles Use reusable grocery bags Purchase wisely and recycle Avoid single use food and drink containers.
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	Using a variety of IoT networks, the sensors send the data to senso's smart waste management Software system, a powerful cloud-based platform , for data driven daily operations , available also as a waste management app. Customers hence provide 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 reduces the number of bins inside town , cities because we are able to monitor the garbage 24/7 for more cost effect and scalability when we move to smarter.

## PROJECT DESIGN

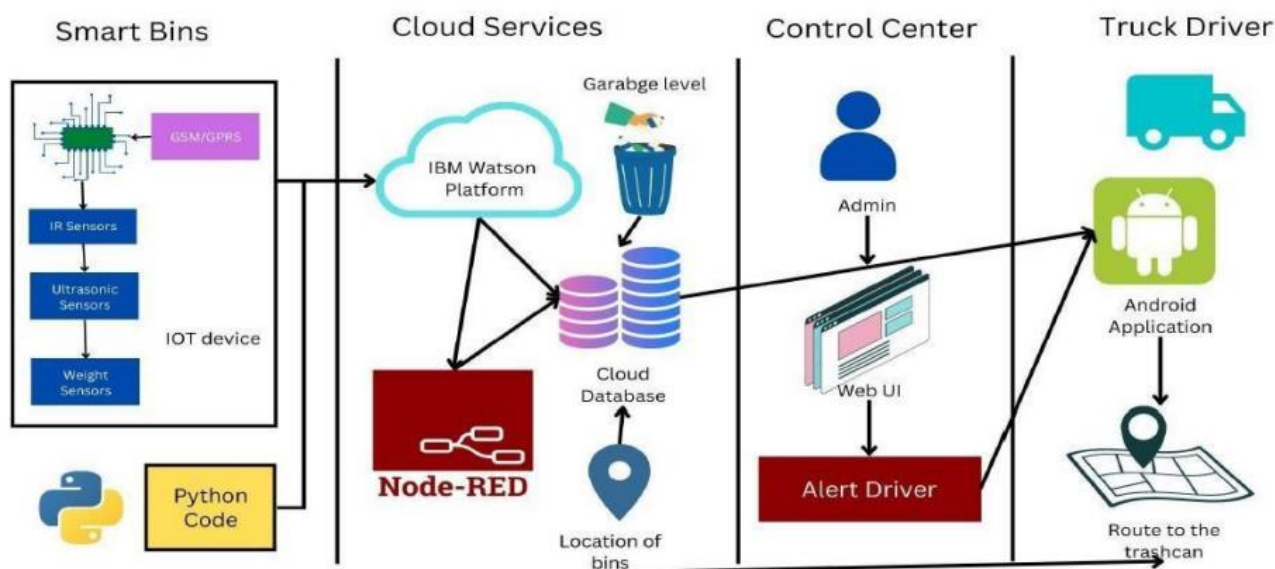
### 5.1 DATA FLOW DIAGRAM



Solution Architecture:



Technical Architecture:



## USER STORIES:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can access through Gmail.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	Log in details are received to me.	High	Sprint-1
	Interface	USN-6	As a user I can log in to the application by using entering email and password.	Easy access application.	High	Sprint-1
Customer (Web user)	Dashboard	WUSN-7	As a web user , I can get all information(data)	I can easily understand how to to use it .	High	Sprint-1
Customer Care Executive	View Perspective	CCE	As a customer care, I can view the data in graph plots.	Easy understanding of graphs.	High	Sprint-1
Administrator	Risk Factor	ADMIN-1	As a admin , update must be done at each step and take care of any errors.	Heavy monitoring is required	High	Sprint-2

## PROJECT PLANNING AND SCHEDULING

### 6.1 SPRINT PLANNING AND ESTIMATION

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc	14-September-2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements	14-September-2022
Ideation	List them by organizing the brainstorming session and prioritize the top 3 ideas based on feasibility & importance.	25-September-2022
Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	28-September-2022

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### **Sprint Delivery Plan:**

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

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Software	USN-1	Design the circuit which is to be integrated within the garbage bin using sensors.	10	High	Kritheebhan B Ragavan M Pandiyam M Venkatesan C
Sprint-1	Cloud	USN-2	Cloud web server is created which connects the bin and the authority who is responsible for the disposal of waste from its bin	10	High	Kritheebhan B Ragavan M Pandiyam M Venkatesan C
Sprint-2	Technology	USN-3	Connect cloud server and the bins.	5	High	Kritheebhan B Ragavan M Pandiyam M Venkatesan C

Sprint-2	Cloud Server	USN-4	Upload the details of truck driver and location of bin using GPS	5	Medium	Kritheebhan B Ragavan M Pandiyam M Venkatesan C
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Sprint-2	Sensor	USN-5	Detect the level of garbage using sensor and stores it in the server for specific interval of time.	10	High	Kritheebhan B Ragavan M Pandiyam M Venkatesan C
Sprint-3	Python, GPS	USN-6	Write the python code for intimating to the authority about alerting message regarding collection of garbage and where to collect	10	High	Kritheebhan B Ragavan M Pandiyam M Venkatesan C
Sprint-3	Cloud	USN-7	Authority should allocate which truck driver should collect the waste at particular area	10	Medium	Kritheebhan B Ragavan M Pandiyam M Venkatesan C

Sprint-4	Communicating Medium	USN-8	Truck driver receives the message from the authority and goes to collect the garbage	10	Medium	Kritheebhan B Ragavan M Pandiyam M Venkatesan C
Sprint-4	Communicating Medium	USN-9	After collecting the garbage, truck driver intimates that the garbage has collected.	10	Low	Kritheebhan B Ragavan M Pandiyam M Venkatesan C



## PROJECT TRACKER, VELOCITY AND BURNDOWN CHART :

### CODING AND SOLUTIONING

#### 7.1 WEBSITE CODES

##### WELCOME PAGE CODES ( HTML)

```
<!DOCTYPE html>

<html>

<head>

<link rel="stylesheet" href="https://cdn.jsdelivr.net/npm/bootstrap@4.3.1/dist/css/bootstrap.min.css"
integrity="sha384-ggOyR0iXCbMQv3Xipma34MD+dH/1fQ784/j6cY/iJTQUOhcWr7x9JvoRxT2MZw1T"
crossorigin="anonymous">
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width">
    <title>Garbage Management System</title>
    <link rel="icon" type="image/x-icon" href="/Images/DUMPSTER.png">
    <link href="style.css" rel="stylesheet" type="text/css" />
    <script src="https://www.gstatic.com/firebasejs/8.10.1/firebase-app.js"></script>
    <script src="https://www.gstatic.com/firebasejs/8.10.1/firebase-database.js"></script>

<script>

    var firebaseConfig =
    {
        apiKey: "AIzaSyB9ysbnaWc3IyeCioh-aJQT_UCMd5CBFeU",
        authDomain: "fir-test-923b4.firebaseio.com",
        databaseURL: "https://fir-test-923b4-default-rtdb.firebaseio.com",
        projectId: "fir-test-923b4",
        storageBucket: "fir-test-923b4.appspot.com",
        messagingSenderId: "943542145393",
        appId: "1:943542145393:web:9b5ec7593e6a3cbd7966d0",
        measurementId: "G-BN7JNX1Q7B"
```

```

        };

        firebase.initializeApp(firebaseConfig)

    </script>

    <script defer src="database.js"></script>

</head>

<body style="background-color:#1F1B24;">

    <script src="map.js"></script>


    <div id="map_container">

        <h1 id="live_location_heading" >LIVE LOCATION</h1>

        <div id="alert_msg">ALERT MESSAGE!</div>

    </div>

    <center><a
href="https://www.google.com/maps/place/RMK+Engineering+College/@13.1014175,79.6674808,10z/data=!3m1!4b1!4m6!
3m5!1s0x3baf7a942bbc622d:0x46d1124a3f30bb0e!8m2!3d13.1019826!4d80.2090117!16s%2Fg%2F1jkwfd0jh"
type="button" class="btn btn-dark">DUMPSTER</a></center>

    </div>

    <script

src="https://www.google.com/maps/place/R.M.K.+Engineering+College/@13.3578614,80.1387504,17z/data=!4m10!1m2!2
m1!1srmk+engineering+colle!3m6!1s0x3a4d807de229f987:0x11cc3e2927bfabc!8m2!3d13.3566454!4d80.1411049!15sChVy
bWsgZW5naW5lZXJpbmcgY29sbGWSAQdjb2xsZWdl4AEA!16zL20vMGM1dmd4"></script></div>

</body></html>

```

**map.js**

```
const database = firebase.database();
```

```
function myMap()
```

```
{
```

```
    var ref1 = firebase.database().ref();
```

```
    ref1.on("value", function(snapshot)
```

```
    {
```

```
        snapshot.forEach(function (childSnapshot) {
```

```
            var value = childSnapshot.val();
```

```
                const latitude = value.latitude;
```

```
                const longitude = value.longitude;
```

```
                var latlong = { lat: latitude, lng: longitude }
```

```
                var mapProp =
```

```
                {
```

```
                    center: new
```

```
                    google.maps.LatLng(latlong),
```

```
                    zoom: 10,
```

```
                }
```

```
            };
```

```
        var map = new
```

```
        google.maps.Map(document.getElementBy
```

```
        Id("map"), mapProp);
```

```
        var marker = new
```

```
        google.maps.Marker({ position: latlong });
```

```
        marker.setMap(map);
```

```

    });

    }, function

(error) {

console.log("Error: " + error.code);

```

## DATABASE CODES

```

const cap_status =
document.getElementById('cap_statu
s');

```

```

const alert_msg =
document.getElementById('alert_msg
');

```

```

var ref = firebase.database().ref();

```

```

ref.on("value", function(snapshot)
{
    snapshot.forEach(function
(childSnapshot) {
        var value = childSnapshot.val();

```

```

const alert_msg_val = value.alert;
const cap_status_val
=value.distance_status;

```

```

t_msg.innerHTML=
`${alert_msg_val}`;

```

```

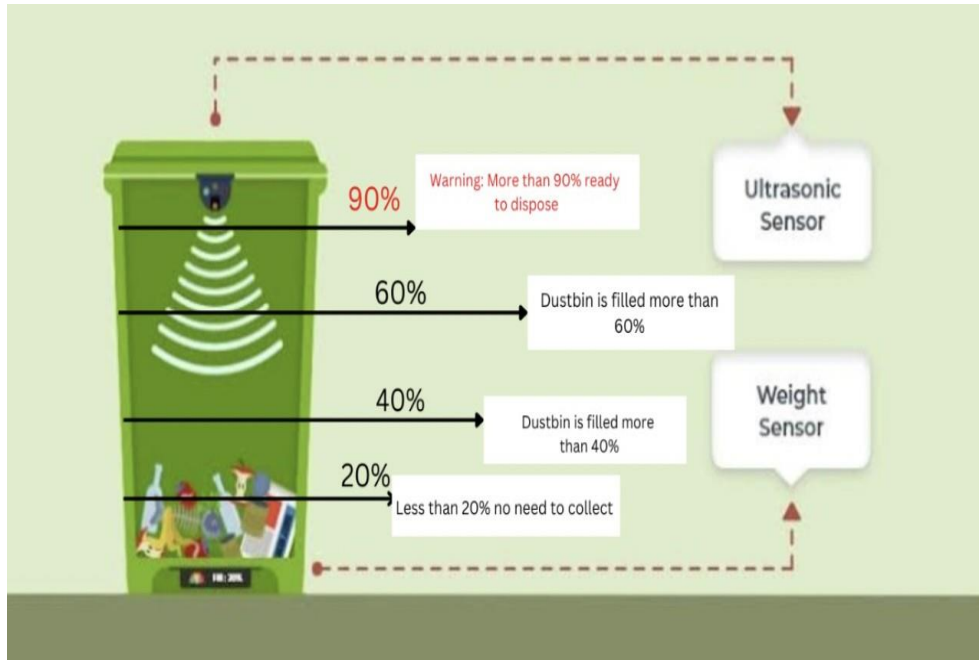
});

}, function (error) {

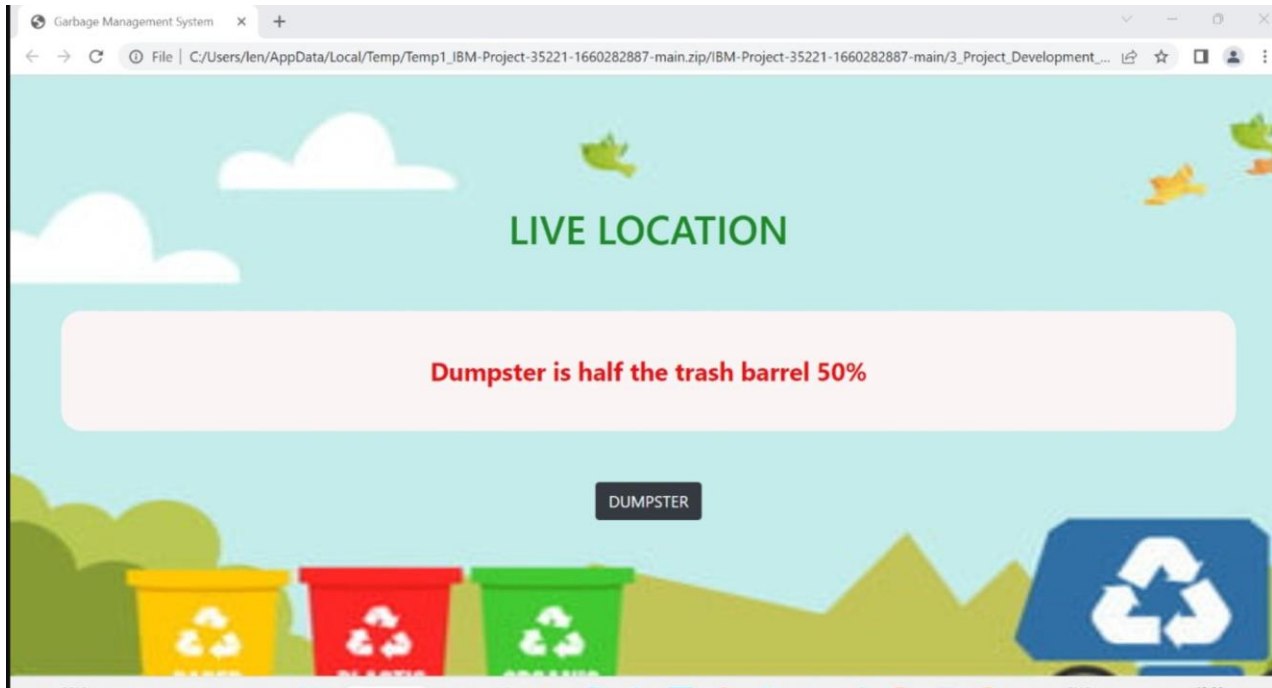
    console.log("Error: " +
error.code);});

```

## WORKING MODEL :



## APPLICATION OUTLOOK :



## PYTHON CODE FOR HARDWARE

```
import pyrebase

import wiotp.sdk

import time

import random

d = 0

w = 0

def database(d,w,m,load,distance,lat = 10.939091,long= 78.135731):

#Initialize Firebase

firebaseConfig={

"apiKey": "AIzaSyB9ysbnaWc3IyeCioh-aJQT_UCMd5CBFeU",

"authDomain": "fir-test-923b4.firebaseio.com",

"databaseURL": "https://fir-test-923b4-default-rtdb.firebaseio.com",

"projectId": "fir-test-923b4",
```

```

        "storageBucket": "fir-test-923b4.appspot.com",

        "messagingSenderId": "943542145393",

        "appId": "1:943542145393:web:9b5ec7593e6a3cbd7966d0",

        "measurementId": "G-BN7JNX1Q7B"
    }

```

```
firebase=pyrebase.initialize_app(firebaseConfig)
```

```
db=firebase.database()
```

```
# #Push Data
```

```

data={ "level":str(d)+"cm",

        "alert":m,

        "weight":str(w)+"g",

        "latitude":lat,

        "longitude":long,

        "distance_status":distance,

        "load_status":load}

# print(db.push(data))

```

```
# update data base
```

```
db.child("-NEkRRkKsX7yVcqy_rK4").update(data)
```

```
myConfig = {
```

```

    "identity": {

        "orgId": "4yi0vc",

        "typeId": "smartwaste123",

        "deviceId":"70103"

    },

    "auth": {

        "token": "123456789"
    }

```

```

    }
}

```

```

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()

client.publishEvent(eventId="status", msgFormat="json", data=data,
qos=0, onPublish=None)

```

## main.py

```

c = 1
import time
for i in range(1,2):
    while True:
        if c == 1:
            import distance
            d=distance.distancesensor()
            c = 2
        elif c == 2:
            import load
            w = int(load.loop())
            c = 3
        else:
            import database as db
            if w < 5000 and w > 4000:
                load = "90 %"

            elif w < 4000 and w > 3000:
                load = "60 %"

            elif w < 3000 and w > 100:

                load = "40 %"
            else:
                load = "0 %"

```



```

if d > 30:
    distance = "90 %"

elif d < 30 and d > 20:
    distance = "60 %"

elif d < 20 and d > 5:
    distance = "40 %"
else:
    distance = "7 %"

if load == "90 %" or distance == "90 %":
    m = "Risk Warning: Dumpster poundage getting high, Time to collect :)"

elif load == "60 %" or distance == "60 %":

    m = "dumpster is above 60%"
else :
    m = "      "

db.database(d,w,m,load,distance)
print("data pushed")
c = 1
break

```

## TESTING

### 8.1 TEST CASE :

- **TEST CASE 1:**
- WEIGHT: 0 KG
- STATUS : NOT FILLED, DUSTBIN IS EMPTY
  
- **TEST CASE 2:**
- WEIGHT : 10KG
- STATUS:20% FILLED, NOT READY TO DISPOSE
  
- **TEST CASE 3:**
- WEIGHT: 20KG
- STATUS: 40% FILLED ,NOT READY TO DISPOSE
  
- **TEST CASE 4:**
- WEIGHT: 30KG
- STATUS: 60% FILLED ,NOT READY TO DISPOSE
  
- **TEST CASE 5:**
- WEIGHT: 45KG
- STATUS: 90% FILLED , READY TO DISPOSE

## RESULTS

### 9.1 PERFORMANCE METRICS

Total MSW Generated = Total tons Recycled + Total tons Recovered + Total tons Disposed  
 MSW = Municipal Solid Waste (does not include industrial, special and demolition wastes)

#### ADVANTAGES:

A reduction in the number of waste collections needed by up to 80%,

- Less manpower, emissions, fuel use and traffic congestion.
- A reduction in the number of waste bins needed.
- Analytics data to manage collection routes and the placement of bins more effectively.

#### ○ DISADVANTAGES:

- Though waste management creates employment, it only has the ability to produce low-quality jobs.
- These jobs include right from sorting the garbage collector to the intensive and laborious jobs that are needed in the factories and outlets.

## 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.

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 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	19 Nov 2022





