# PROJECT:

# SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES

## TEAM ID: PNT2022TMID17577

## DONE BY:


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# INTRODUCTION

## 1.1 PROJECT OVERVIEW

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

Category **: Internet Of Things.**

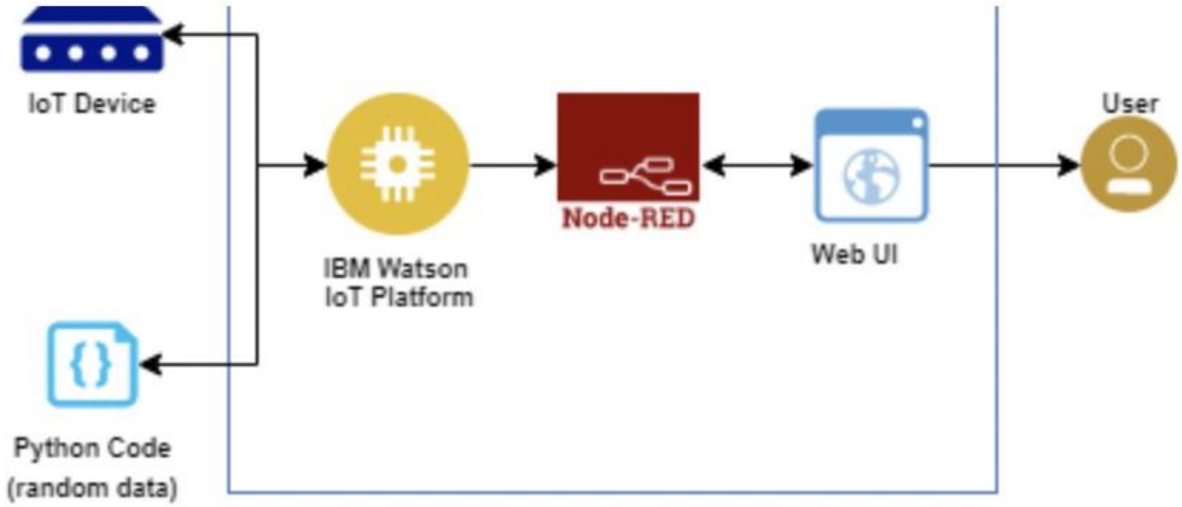
Project Description:

- 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 Node-red, 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 waste management.
2. Providing smart technology for waste systems.
3. Avoiding human intervention.
4. Reducing human time and effort
5. Resulting in a healthy 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 of many of 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 the 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/6fbe2679732dbcff5132ed75114137e00dcc53beisher

**Reference:** https://www.irjet.net/archives/V5/i2/IRJET-V5I2118.pdf

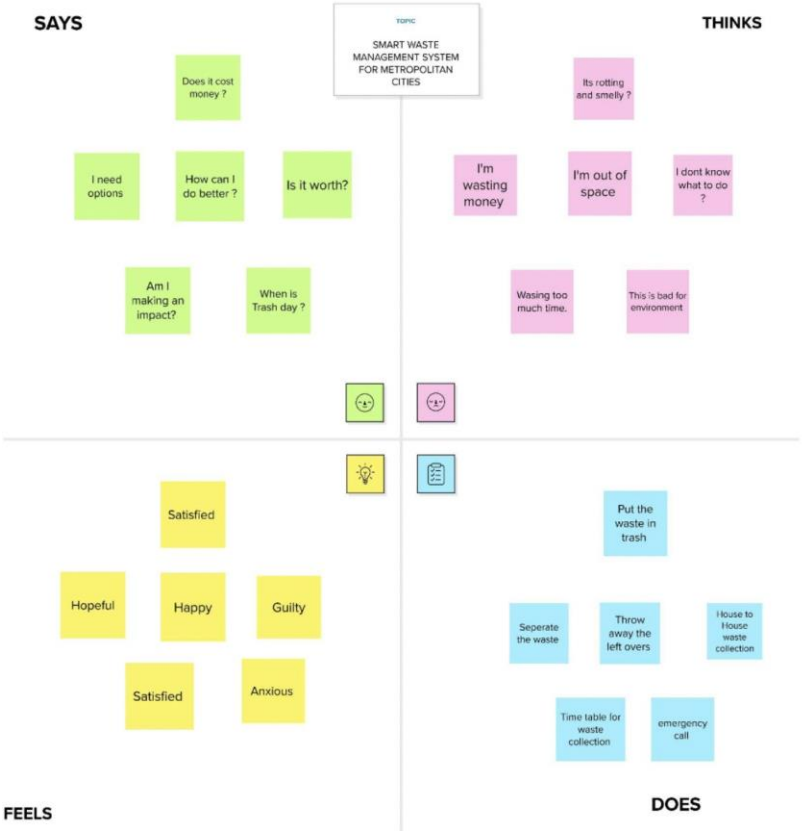
## 2.3 PROBLEM STATEMENT DEFINITION

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




## 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 include, 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:

The smart net bin is an ideology put forward which is a combination of hardware and software technologies i.e. connecting a 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 with the proper waste management in a locality. Smartnet 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 tothe Wi-Fi system. The proposed system will function on a client-server model, a cause that will assure a clean environment, good health, and a 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 the automatic opening and closing of the lid. The 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 the 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.

## 3.3 PROPOSED SOLUTION

| S.NO | PARAMETER | DESCRIPTION |
|---|---|---|
| 1. | Problem statement | A growing population and economy, means increased volumes ofwaste are 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 stable equipment of weighing sensors and other communication IoT devices to create the best and most 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 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 their 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 |

| | | |
|---|---|---|
| | | desperately needed. |

## 3.4 PROBLEM SOLUTION FIT

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

This product is for trash collectors in metropolitan cities and also for people who like to create a cleaner, safer, and more hygienic environment. It is ideal for busy locations such as campuses, themeparks, 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. With less manpower, I can view the location of every bin using a web application.

**3.TRIGGERS:**

Due to overflowing bins, if there is an odour, trash collectors think of a solution and buy it in busylocations 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 an improvement in the monitoring system as it alerts the authorized person to empty thebin 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 targeted way. Reduce the number of bins required- decluttering and improving the street scene.

**6. CUSTOMER CONSTRAINTS:**

- May have confusion about 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 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 labour time and avoids unnecessary lumping of waste on roadsides.

### 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, behaviour and other aspects of the software to projectstakeholders.
- Define features, development phases and solution requirements.
- Provide specifications according to which the solution is defined, managed and delivered.

### Features:

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

1. Communication sensors

2. GPS

3. Notify Alert signal

## REQUIREMENT ANALYSIS

### 4.1 FUNCTIONAL REQUIREMENT(FR)

| FR NO. | Functional Requirement (Epic) | Sub Requirement (Story / Sub Task) |
|---|---|---|

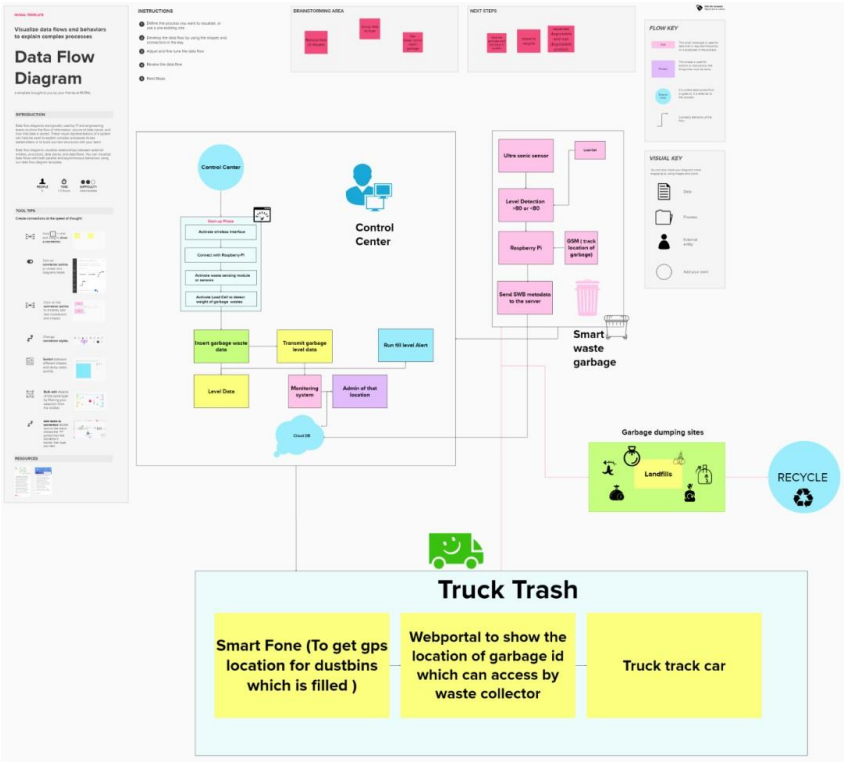
| | | |
|---|---|---|
| FR-1 | Detailed bin inventory | Bins or stands are visible on the map as green, orange or red circles. You can see bin details in the Dashboard – capacity, waste type, last measurement, GPS location and collection schedule or pick recognition. |
| FR-2 | Real time bin monitoring | 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 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. |

## 4.2 NON-FUNCTIONAL REQUIREMENTS (NFR)

| 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 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 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

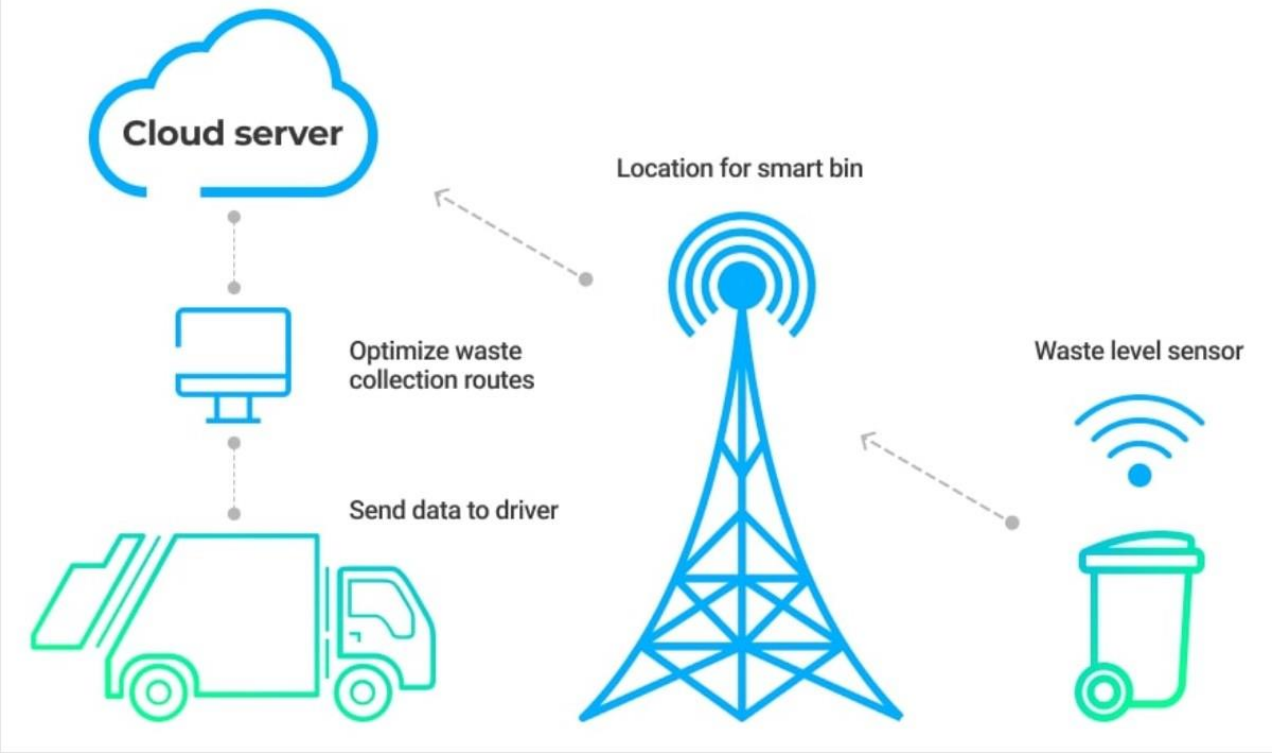
## 5.1 DATA FLOW DIAGRAM




## 5.2 SOLUTION AND TECHNICAL ARCHITECTURE

| S.No | Characteristics | Description | Technology |
|---|---|---|---|
| 1. | User Interface | Web Portal | HTML, CSS, Node-Red, JavaScript. oron |
| 2. | Application logic-1 | To calculate the distance of the dreck and show the real-time level in the web portal, information gets via ultrasonic sensor and The alert message activates with Python script to the web portal. | Ultrasonic sensor/Python. |
| 3. | Application logic-2 | To calculate the weight of the garbage and show the real-time weight in the web portal, this info gets via load cell and the alert message activates with python to | Load cell, python |

| | | | |
|---|---|---|---|
| | | Web portal. | |
| 4. | Application logic -3 | Getting location of the Garbage. | GSM/ GPS |
| 5. | Cloud database | Database service on cloud | IBMDB2,IBM Cloudant etc. |
| 6. | File storage | File storage requirements | Github, Local file system. |
| 7. | External API 1 | Fire base is a set of hosting Services for any type of application. It offers No SQL and real time hosting of databases , content, social authentication, and notifications, or services, such as a real- time Communication server. | Firebase |
| 8. | Ultrasonic sensor | To throw alert message when Garbage is getting full | Distance Recognition Model. |
| 9. | Infrastructure | Application Deployment On Local System/Cloud Local Server Configuration:localhost Configuration:localhost,Firebase | Local host ,web portal |




## 5.3 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 |

| | | |
|---|---|---|
| Problem Solution Fit | Prepare problem - solution fit document. | 3-October-2022 |
| Solution Architecture | Prepare a solution architecture document. | 4-October-2022 |
| Customer Journey | Prepare the customer journey maps to understand the user interactions & experiences with the application | 13-November-2022 |
| Functional Requirement | Prepare the functional requirement document | 13-November-2022 |
| Data flow diagrams | Draw the data flow diagrams and submit for review | 16-November-2022 |
| Technology architecture | Prepare the technology architecture diagram. | 13-November-2022 |
| Prepare milestone and activity list | Prepare the milestones & activity list of the project | 15-October-2022 |
| Project Development, delivery of sprints-1,2,3 & 4 | Develop & submit the developed code by testing it. | 24-October-2022 |

## 6.2 SPRINT DELIVERY SCHEDULE

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | Login | USN-1 | As an Administrator, I need to give a user id andpasscode for ever worker over there in municipality | 10 | High | Indhumathi S |
| Sprint-1 | Login | USN-2 | As a Co-Admin, I'll control the waste level by monitoring them vai real-time web portal. Once the filling happens, I'll notify trash truck with location of bin with bin ID | 10 | High | Indhumathi S |
| 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 | Low | Kodali Gireeshma Chowdaray |
| 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 | Iswarya S P |
| Sprint-4 | Dashboard | USN-5 | As a Municipality officer, I'll make sure everything is proceeding as planned and without any problems | 20 | High | Meena |

## PROJECT TRACKER, VELOCITY AND BURNDOWN CHART:

| 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 |
| | | | | | | |
| | | | | | | |
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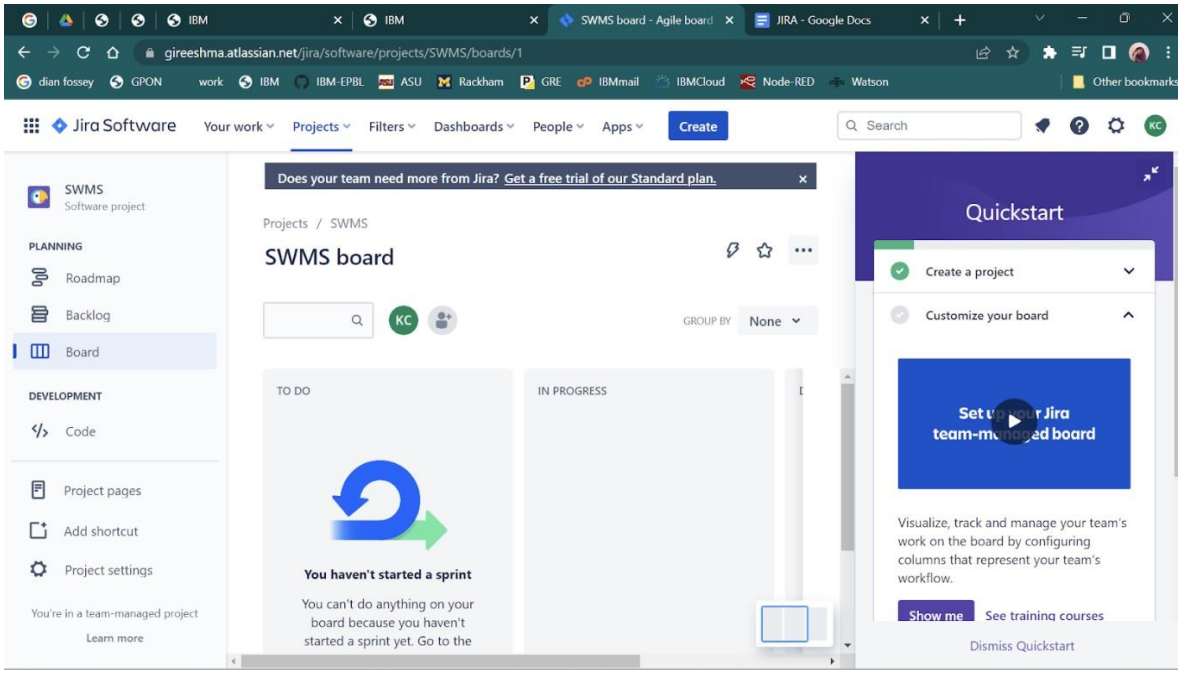
| | | | | | | |

## 6.3 REPORTS FROM JIRA

### SMART WASTE MANAGEMENT SYSTEM IN THE JIRA SOFTWARE PLATFORM: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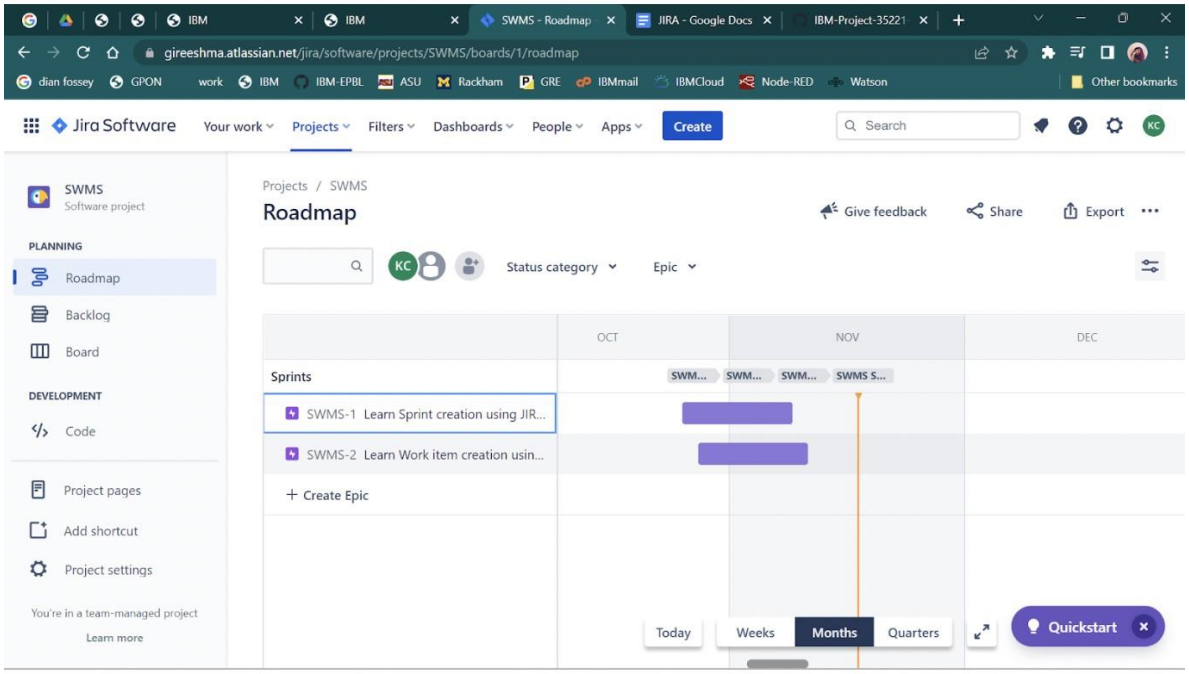
Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
SWMS
Software project
PLANNING
Roadmap
Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Does your team need more from Jira? Get a free trial of our Standard plan.
Projects / SWMS
SWMS board
GROUP BY
None
TO DO
IN PROGRESS
You haven't started a sprint
You can't do anything on your board because you haven't started a sprint yet. Go to the
Quickstart
Create a project
Customize your board
Visualize, track and manage your team's work on the board by configuring columns that represent your team's workflow.
Show me
See training courses
Dismiss Quickstart

## ROADMAP: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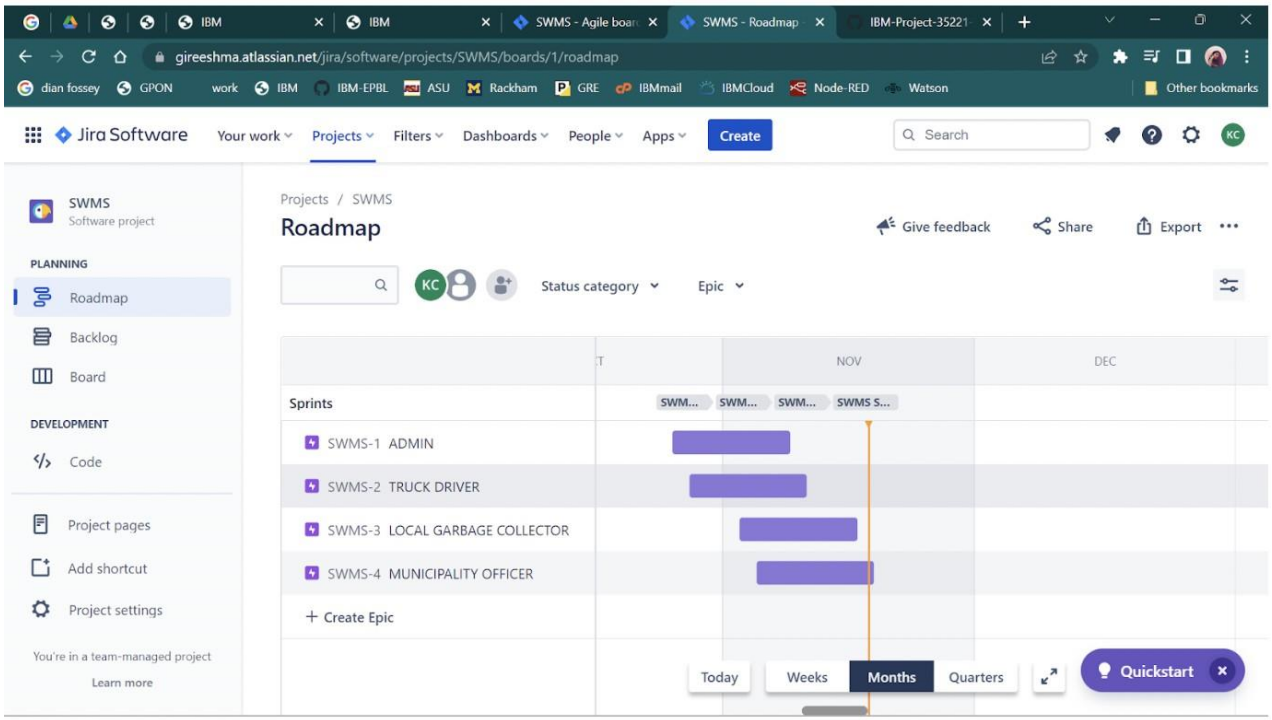
Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
SWMS
Software project
PLANNING
Roadmap
Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / SWMS
Roadmap
Give feedback
Share
Export
Status category
Epic
OCT
NOV
DEC
Sprints
SWMS-1 Learn Sprint creation using JIR...
SWMS-2 Learn Work item creation usin...
Create Epic
Today
Weeks
Months
Quarters
Quickstart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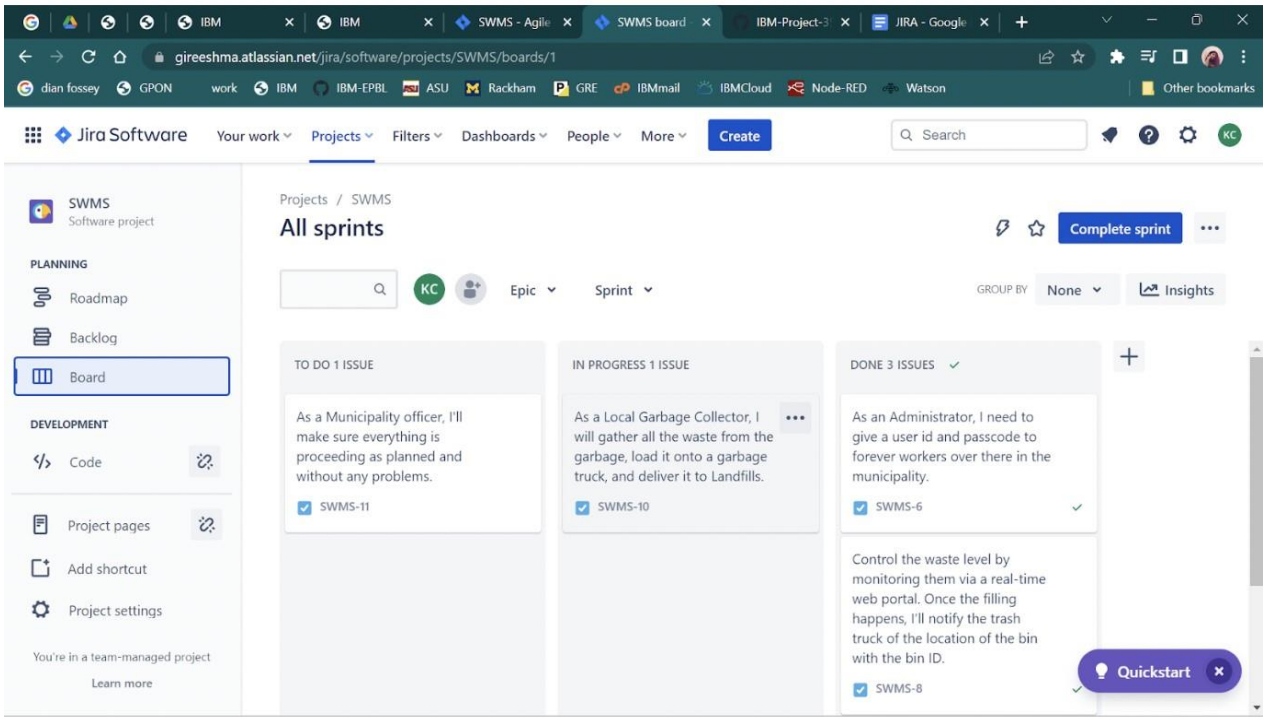
Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
SWMS
Software project
PLANNING
Roadmap
Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / SWMS
Roadmap
Give feedback
Share
Export
Status category
Epic
NOV
DEC
Sprints
SWMS-1 ADMIN
SWMS-2 TRUCK DRIVER
SWMS-3 LOCAL GARBAGE COLLECTOR
SWMS-4 MUNICIPALITY OFFICER
Create Epic
Today
Weeks
Months
Quarters
Quickstart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Your work
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Filters
Dashboards
People
More
Create
Search
SWMS
Software project
PLANNING
Roadmap
Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / SWMS
All sprints
Complete sprint
Epic
Sprint
GROUP BY
None
Insights
TO DO 1 ISSUE
As a Municipality officer, I'll make sure everything is proceeding as planned and without any problems.
SWMS-11
IN PROGRESS 1 ISSUE
As a Local Garbage Collector, I will gather all the waste from the garbage, load it onto a garbage truck, and deliver it to Landfills.
SWMS-10
DONE 3 ISSUES
As an Administrator, I need to give a user id and passcode to forever workers over there in the municipality.
SWMS-6
Control the waste level by monitoring them via a real-time web portal. Once the filling happens, I'll notify the trash truck of the location of the bin with the bin ID.
SWMS-8
Quickstart

# 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.firebaseapp.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>
```

**APP LOGO**


**map.js**

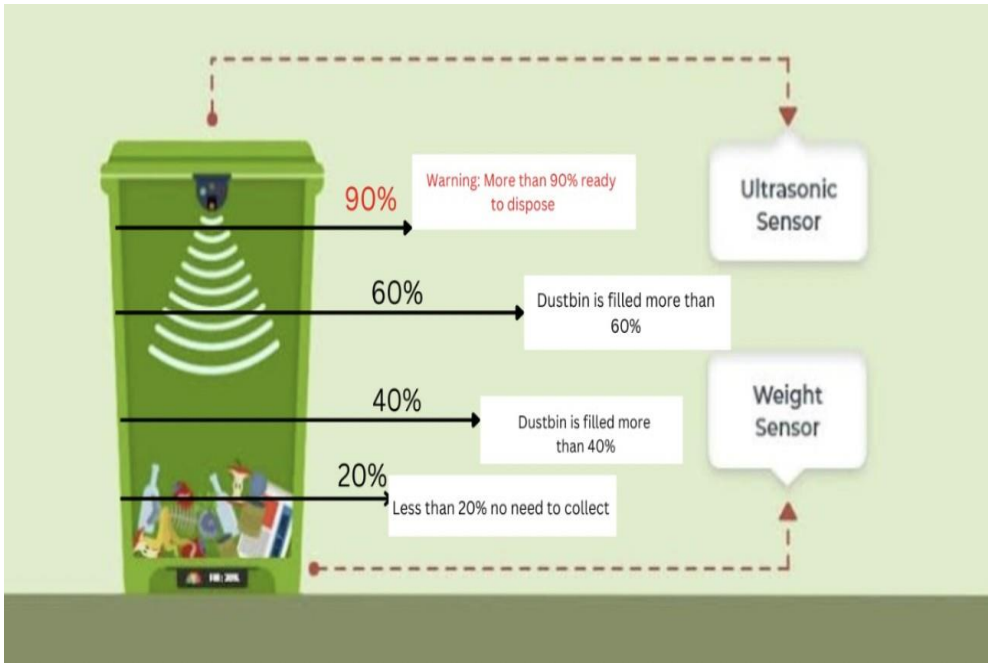
```
const database = firebase.database();

                                        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.getElem
        entById("map"), mapProp);


                var marker = new
        google.maps.Marker({ position:
        latlong });

                marker.setMap(map);
```

```
                    });
                }, function
(error) {

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

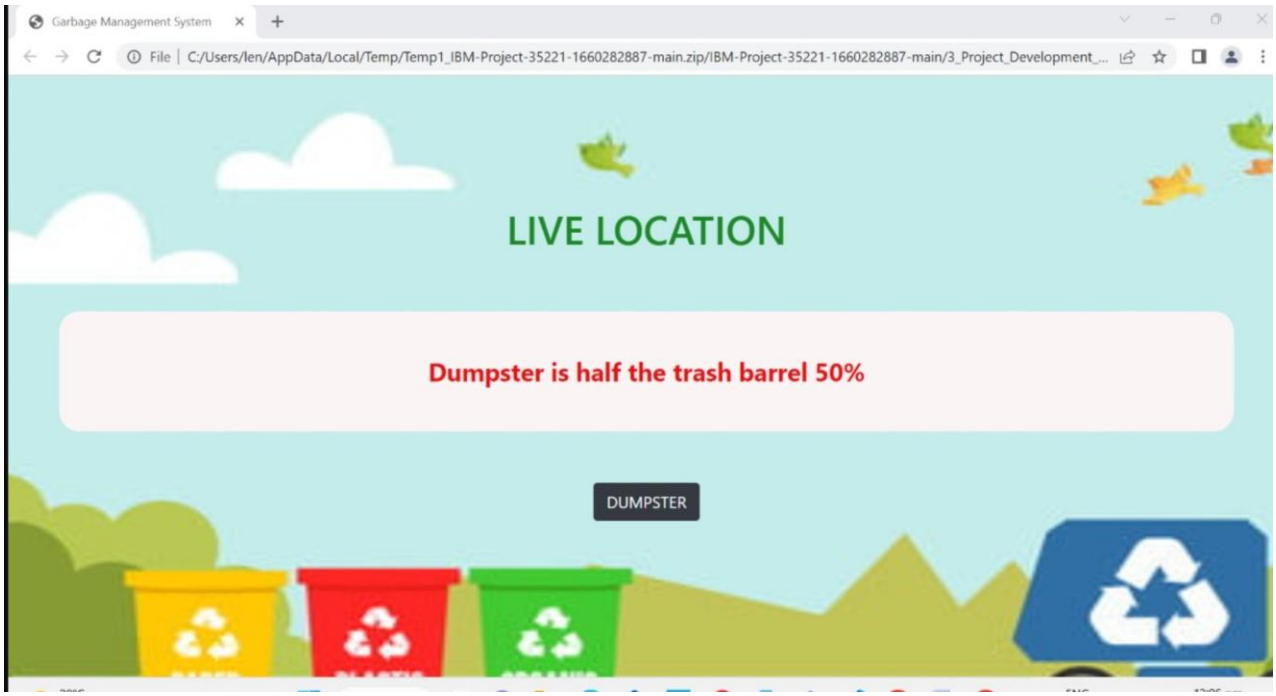
**DATABASE CODES**

```
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.firebaseapp.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"
```

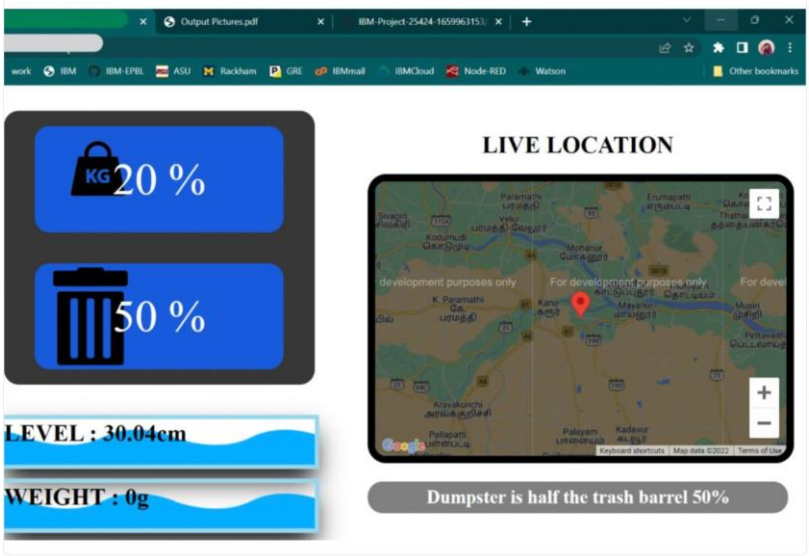
```
        }
    }

    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
```

**OUTLOOK**




# 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.