SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES

NALAIYA THIRAN PROJECT BASED LEARNING

SUBMITTED BY

Team ID: PNT2022TMID30432

S.DEEPALAKSHMI	**611419106020**
M. NIVETHA	**611419106043**
E. ISWARYA	**611419106302**
A.BRINDHA	**611419106015**

in partial fulfilment for the award of the degree

of

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MAHENDRA ENGINEERING COLLEGE FOR WOMEN

KUMARAMANGALAM ,205,NAMAKKAL MAIN ROAD ,THIRUCHENGODE, TAMILNADU.

1. INTRODUCTION

1.1 Project Overview:

The solid waste is increasing in urban and rural areas as the population is increasing and waste management has become a global concern. In implementing the smart cities the great challenge is how to manage waste with low cost and high performance. Waste has a negative impact on the quality of society which smart cities aim to improve. The process of collecting wastes, separating it, and transporting the containers daily and quickly to avoid any prospect of a spread of diseases is a complex process. The Internet and its applications have become an integral part of today's human lifestyle. It has become an essential tool in every aspect. Due to the tremendous demand and necessity, researchers went beyond connecting just computers into the web. With the help of IOT, garbage in the cities can be collected on monitoring the bin level, to prevent overflow of the garbage which negatively impacts the environment and to avoid or postpone garbage collection schedules in case of low garbage levels.

1.2 Purpose:

We amalgamate technology along with waste management in order to effectively create a safe and a hygienic environment. Smart waste management is about using technology and data to create a more efficient waste industry. Based on IoT (Internet of Things) technology, smart waste management aims to optimize resource allocation, reduce running costs, and increase the sustainability of waste services. This makes it possible to plan more efficient routes for the trash collectors who empty the bins, but also lowersthe chance of any bin being full for over a week. A good level of coordination exists between the garbage collectors and the information supplied via technology. This makes them well aware of the existing garbage level and instigate them whenever the bins reach the threshold level. They are sent with alert messages so that they can collect the garbage on time without littering the surrounding area. The fill patterns of specific containers can be identified by historical data and managed accordingly in the long term. Thus, smart waste management provides us with the most optimal way of managing the waste in an efficient manner using technology.

2.LITERATURE SURVEY:

2.1 Existing problem:

Waste management has become an alarming challenge in local towns and cities across the world. Often the local area bins are overflowing and the municipalities are not aware of it. This affects the residents of that particular area in numerous ways starting from bad odor to unhygienic and unsafe surroundings. Poor waste management - ranging from non-existing collection systems to ineffective disposal -causes air pollution, water and soil contamination. Open and unsanitary areas contribute to contain viruses and bacteria (i.e., salmonella and e-coli), which are a risk to human health.mination of drinking water and can cause infection and transmit diseases. Toxic components such as Persistent Organic Pollutants (POPs) pose particularly significant risks to human health and the environment as they accumulate through the food chain. Animals eating contaminated plants have higher doses of contaminants than if they were directly exposed. Precipitation or surface water seeping through waste will absorb hazardous components from landfills, agricultural areas, feedlots, etc. and carry them into surface and groundwater. Contaminated groundwater also poses a great health risk, as it is often used for drinking, bathing and recreation, as well as in agricultural and industrial activities. Landfills and waste transfer stations can attract various pests (insects, rodents, gulls, etc.) that look for food from waste. These pests can spread diseases through

2.2 References:

LITERATURE SURVEY: A number of researches and reviews have been done over the past few decades on the topic of 'SMART WASTE MANAGEMENT FOR METROPOLITAN CITIES'. A few notable of them are given below.

PAPER 1

AUTHORS: Mohammad Aazam, Marc St-Hilaire, Chung-Horng Lung, Ioannis Lambadaris

YEAR: 2016

DESCRIPTION:

Mohammad Aazam et al proposed Cloud SWAM, in which each bin is equipped with sensors to notify its waste level. Different bins for each category of waste, namely: organic, plastic/paper/bottle, and metal. In this way, each type of waste is already separated and through the status, it is known how much of waste is collected and of what type. The availability of data stored in the cloud can be useful for different entities and stakeholders in different ways. Analysis and planning can start from as soon as waste starts gathering and up to when recycling and import/export related matters are conducted. The system Cloud SWAM provides Timely waste collection. Timely and efficient way of collecting waste leads to better health, hygiene, and disposal. The system provides the shortest path to the location of waste bins. So the collectors can plan a better and fuel efficient route.

PAPER 2

AUTHORS: Dr. N. Sathish Kumar, B.Vijayalakshmi, R. Jenifer Prarthana, A .Shankar

DESCRIPTION:

Designed a smart dustbin in which the dustbin gets blocked when it reaches a threshold value. The ultrasonic sensor measures the waste volume .The microcontroller reads the data from the sensor and alerts the server. For the verification process RFID tag (ID card of the cleaner) interrupts the RFID reader, the ultrasonic sensor checks the status of the dustbin and sends it to the web server. An android application is used to view the alerts and status at the server end.

PAPER 3

AUTHORS: Belal Chowdhury and Morshed U. Chowdhury

DESCRIPTION:

Designed a five layer architecture for RFID and sensor based waste management systems. The layers are named as physical layer, middleware layer, process layer, data access layer and user interface layer. The physical layer consists of the actual RFID hardware components and it includes RFID waste tag, reader and antennas. Middleware layer is act as the interface between the RFID reader, load cell sensor and waste management service providers (i.e., waste collectors, and municipalities) IT system. The important element of RFID and load cell sensor systems is the middleware layer , which is viewed as the central nervous system from the waste management system perspective. This layer enables waste management service provider's (e.g., waste collector) a quick connectivity with RFID readers and load cell sensors and also the layer lowers the volume of information that waste management system applications need to process, by grouping and filtering raw RFID and load cell data from readers and sensors respectively. An application-level interface is provided by a middleware layer for managing RFID readers, and load cell sensors for processing large volumes of waste data for their applications.

PAPER 4

AUTHORS: Mohd Helmy Abd Wahab, Aeslina Abdul Kadir, Mohd Razali Tomari and Mohamad Hairol Jabbar

YEAR: 2014

DESCRIPTION:

Proposed a Smart Recycle Bin that caters for recycling glass, paper, aluminum can and plastic products. It automatically evaluates the value of the wastes thrown accordingly and provides a 3R card. The recycle system enables collection of points for performing a disposal activity into designated recycle bins. Such a system encourages recycling activities by allowing the points to be redeemable for products or services. The system records the data related to the disposal

activities, disposed material, identification of the user and points collected by the user. The user has to touch his card to the specified RFID reader at the recycle bin. Recycle bin doors open and the user puts waste one by one. A microcontroller processes information about his user ID and number of wastes and sends it to a database server. The database server calculates the user points and updates it. The system provides user login to an online system to check his total points.

PAPER 5

AUTHORS: Fachmin F olianto, Yong Sheng Low and Wai Leong Yeow

YEAR: 2015

DESCRIPTION:

Proposed Smart bin system has 3 –tier architecture.The ultrasonic sensor installed in every Smartbin senses bin fullness and reports readings and sensor statuses. The sensor reading is transmitted to the gateway nod which is installed in every sensor cluster. It forwards the information to the backend server. The analytics module in the back end server analyzes data collected by the bin sub system. The analytics module processes fullness readings, compares against predefined rules, and generates events upon exceeding threshold. The bin sub-system sends information to the workstation and it shows meaningful information to users through a graphical user interface.

PAPER 6

AUTHORS: Keerthana b et al.

YEAR: 2017

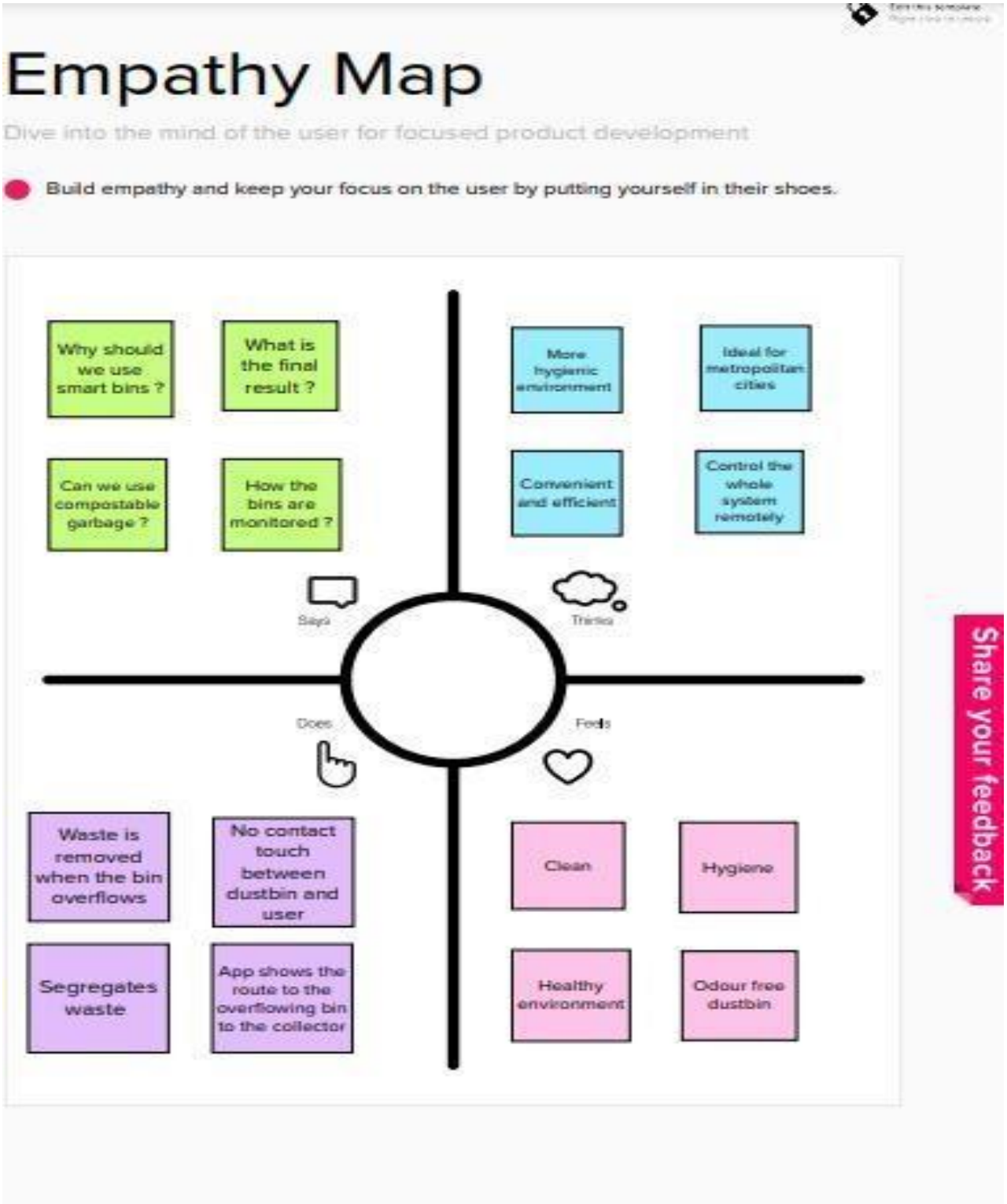
Designed an internet of bins for trash management in India. The smart TRASH management system using sensor, microcontroller and other modules ensures emptying of dustbins appropriately when the garbage level reaches its maximum. Two threshold limits are set for the bins and an alert message is sent to the van that collects the trash if the waste amount reaches
these thresholds. The system further allows the people to drop down the trash bags into the bins till it reaches the threshold limit .It waits for the acknowledgment from the van to clear off the bin and if the acknowledgment is not received it is sent again when it reaches the threshold limit and the bin gets locked. When the bin gets locked it displays the message “Overloaded”. Then the dustbin will be monitored for a specific time and when not cleared within a certain time limit, then a message will be sent to the higher authority who can take appropriate action.

2.3 Problem Statement Definition:

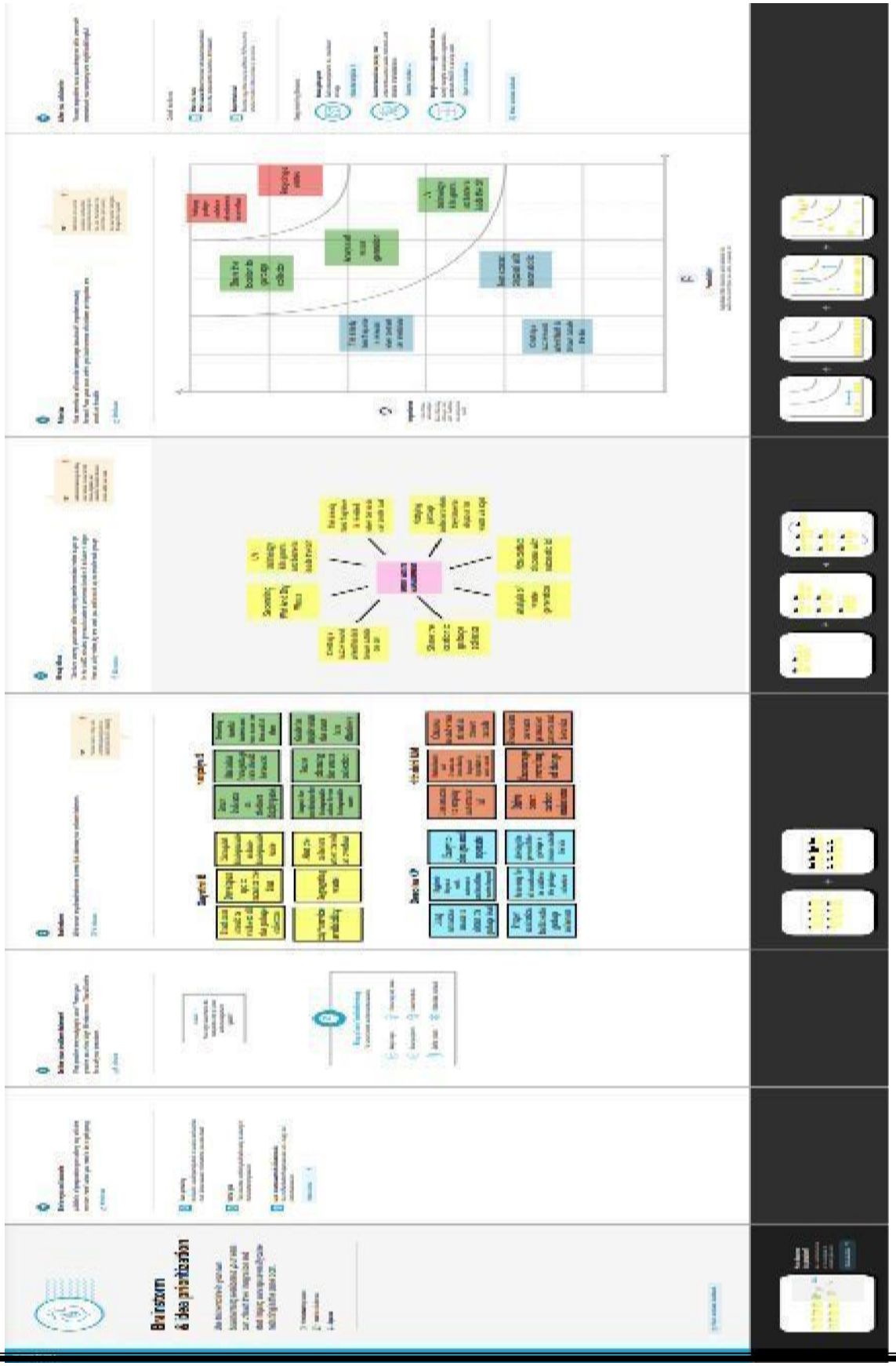
Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Municipal corporation authority	Get notified when the trash cans are full and be made aware of where the full cans are located.	Don't have the facilities at the moment	There is no tool available to determine the level of bins.	Frustrated
PS-2	Individual working for a private limited corporation	Get rid of the example of a surplus of waste	The trash cans are always filled	I occupy a metropolitan city which is invariably crowded	Worried

3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



3.3 Proposed Solution

S. No	Parameter	Description
1.	Problem Statement (Problem to be solved)	✓ The manual monitoring of wastes in trash cans is a laborious operation that requires additional time, money, and human labor ✓ Unsafe trash disposal is generatingproblems for people. ✓ Bad odor all around the place from uncollected trash or rubbish.
2.	Idea / Solution description	✓ This procedure uses a cloud connection and non-bio degradable wastes and an ultrasonic sensor to determine the level of a rubbish container ✓ By developing an app, the companyof a certain neighborhood inside alarge metropolis will be able to check the trash cans to see if they are full or not.
3.	Novelty / Uniqueness	✓ In contrast to the traditional ways for collecting trash cans, this strategy instructs us to utilize the transportation only when necessary. ✓ Keeping an eye on the trash canseasier and less labor-intensive for humans.
4.	Social Impact / Customer Satisfaction	✓ People can experience a clean atmosphere. ✓ Reduces the amount of laborrequired from humans for waste disposal. ✓ For a municipal corporation to monitor the cleanliness of different areas of the city, this proposal will be quite helpful.
5.	Business Model (Revenue Model)	✓ By cutting back on unneeded transportation costs to pointless locations, this lowers a significant amount of fuel costs for city businesses. ✓ This initiative intends to assist municipal corporation. ✓ Provide a sanitary atmosphere.

3.4 Problem Solution fit

PROBLEM-SOLUTION FIT

1. CUSTOMER SEGMENT(S)

FOR GOVERNMENT: Ensures timely garbage pickups and prevents overflowing of garbage bins.
FOR PUBLIC: Promotes cleanliness around the bins and prevents the spread of contagious diseases

6. CUSTOMER

1.Proper maintenance and checks should be done on a regular basis for long functioning of the bins.
2.Technicians can be appointed for these periodic checks

5. AVAILABLE SOLUTIONS

Moisture sensors can be used to detect and segregate dry and wet wastes accordingly.

2.JOBS TO BE DONE / PROBLEMS:

JOBS TO BE DONE:
Automatic garbage threshold detection.
Segregation of dry and wet wastes
PROBLEMS:
The sensors can wrongly assume the threshold level to be achieved when the garbage thrown in the bin touches the sensor.

9.PROBLEM ROOT CAUSE:

1. Sensors may not function properly at times that may pose a great problem.
2. Also it is challenging in segregating dry and wet waste.

7.BEHAVIOUR:

1. Identifies the threshold limit crossing of the garbage in the bins.(IR sensor)
2. Identifies and segregates dry and wet waste.(Moisture sensor

3.TRIGGERS:

When the threshold level is reached, an alert message will be sent to the local municipal body to collect the garbage.

4.EMOTIONS BEFORE / AFTER:
Before, garbage collection and segregation posed a great problem and threat to the government and common people. But after the implementation of our project, all these obstacles can be addressed accordingly

10. YOUR SOLUTION

1. Throwing of garbage directly over the sensor should be avoided to prevent the false threshold limit assumption.

8.CHANNELS of BEHAVIOUR

ONLINE: Easy relationship and interaction with the local municipal body.
OFFLINE: Implementing and maintenance of the project is easy.

\4.REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**Fitting IoT device in the trashcans.**	The IoT device need to be fixed in the dustbin with Water proof safety. The IoT device consists Ultrasonic sensor, IR sensor, Weight sensor. To send data to the cloud GPRS/GSM is used.
FR-2	**Bin monitoring**	All monitored bins and stands can be seen on the map, and you can visit them at any time 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, lastmeasurement, GPS location and collection schedule or pick recognition.
FR-3	**Predictions for bin fulness**	It is a 24×7 monitoring system is designed for monitoring the dumpster. If either of the containers is full then an alert message is sent from the dustbin to employees and the cloud. In turn, employees can clear the corresponding dumpster. The bin has Sensors that can recognize picks as well;so you can check when the bin was last collected. With real-time data and predictions, you can eliminate the overflowing bins and stop collecting half-empty ones.
FR-4	**Plan waste collection routes**	Based on current bin fill-levels and predictions of reaching full capacity, you are ready to respond andschedule waste collection. You can compare planned vs. executed routes to identify any inconsistencies.

4.2 Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	A smart solution has been proposed to make the waste by sorting more simple and accurate and improve the user experience, usability, and satisfaction. It aims to optimize ease of use while offering maximum functionality.
NFR-2	**Security**	Building and deploying IoT-based smart waste management in cities can be a complex,time consuming and resource-intensive process. Many municipal IT departments will not have the resources or in-house skills to support such a project internally.
NFR-3	**Reliability**	Smart waste management is also about creating better working conditions for waste collectors and drivers. Operates in a defined environment without failure resulting in less manpower, emissions, fuel use and traffic congestion.
NFR-4	**Performance**	The system will provide accurate reports, thus increasing the efficiency of the system. The real-time monitoring of the garbage level with the help of sensors and wireless communication will reduce the total number of trips required of Garbage collecting truck. This will reduce the total expenditure associated with the garbage collection.
NFR-5	**Availability**	Another purpose of this project is to make the proposed waste management system as cheap as possible. By this we empower cities,businesses, and countries to manage waste smarter.
NFR-6	**Scalability**	Using smart waste bins reduce the number of bins inside town , cities coz we able to monitor the garbage 24/7 more cost effect and scalability when we moves to smarter.

5.PROJECT DESIGN

5.1 Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically.

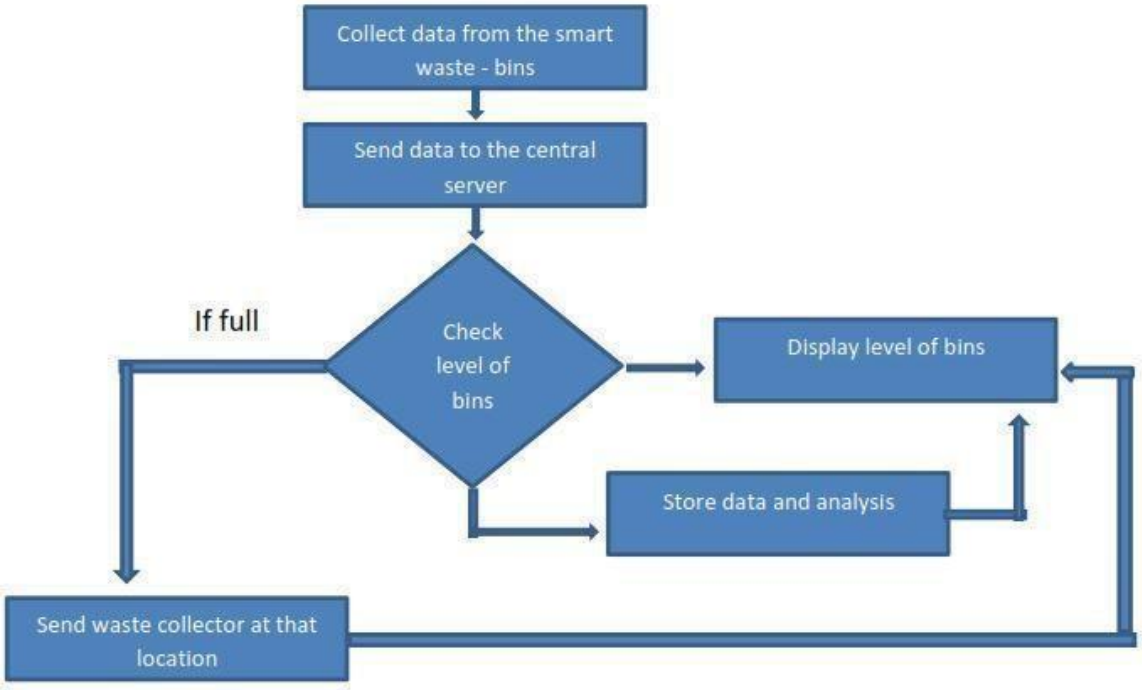
It shows how data enters and leaves the system, what changes the information, and where data is stored.

A smart waste management platform uses analytic to translate the data gather in your

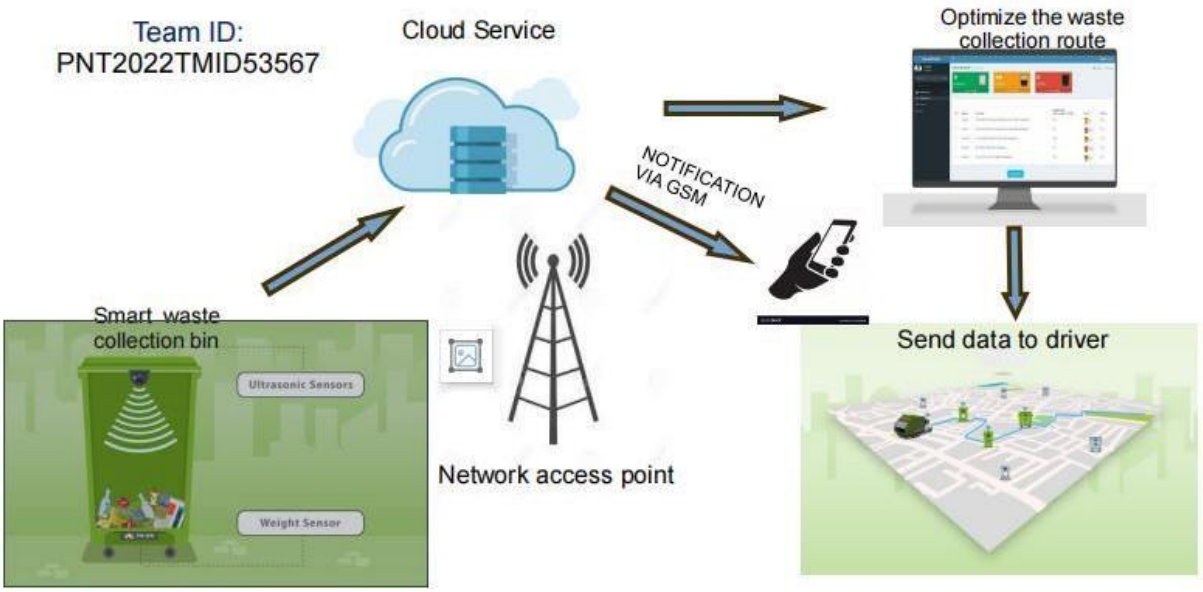
bins into actionable insights to help you improve your waste services.
You can receive data on metric such as:

- The first test conducted is the situation where the garbage bin is empty or its garbage level is very low
- Then, the bin is filled with more garbage until its level has surpassed the first threshold value, which is set to 80% then the first warning SMS is being sent, as depicted
- The first notification SMS sent by the system, once the waste reaches the level of 85% full
- The second notification SMS sent by the system, indicating that bin is at least 95% full and the garbage needs to be collected immediately
- Locations prone to overflow
- The number of bins needed to avoid overflowing waste
- The number of collection services that could be saved
- The amount of fuel that could be saved
- The driving distance that could be saved

Data flow diagram:



5.2 Solution & Technical Architecture



SOLUTION ARCHITECTURE

TECHNOLOGY ARCHITECTURE

Design:

• 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.

Software and system required:

• Python IDLE

• 4GB processor and OS-Windows/Linux/MAC

Table-1: Components & Technologies:

S.no	Component	Description	Technology
1.	User Interface	Mobile Application	HTML, CSS, JavaScript.
2.	Application Logic	Logic for a process in the application	Java
3.	Database	Data Type, Configurations etc.	MySQL
4.	Cloud Database	Database Service on Cloud	IBM Cloud
5.	File Storage	File storage requirements	Local File system and IBM cloud
6.	Infrastructure (Server / Cloud)	Application Deployment on Cloud Local Server Configuration	Local and Cloud Foundry

Table-2: Application Characteristic

S.no	Characteristics	Description	Technology
1.	Open-Source Frameworks	GitHub	Internet hosting service
2.	Security Implementations	Application security: Veracode Firewall: Cisco	Network automation
3.	Scalable Architecture	It provides the room for expansion more database of smart bins added additionally can be updated.	Cloud storage
4.	Availability	As the system control is connected to web server it is available 24*7 and can be accessed whenever needed.	Server
5.	Performance	Performance is high it uses 5mb caches	Wireless Sensor Network

6.PROJECT PLANNING AND SCHEDULING

6.1. Sprint Planning and Estimation

TITLE	DESCRIPTION	RELEASE DATE
Literature Survey and Information Gathering	Surveying on the topic of selected project & gathering information by referring the, technical papers ,research publications etc.	23 SEPTEMBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user pains & gains on particular issue.	25 SEPTEMBER 2022
Ideation	Jot down the ideas by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	27 SEPTEMBER 2022
Proposed Solution	Prepare your proposed solution of the project 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.	28 SEPTEMBER 2022
Solution Architecture	Prepare solution architecture document.	30 SEPTEMBER 2022
Customer Journey Map	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit)	17 OCTOBER 2022
Functional Requirement	Prepare the functional requirement for the project.	17 OCTOBER 2022
Data Flow Diagrams	Draw the data flow diagrams to understand the flow of execution of the project.	18 OCTOBER 2022
Technology Architecture	Prepare the technology architecture diagram.	18 OCTOBER 2022
Milestone & Activity List	Prepare the milestones & activity list of the project.	29 OCTOBER 2022

Delivery of Sprints	Submit the coding development of the project and submit in sprints. Sprint -1 Sprint -2 Sprint -3 Sprint -4	 30 October 2022 5 November 2022 11 November 2022 17 November 2022

6.2. Sprint Delivery Schedule

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	Objective	USN-1	The smart bin system will alert the nearby garbage collectors when the bin overflows.	6	High	Gayathri B Deepika K P Haripriya S Hithaishi U M
Sprint-1	Registration	USN-2	The user(garbage collectors) can register for the application using the respective credentials provided to them.	4	Medium	Gayathri B Deepika K P Haripriya S Hithaishi U M
Sprint-1	Designing	USN-3	Designing a circuit with sensors and arduino interface	6	High	Gayathri B Deepika K P Haripriya S Hithaishi U M
Sprint-1	Cloud	USN-4	As an administrator, register in IBM cloud	4	Medium	Gayathri B Deepika K P Haripriya S Hithaishi U M
Sprint-2	Code development	USN-5	Develop a code to send a message when the bin overflows using ultrasonic sensor	10	High	Gayathri B Deepika K P Haripriya S Hithaishi U M
Sprint-2	Cloud Server	USN-6	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	Gayathri B Deepika K P Haripriya S Hithaishi U M
Sprint-3	Sensor	USN-7	Detect the level of garbage using sensor and store it in the server for specific interval of time.	10	High	Gayathri B Deepika K P Haripriya S Hithaishi U M
Sprint-3	Cloud	USN-8	Authority should allocate which garbage collector should collect the waste at particular area	10	High	Gayathri B Deepika K P Haripriya S Hithaishi U M
Sprint-4	Communicating Medium	USN - 9	Garbage collector receives the message from the authority and goes to collect the garbage	10	High	Gayathri B Deepika K P Haripriya S Hithaishi U M
Sprint-4	Communicating Medium	USN-10	Once the garbage is collected the particular person should intimate the completion of the task	5	Medium	Gayathri B Deepika K P Haripriya S Hithaishi U M
Sprint -4	Cloud database	USN-11	Update the database after task completion	5	Medium	Gayathri B Deepika K P Haripriya S Hithaishi U M

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	30 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

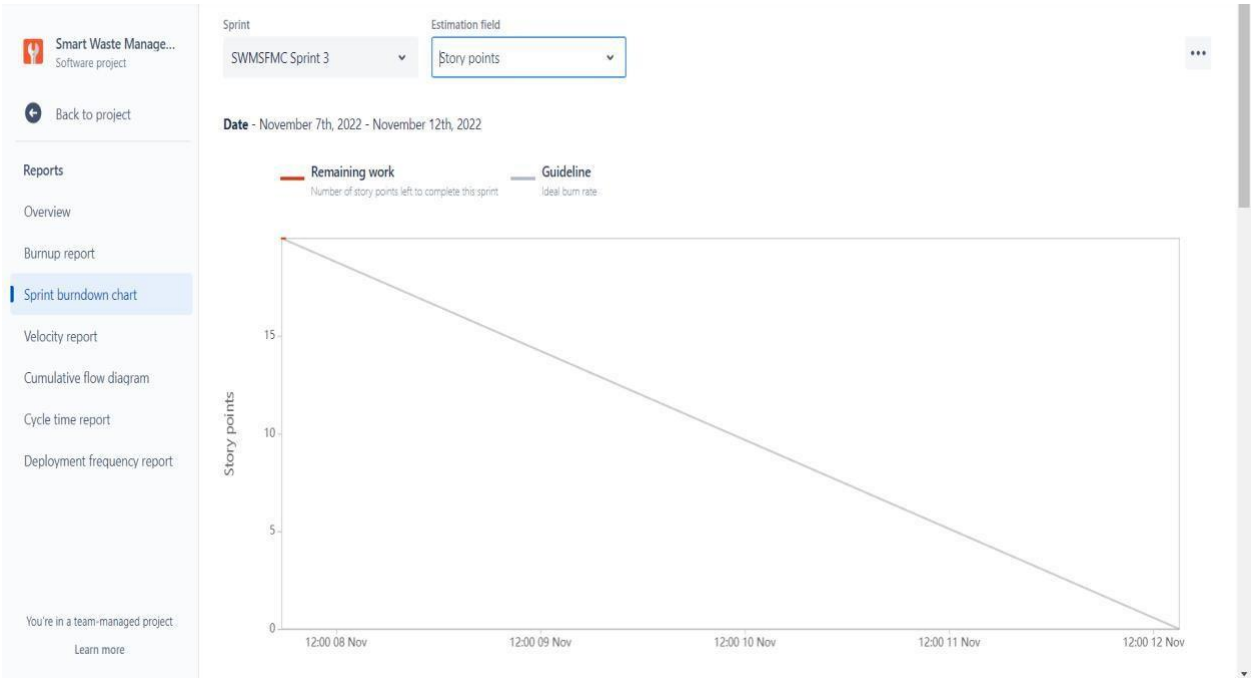
Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

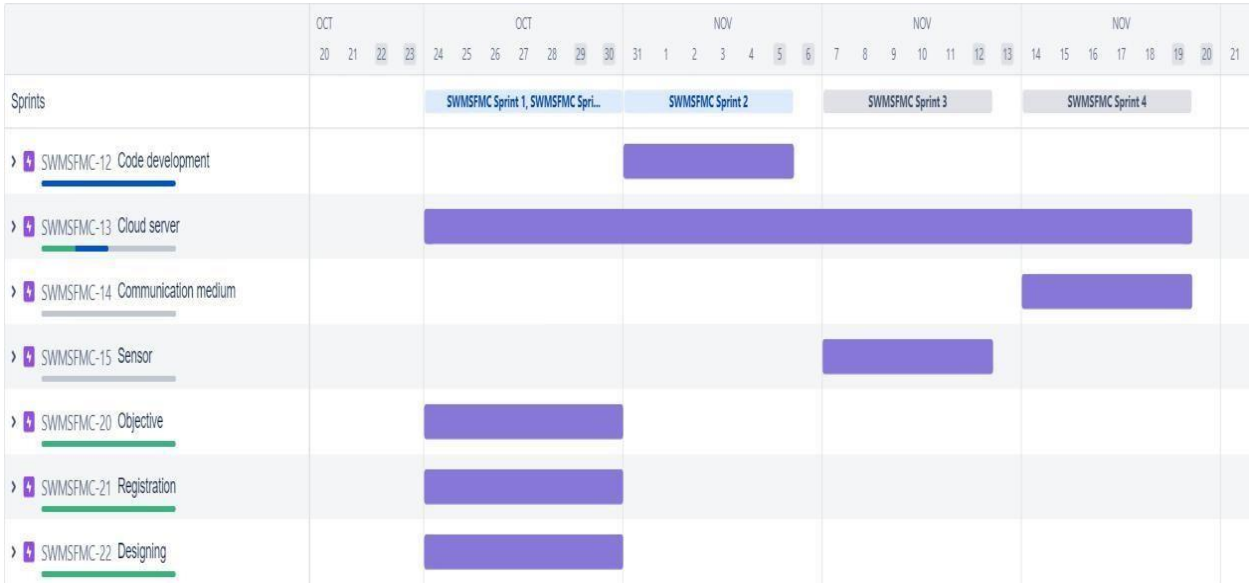
6.3 Reports from JIRA

BURNOUT CHART

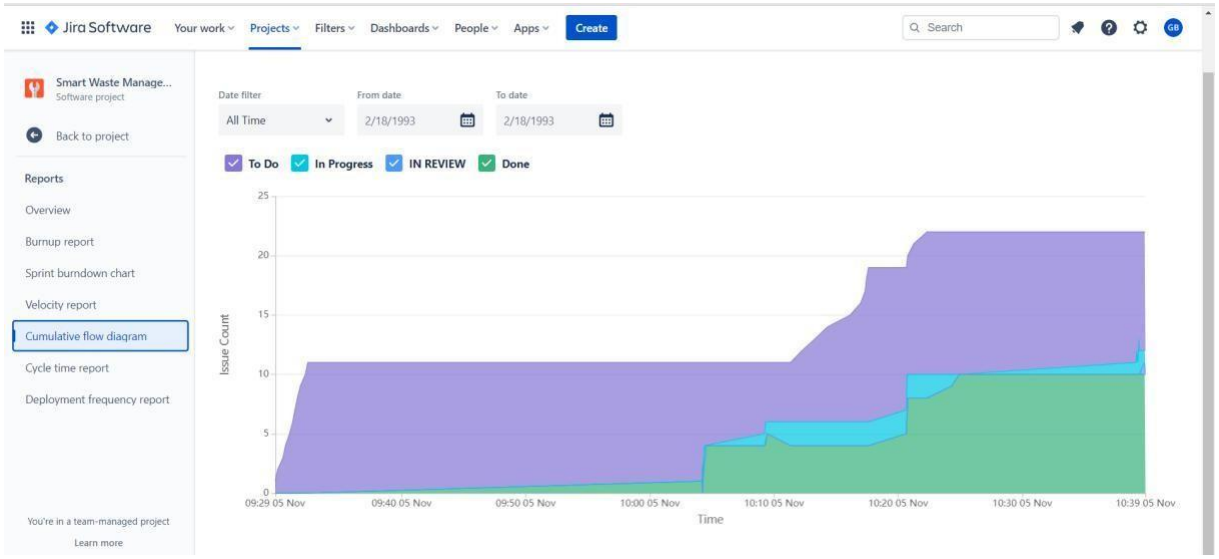


JIRA SOFTWARE SCREENSHOTS

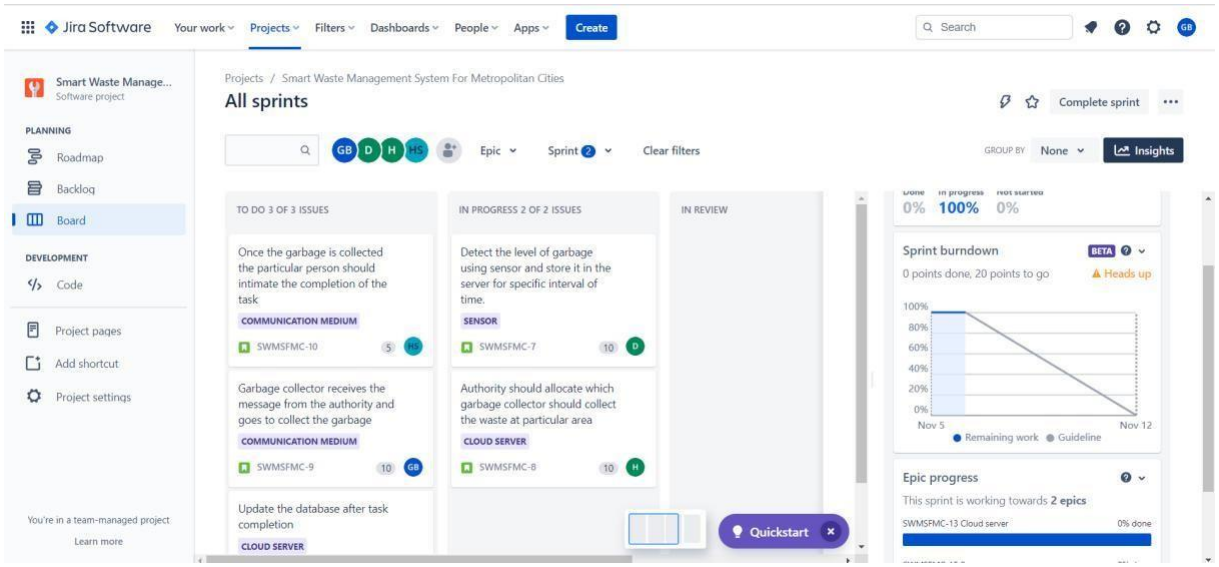
ROADMAP



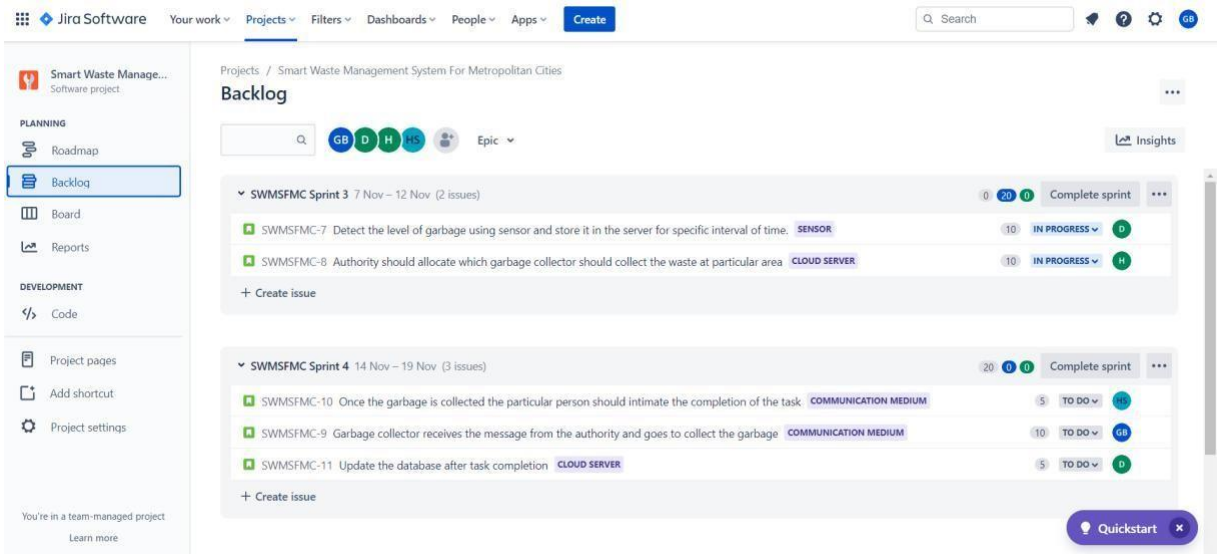
CUMULATIVE FLOW DIAGRAM



BOARDS

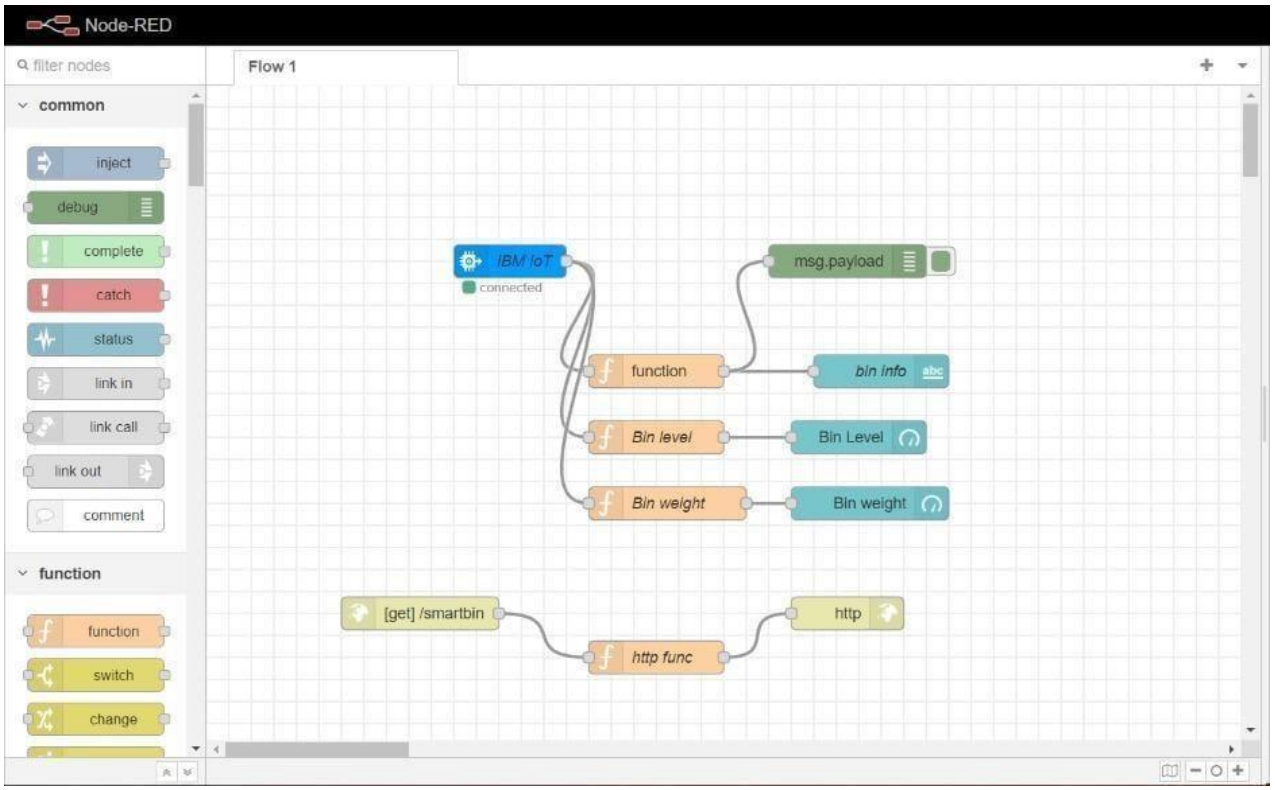


BACKLOG

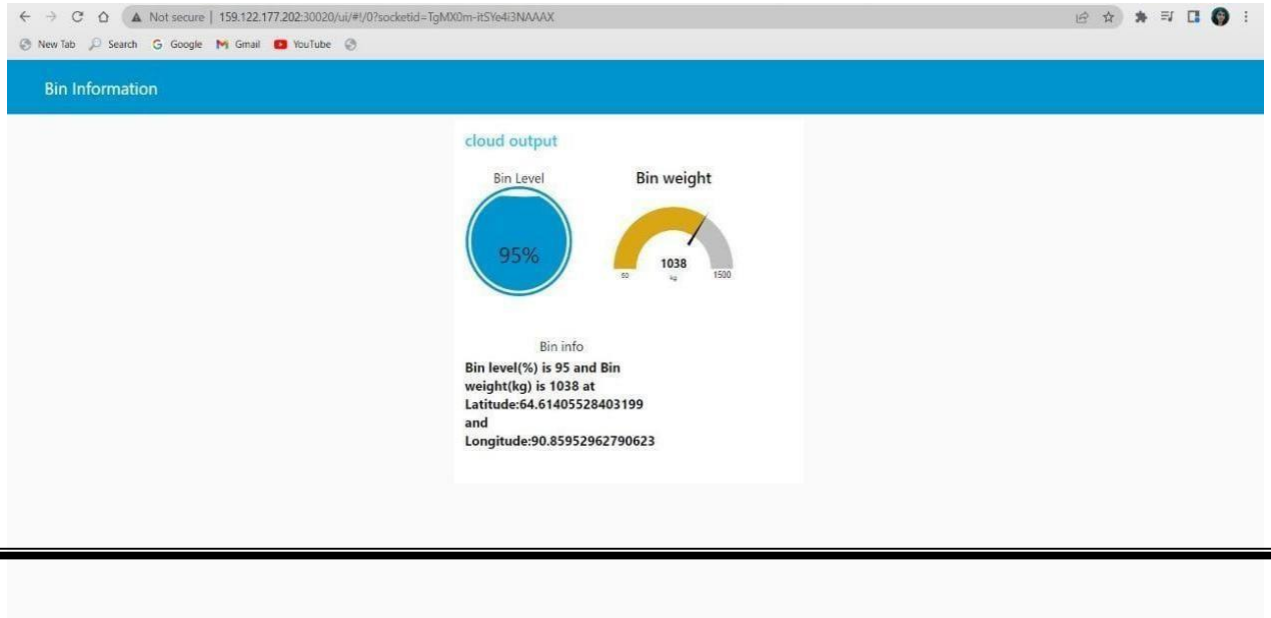


7. CODING & SOLUTIONING (Explain the features added in the project along with code)

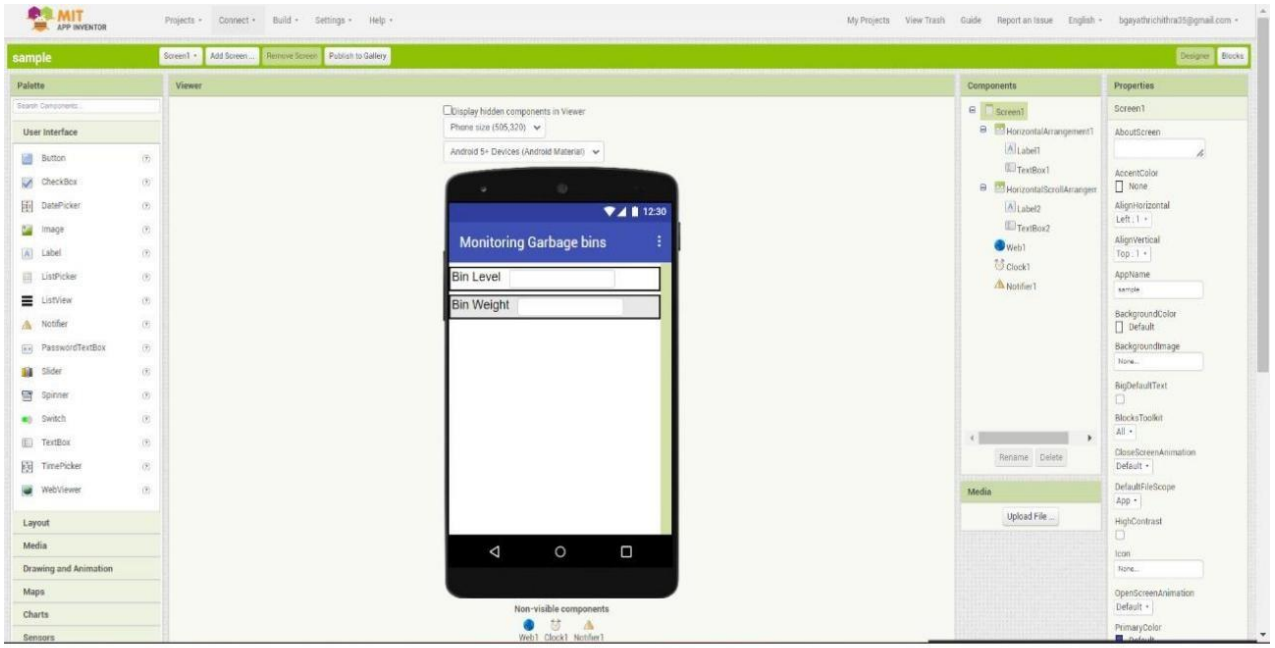
7.1 Feature 1 - Node Red

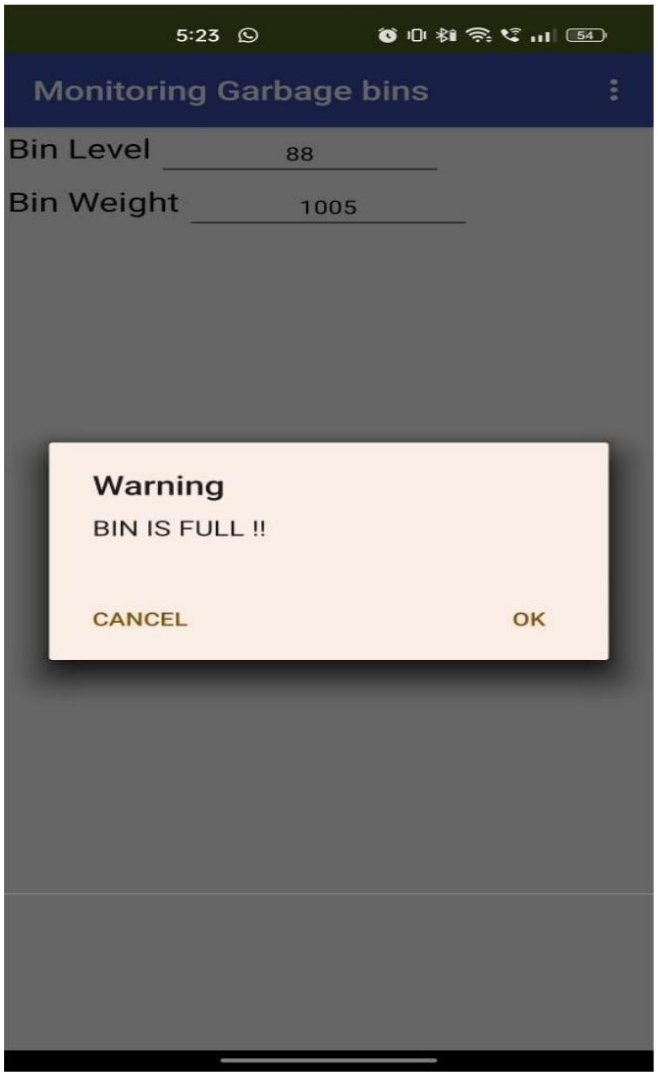


7.2 Feature 2- Web UI Displaying bin details

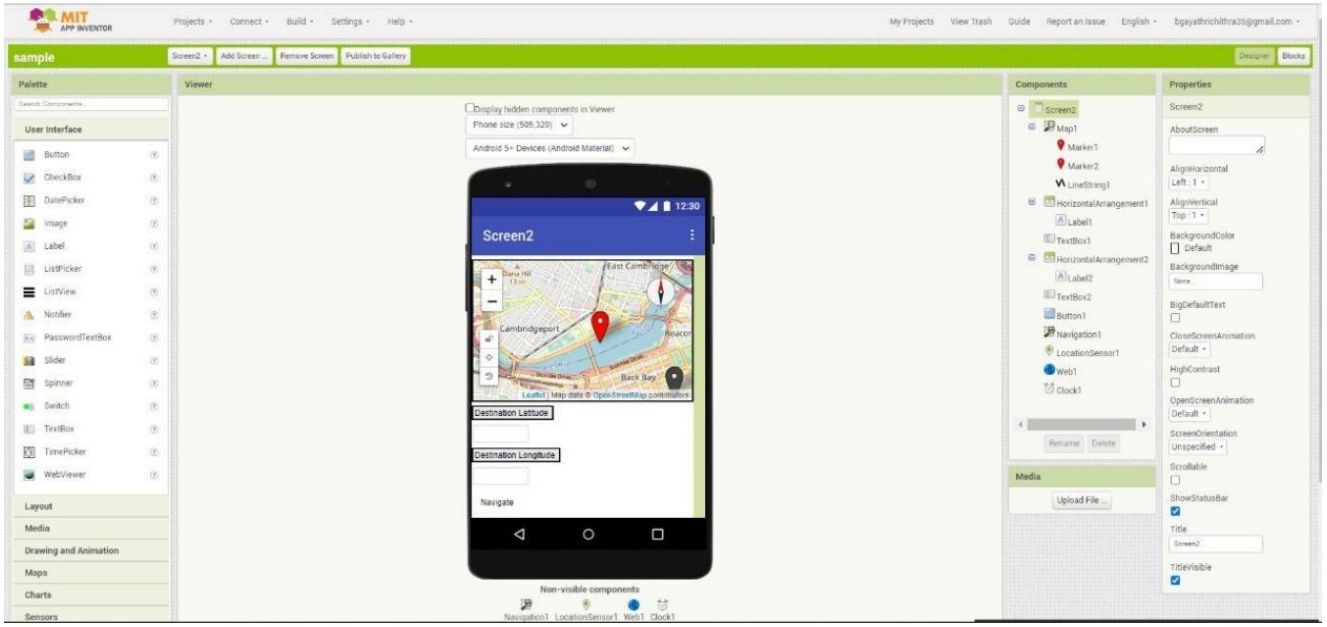


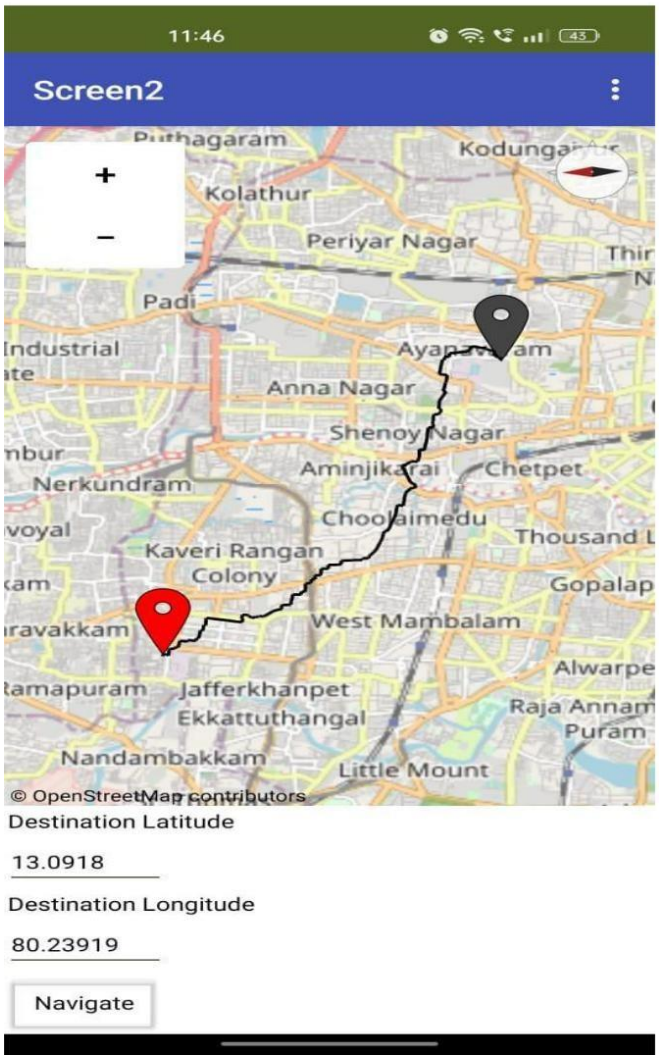
7.3 Feature 3-Live update on collected Data





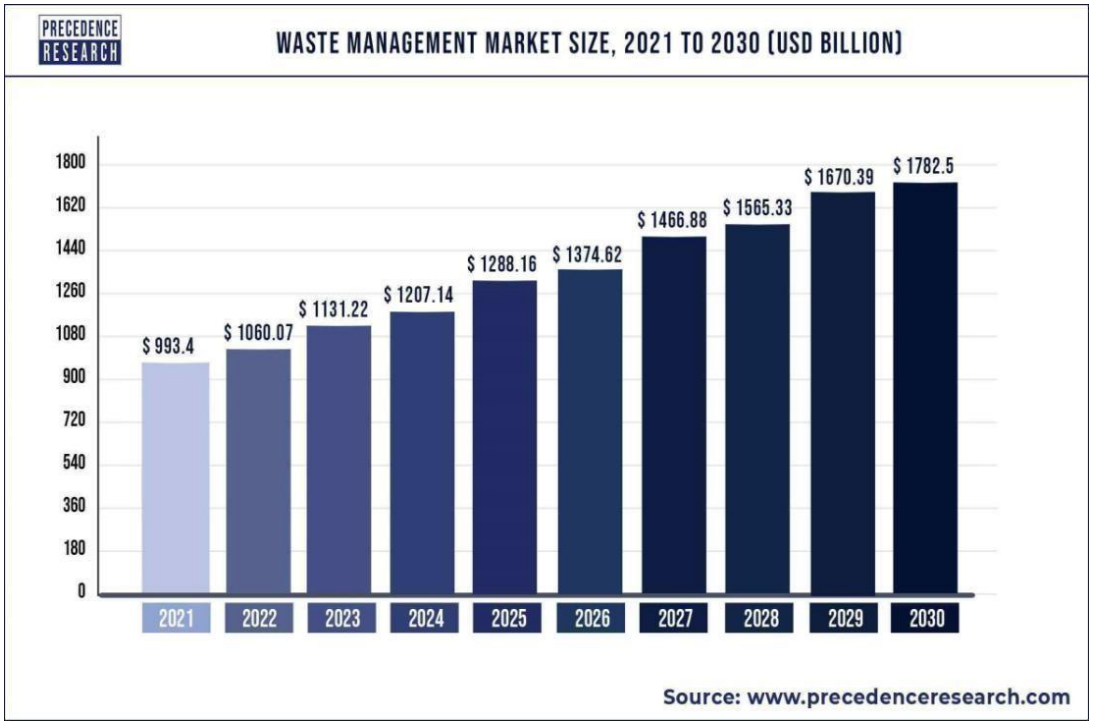
7.4 Feature 4 - Location Tracker





8.RESULTS

8.1 Performance Metrics



9. ADVANTAGES &

DISADVANTAGES ADVANTAGES:

1.Reduction in Collection Cost

2.No Missed Pickups

3.Reduced Overflows

4.Waste Generation Analysis

5.CO2 Emission Reduction

DISADVANTAGES:

System requires a greater number of waste bins for separate waste collection as per population in the city.

This results in high initial cost due to expensive smart dustbins compare to other methods.

Sensor nodes used in the dustbins have limited memory size.

10. CONCLUSION

A Smart Waste Management system that is more effective than the one in use now is achievable by using sensors to monitor the filling of bins. Our conception of a "smart waste management system" focuses on monitoring waste management, offering intelligent technology for waste systems, eliminating human intervention, minimizing human time and effort, and producing a healthy and trash-free environment. The suggested approach can be implemented in smart cities where residents have busy schedules that provide little time for garbage management. If desired, the bins might be put into place in a metropolis where a sizable container would be able to hold enough solid trash for a single unit. The price might be high.

11. FUTURE SCOPE

There are several future works and improvements for the proposed system, including the following:

1.Change the system of user authentication and atomic lock of bins, which would aid in protecting the bin from damage or theft.

2.The concept of green points would encourage the involvement of residents or end users, making the idea successful and aiding in the achievement of collaborative waste management efforts, thus fulfilling the idea of Swachh Bharath.

3.Having case study or data analytics on the type and times waste is collected on different days or seasons, making bin filling predictable and removing the reliance on electronic components, and fixing the coordinates.

4.Improving the Server's and Android's graphical interfaces

12. APPENDIX

SOURCE CODE

```python
#Project: Smart Waste Management System for Metropolitan cities
#Team ID: PNT2022TMID53567

#Installing necessary libraries
import wiotp.sdk.device
import time
import random
import requests
import math

#Configuration details for connecting python script to IBM Watson IOT Platform
myConfig = {
"identity": {
"orgId": "mldk59",
"typeId": "pythoncode",
"deviceId":"252525"
},
"auth": {
"token": "QZqODYo6U*Q6b+IpuC"
} }

def myCommandCallback(cmd):
```

```python
def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']

#Connecting the client to ibm watson iot platform
client = wiotp.sdk.device.DeviceClient(config=myConfig,logHandlers=None)
client.connect()


#Generate Random values for latitude, longitude in a circular distribution from the current location and
#alert the garbage collector to go to the particular location where the bin level and bin weight exceeds the thresho

while True:

    res = requests.get('https://ipinfo.io/')
    data = res.json()
    loc = data['loc'].split(',')
    theta = random.uniform(0,2*math.pi)
    area = (0.05**2)*math.pi
    radius = math.sqrt(random.uniform(0,area/math.pi))
    latitude,longitude = [float(loc[0])+radius*math.cos(theta), float(loc[1])+radius*math.sin(theta)]
```

```python
    binlevel=random.randint(10,100)
    binweight = random.randint(50,1500)

    if binweight>=1000 and binlevel>80:
        myData={'latitude':latitude, 'longitude':longitude,'binlevel':binlevel,
                'binweight':binweight}
        client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
        onPublish=None)
        ##print("Published data Successfully: %s", myData)
        print("BIN IS FULL..TIME TO EMPTY IT!!!!\n",myData)
        client.commandCallback = myCommandCallback
        time.sleep(2)
        #break

    else :
        print("BIN IS IN NORMAL LEVEL...")
        time.sleep(2)

#Disconnect the client connection
client.disconnect()
```