

TAGORE ENGINEERING COLLEGE

SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES

PNT2022TMID38381- TEAM LEADER:KEERTHANA. R

TEAM MEMBER 1:KALAIARASI. R

TEAM MEMBER 2:MEGANA. A

TEAM MEMBER 3:VIGNESH. S

TEAM MEMBER 4:MOHANAPRIYA. T

REPORT

PROJECT REPORT FORMAT

1. INTRODUCTION

1. Project Overview
2. Purpose

2. LITERATURE SURVEY

1. Existing problem
2. References
3. Problem Statement Definition

3. IDEATION & PROPOSED SOLUTION

1. Empathy Map Canvas
2. Ideation & Brainstorming
3. Proposed Solution
4. Problem Solution fit

4. REQUIREMENT ANALYSIS

1. Functional requirement
2. Non-Functional requirements

5. PROJECT DESIGN

1. Data Flow Diagrams
2. Solution & Technical Architecture
3. User Stories

6. PROJECT PLANNING & SCHEDULING

1. Sprint Planning & Estimation
2. Sprint Delivery Schedule
3. Reports from JIRA

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

1. Feature 1
2. Feature 2
3. Database Schema (if Applicable)

8. TESTING

1. Test Cases
2. User Acceptance Testing

9. RESULTS

1. Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

13. APPENDIX

GitHub & Project Demo Link

Project Report

Team ID	PNT2022TMID38381
Project Name	Project - Smart Waste Management System For Metropolitan Cities

1. INTRODUCTION

1.1 Project Overview:

With the increasing population and industrialization of nations throughout the globe, waste has become a great concern for all of us. Over years, researchers figured that only waste management is not enough for its proper treatment and disposal techniques to preserve our environment and keeping it clean in this era of globalization. With the help of technology researchers have, introduced IoT based Smart Waste Management solutions and initiatives that ensures reduced amount of time and energy required to provide waste management services and reduce the

amount of waste generated. Unfortunately, developing countries are not being able to implement those existing solutions due to many factors like socio-economic environment. Therefore, in this research we have concentrated our thought on developing a smart IoT based waste management system for developing countries like INDIA that will ensure proper disposal, collection, transportation and recycling of household waste with the minimum amount of resources being available

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 lowers the 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. In addition to hardware solutions, mobile applications are used to overcome the challenges in the regular waste management system, such as keeping track of the drivers while they are operating on the field. Thus, smart waste management provides us with

the most optimal way of managing the waste in an efficient manner using technology.

PNT2022TMID38381

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 odour 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 contamination 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 viruses and bacteria (i.e., salmonella and e coli), which are a risk to human health.

2.2 References:

PAPER 1:

TITLE: IoT Based Waste Management for Smart City

AUTHOR NAME: Parkash Tambare, Prabu Venkatachalam

PUBLICATION YEAR: 2016

DESCRIPTION:

In the current situation, we frequently observe that the trash cans or dust cans that are located in public spaces in cities are overflowing due to an increase in the amount of waste produced each day. We are planning to construct "IoT Based Waste Management for Smart Cities" to prevent this from happening because it makes living conditions for people unsanitary and causes unpleasant odours in the surrounding area. There are numerous trash cans scattered throughout the city or on the campus that are part of the proposed system. Each trash can is equipped with a low-cost embedded device that tracks the level of the trash cans and an individual ID that will enable it to be tracked and identified.

PNT2022TMID38381

PAPER 2:

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

PUBLICATION YEAR: 2016

DESCRIPTION:

Each bin in the Cloud SWAM system that Mohammad Aazam et al suggested has sensors that can detect the amount of waste inside. There are separate bins for organic, plastic/paper/bottle/glass, and metal waste. This way, each form of waste is already divided, and it is known how much and what kind of waste is collected

thanks to the status. Different entities and stakeholders may benefit from the accessibility of cloud-stored data in different ways. Analysis and planning can begin as soon as garbage is collected and continue through recycling and import/export-related activities. Timely garbage collection is provided via the Cloud SWAM system. A timely and effective method of waste collection improves health, hygiene, and disposal.

PAPER 3:

TITLE: Arduino Microcontroller Based Smart Dustbins for Smart Cities

AUTHOR NAME: K. Suresh, S. Bhuvanesh and B. Krishna Devan

PUBLICATION YEAR: 2019

DESCRIPTION:

In this paper, a technique for cleaning up our surroundings and environment is described. The Indian government just began work on a smart city initiative, and in order for these towns to be smarter than they already are, the garbage collection and disposal system must be improved upon. Self-Monitoring Automated Route Trash (SMART) dustbins are intended for use in smart buildings such as colleges, hospitals, and bus stops, among other places. In this study, we have employed the PIR and Ultrasonic sensors to detect human presence, the Servomotor to open the dustbin lid, and the Ultrasonic sensor to detect the level of rubbish. Signals between two trash cans are transmitted using a communication module, and the GSM module sends the message to the operator.

PAPER 4:

AUTHOR NAME: Mohd Helmy Abd Wahab, Aeslina Abdul Kadir, Mohd Razali

Tomari and Mohamad Hairol Jabbar

PUBLICATION YEAR: 2014

DESCRIPTION:

Proposed a smart recycle bin that can handle the recycling of plastic, glass, paper, and aluminium cans. It generates a 3R card after automatically determining the value of the trash thrown away. The recycle system makes it possible to accumulate points for placing waste into designated recycle bins. By allowing the points to be redeemed for goods or services, such a system promotes recycling activities. The system keeps track of information on disposal procedures, materials disposed of, user identification, and points accrued by the user.

PNT2022TMID38381

PAPER 5:

TITLE: Waste Management Initiatives in India For Human Wellbeing

AUTHOR NAME: Dr. Raveesh Agarwal, Mona Chaudhary and Jayveer Singh

PUBLICATION YEAR: 2015

DESCRIPTION:

The objective of this paper is to examine the present methods used in India for the welfare of its people in different waste management efforts. The other goal is to offer advice on how to make Indian municipalities' trash disposal procedures better. On secondary research, this essay is founded. The system is improved by looking at the reports that have already been written about waste management and the suggestions made for improvement by planners, NGOs, consultants, government accountability organisations, and important business leaders. It provides in-depth

understanding of the various waste management programmes in India and identifies areas where waste management might be improved for societal benefit. The essay makes an effort to comprehend the crucial part that our nation's official waste management sector plays in the waste management process.

2.3 Problem Statement Definition:

Who does the problem affect?	Public affects because of an unhygienic environment and they may lead to the cause of health problems.
What are the boundaries of the problem?	<ul style="list-style-type: none">● Lack of Waste Collecting Points.● Irregularity of Waste Collection.● Inadequate Waste Collection Vehicles.● Inadequate Access to Waste Bins.● Alternatives to Final Waste Disposal (Burning and Illegal Dumping) .● Improper Waste Separation Facilities

<p>What is the issue?</p>	<p>The major problems affecting solid waste management are unscientific treatment, improper collection of waste, and ethical problems. This in turn leads to hazards like environmental degradation, water pollution, soil pollution, and air pollution.</p>
<p>When does the issue occur?</p>	<p>By the 1700s, refuse had become a major problem: waste was still dumped in the streets and open burning of garbage was a common practice.</p>

<p>Where does the issue occur?</p>	<ul style="list-style-type: none"> ● Commercial establishments. ● Residential houses. ● Debris from construction and demolition. <ul style="list-style-type: none"> ● Debris from roads (such as asphalt and scrap metal) ● Scrap from vehicles. ● Agriculture.
<p>Why is it important that we fix the problem?</p>	<p>When rubbish isn't disposed of properly, it can leak harmful pollutants into the air, soil and water. This can cause environmental damage as well as impacting people's health negatively - proper waste disposal</p>

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

Empathy Map Canvas

Gain insight and understanding on solving customer problems.

TEAM MEMBERS
KEERTHANA R.
KALAIARASI R.
VISHESH S.
MEHANA A.
MOHANA PRIYA T

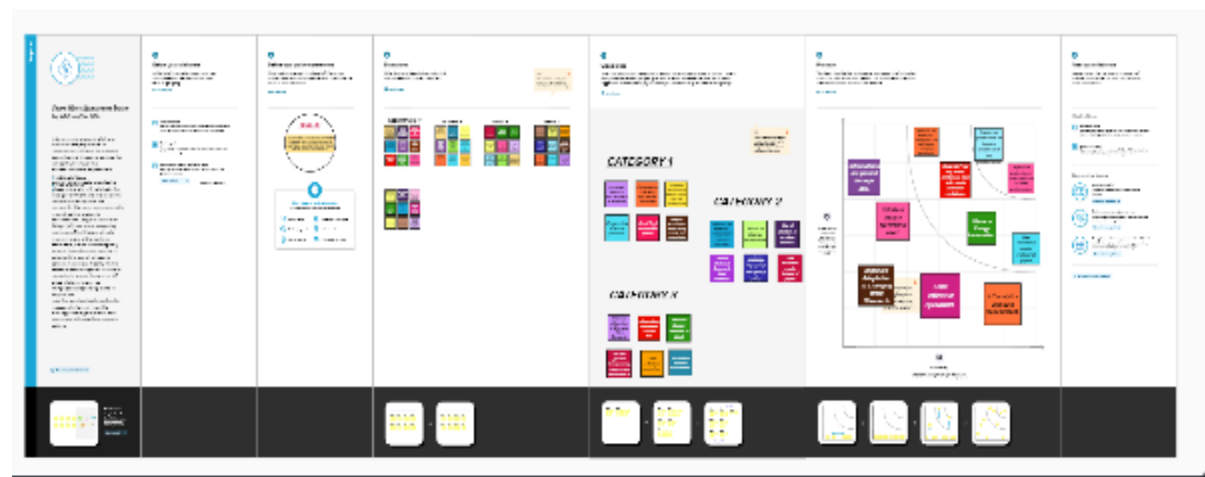
SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES

Build empathy and keep your focus on the user by putting yourself in their shoes.



Share your feedback

3.2 Ideation & Brainstorming



3.3 Proposed Solution

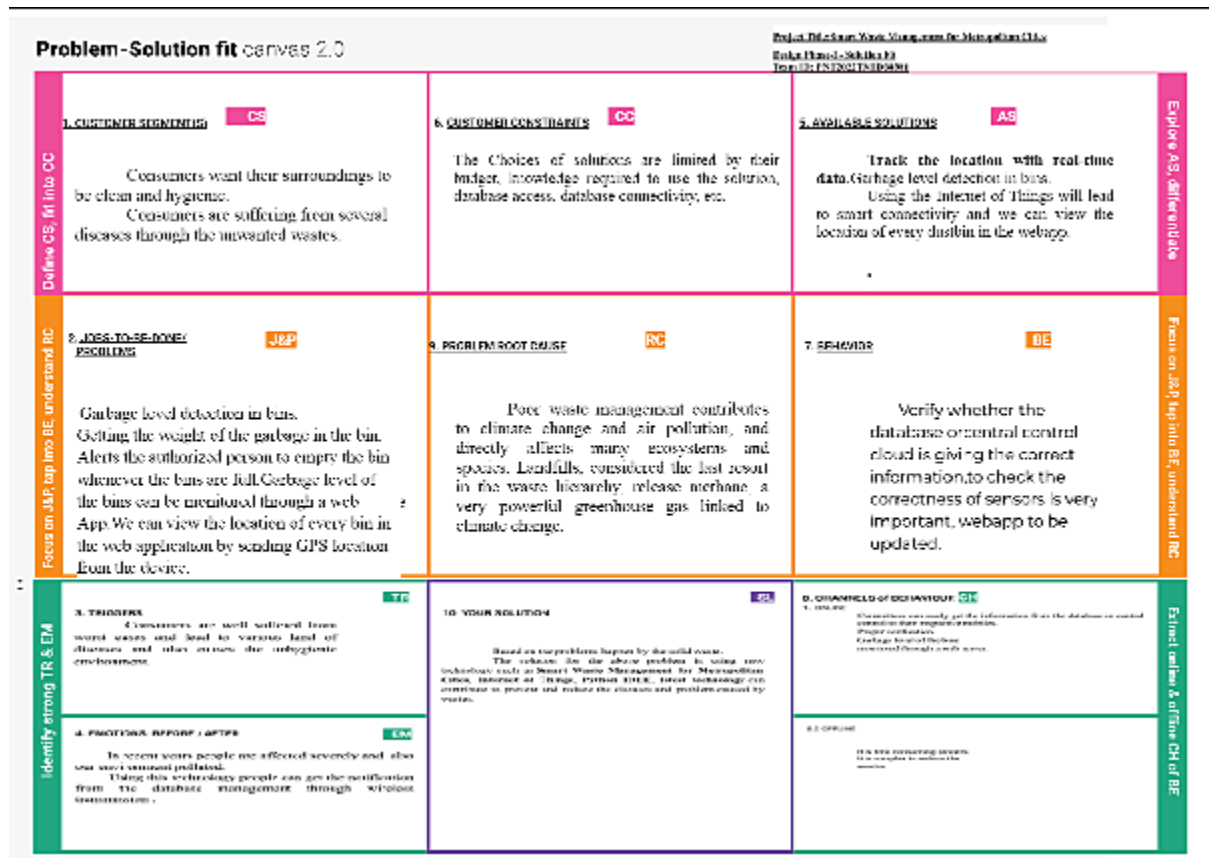
S.No.	Parameter	Description
1●	Problem Statement (Problem to be solved)	<p>*Indiscriminate disposal of solid waste is a major issue in urban centers of most developing countries and it poses a serious threat to the healthy living of the citizens.</p> <p>*The rate at which solid wastes are produced in most developing countries is becoming alarming.</p>
2.	Idea / Solution description	<p>*The smart, sensor based dustbin will judge the level of waste in it and send the message directly to the municipal corporation.</p> <p>*It can sense all types of waste material either in the form of solid or liquid.</p> <p>*According to the filled level of the dustbin, the vehicles from the municipal corporation will choose the shortest path with the help of the "TRANSPORTATION SOFTWARE ", which will save</p>

		<p>their time.</p> <p>*It emphasizes on “DIGITAL INDIA”.</p>
3.	Novelty / Uniqueness	<p>* With the help of proper technology (GPS & SOFTWARE APPLICATIONS) we can guide the trucks to choose the shortest path.</p> <p>*It also favours the “SMART CITY” project and “DIGITAL INDIA”.</p> <p>*Introducing Iot makes it smartest and easiest.</p>

4.	Social Impact / Customer Satisfaction	<p>*Reducing waste will not only protect the environment but will also save on costs or reduce expenses for disposal.</p> <p>*It keeps the surroundings clean and green, free from bad odour of wastes, emphasizes on a healthy environment and keeps cities more beautiful.</p> <p>*Reducing manpower required to handle the garbage collection. Reducing the diseases which are spread by the waste.</p>
5.	Business Model (Revenue Model)	<p>*By using this method the collection of waste in the city becomes easier. It helps in reducing air pollution, traffic flow, man power, time and money.</p> <p>*With the help of proper technology (GPS & SOFTWARE APPLICATIONS) we can guide the trucks in selecting the shortest path for garbage collection.</p> <p>*This project can add an edge to the cities aiming to get smart and people-friendly.</p>

6.	Scalability of the Solution	<p>*This project is very effective in managing waste in any big city.</p> <p>*Rather than using conventional periodic collection methods here priority system is used to ensure the city is clean all the time without any overflowing dumpsters.</p> <p>*It has been tested and verified properly to make sure all the different parts work together for a smooth function of the whole system.</p>
----	-----------------------------	--

3.4 Problem Solution fit



4.REQUIREMENT ANALYSIS

4.1 Functional requirement

Following are the functional requirements of the proposed solution.

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

FR-1	Real time bin monitoring.	The Dashboard shows statistics on the amount of fill in bins as it is being tracked by smart sensors. The application also forecasts when the bin will fill up based on past data in addition to the percentage of fill level, which is one of the features that even the finest waste management software lacks. As picks are also recognized by the sensors, you can determine when the bin was last emptied. You can get rid of the overflowing bins and cease collecting half-empty ones using real-time data and forecasts.
FR-2	Eliminate inefficient picks.	Get rid of the collection of half-empty trash cans. Picks are recognized by sensors. We can demonstrate to you how full the bins you collect are using real-time data on fill-levels and pick recognition.
FR-3	Plan waste collection routes.	Route planning for rubbish pickup is semi-automated using the tool. You are prepared to act and arrange for garbage collection based on the levels of bin fill that are now present and forecasts of approaching capacity. To find any discrepancies, compare the planned and actual paths.

FR-4	Adjust bin distribution.	Ensure the best possible bin distribution. Determine which regions have a dense or sparse distribution of bins. Ensure that each form of waste has a representative stand. You can make any required adjustments to bin position or capacity based on past data.
FR-5	Expensive bins.	We assist you in locating containers that increase collection prices. The tool determines a collection cost rating for each bin. The tool takes local average depo bin discharge into account. The tool determines the distance from depo-bin discharge and rates bins (1–10).
FR-6	Detailed bin inventory.	On the map, you can see every monitored bin and stand, and you can use Google Street View at any time to visit them. On the map, bins or stands appear as green, orange, or red circles. The Dashboard displays information about each bin, including its capacity, trash kind, most recent measurement, GPS position, and pick up schedule.

4.2 Non-Functional requirements

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NF R-1	Usability	Usability is a unique and significant perspective to examine user needs, which may further enhance the design quality, according to IoT devices. Analyzing how well people interact with a product may help designers better understand customers' prospective demands for waste management, behavior, and experience in the design process when user experience is at the Centre.
NF R-2	Security	Utilize recyclable bottles. Utilize reusable shopping bags. Spend responsibly and recycle Eat and drink in limited-use containers.
NF R-3	Reliability	Creating improved working conditions for garbage collectors and drivers is another aspect of smart waste management. Waste collectors will use their time more effectively by attending to bins that require

		service rather than travelling the same collection routes and servicing empty bins.
NF R-4	Performance	The Smart Sensors assess the fill levels in bins (along with other data) numerous times each day using ultrasonic technology. The sensors feed data to Senone's Smart Waste Management Software System, a robust cloud based platform with data-driven daily operations and a waste management app, using a variety of IoT networks (NB-IoT, GPRS). As a consequence, customers receive data-driven decision-making services, and garbage collection routes, frequency, and truck loads are optimized, resulting in at least a 30% decrease in route length.
NF R-5	Availability	By creating and implementing robust hardware and gorgeous software, we enable cities, companies, and nations to manage garbage more intelligently.
NF R-6	Scalability	Using smart trash bins allows us to scale up and monitor the rubbish more efficiently while also reducing the number of bins needed in towns and cities.

5.PROJECT DESIGN

5.1Data 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 analytics to translate the data gathered in your

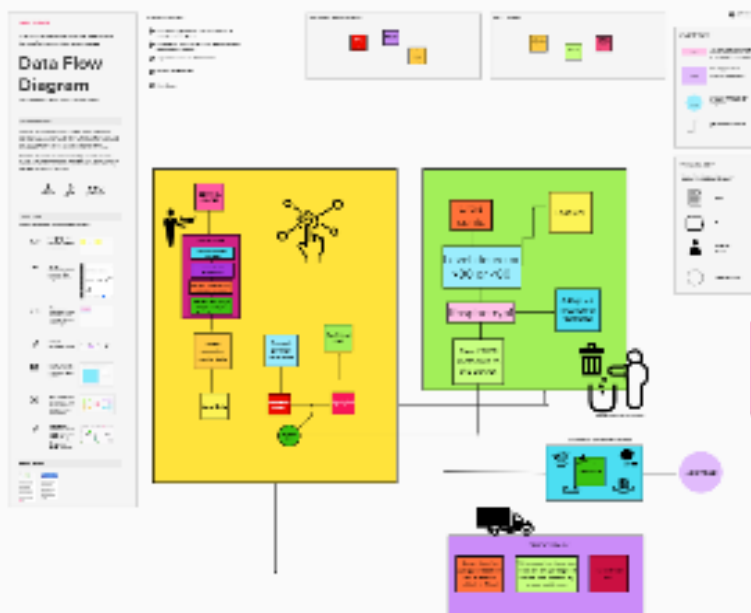
bins into actionable insights to help you improve your waste services.

You can receive data on metrics 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.

5.2 Data flow diagram:



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 clever waste management platform uses analytics to translate the statistics accumulate for your bins into actionable insights to help you improve your waste offerings.

You can receive information on metrics inclusive of:

The first check conducted is the situation in which the rubbish bin is empty or its garbage level could be very low.

Then, the bin is packed with greater rubbish till its level has reached the first threshold point which is nearly 50% then the first caution SMS is being dispatched, as depicted.

The first notification SMS sent with the aid of the machine, once the waste reaches the level of nearly 50% full.

The 2nd notification SMS dispatched with the aid of the machine, indicating that bin is at nearly 90% full and the rubbish needs to be collected at once.

Location vulnerable to overflow

- ★ The variety of packing containers needed to keep away from overflowing waste.
- ★ The quantity of collection offerings that could be saved
- ★ The amount of gas that might be saved
- ★ The driving distance that might be saved.

User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Admin(who manage web server	Login	USN-1	As an admin, I gave user id and password for ever workers and manage them.	I can manage web account/dashboard.	Medium	Sprint-1
Co Admin	Login	USN-2	As a Co admin, I'll manage garbage level monitor, if garbage get filling alert I will post location and garbage fed to trash truck.	I can manage garbage monitoring.	High	Sprint-2
Truck driver	Login	USN-3	As Truck Driver, I'll follow the route send by Co admin to reach the filled garbage.	I can drive to reach the garbage filled route in shortest route given	Medium	Sprint-3
Total garbage collector	Login	USN-4	As a Waste Collector, I'll collect all the trash from garbage and load into garbage truck and send them to landfill.	I can collect trash and pulled to truck and send off.	Medium	Sprint-4
Municipality	Login	USN-5	As a municipality, I'll check the process are happening in discipline manner without any issues.	I can manage all these process going good.	High	Sprint-5

5.2 Solution& Technical Architecture:

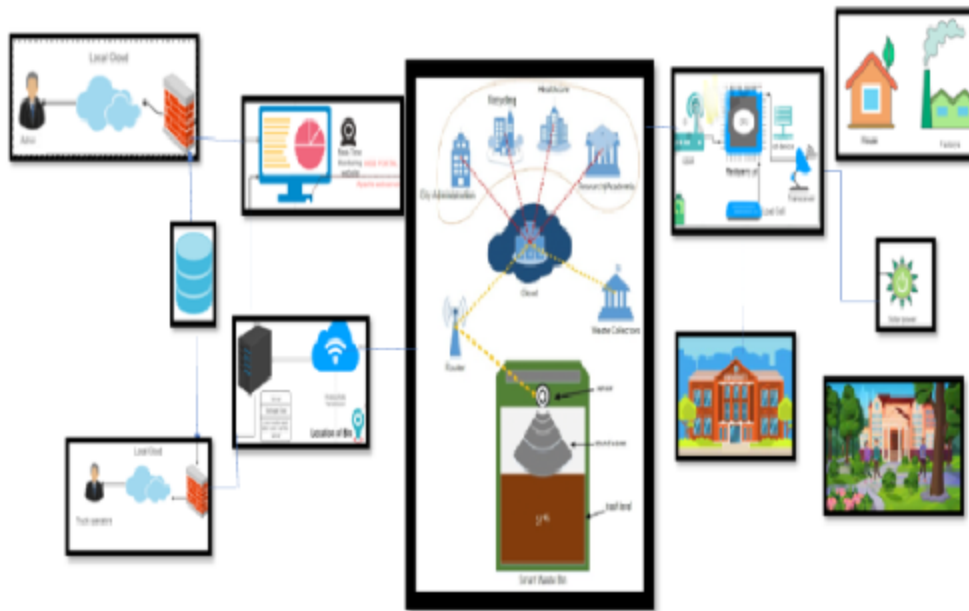


Table-1: Components & Technologies:

S. no	Component	Description	Technology
1.	User Interface	Mobile Application	HTML, CSS, JavaScript.
2.	Application Logic	Logic for a process in the application	Javascript
3.	Database	Data Type, Configurations etc.	Firebase, ibm cloud
4.	Cloud Database	Database Service on Cloud	IBM Cloud
5.	File Storage	File storage requirements	Local Filesystem and IBM cloud

6.	Infrastructure (Server / Cloud)	Application Deployment on CloudLocal Server Configuration	Local and Cloud Foundry
----	---------------------------------------	---	----------------------------

Table-2:Application Characteristics:

S. no	Characteristics	Description	Technology
1.	Open-Source Frameworks	Git Hub	Internet hosting service
2.	Security Implementations	Application security: Veracode.	Network automation
3.	Scalable Architecture	It provides the room for expansion more databaseof 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, Appleix, reple

5.	Performance	Performance is high it uses 5mb caches	Wireless Sensor Network
----	-------------	--	-------------------------

5.3 User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Admin	Login	USN-1	As an administrator, \ I assigned user names and passwords to each employee and managed them.	I can control my online account And dashboard.	Medium	Sprint-1
Co-Admin	Login	USN-2	As a Co-Admin, I'll control the waste level monitor. If a garbage filling alert occurs, I will notify the trash truck of the location and rubbish ID.	I can handle the waste collection.	High	Sprint-1

Truck Driver	Login	USN-3	As a Truck Driver, I'll follow Co Admin's instruction to reach the filled garbage.	I can take the shortest path to reach the waste filled route specified.	Medium	Sprint-2
Local Garbage Collector	Login	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	I can collect the trash, pull it to the truck, and send it out.	Medium	Sprint-3
Municipality officer	Login	USN-5	As a Municipality officer, I'll make sure everything is proceeding as planned and without any problems.	All of these processes are under my control.	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

<u>S.NO</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>DATE</u>
1.	Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring to technical papers, research publications etc.	28 SEPTEMBER 2022
2.	Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements	24 SEPTEMBER 2022
3.	Ideation	List them by organizing the brainstorming session and prioritize the top 3 ideas based on feasibility & importance.	25 SEPTEMBER 2022
4.	Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	23 SEPTEMBER 2022
5.	Problem Solution Fit	Prepare problem - solution fit document.	30 SEPTEMBER 2022

6.	Solution Architecture	Prepare a solution architecture document.	28 SEPTEMBER 2022
7.	Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit).	16 OCTOBER 2022
8.	Functional Requirement	Prepare the functional requirement document.	16 OCTOBER 2022
9.	Data Flow Diagrams	Draw the data flow diagrams and submit for review.	15 OCTOBER 2022
10.	Technology Architecture	Prepare the technology architecture diagram.	14 OCTOBER 2022
11.	Prepare Milestone & Activity List	Prepare the milestones & activity list of the project.	22 OCTOBER 2022
12.	Project Development - Delivery of Sprint-1, 2, 3 & 4	Develop & submit the developed code by testing it.	IN PROGRESS...

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

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Login	USN-1	As a Administrator, I need to give user id and passcode for ever workers over there in municipality	10	High	Keerthana. R
Sprint-1	Login	USN-2	As a Co-Admin, I'll control the waste level by monitoring them val real time web portal. Once the filling happens, I'll notify trash truck with location of bin with bin ID	10	High	Kalaiarasi. R
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	Megana. A
Sprint-1	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	Vignesh. S
Sprint-1	Dashboard	USN-5	As a Municipality officer, I'll make sure everything is proceeding as planned and without any problems	20	High	Mohana priya.T

6.2. Sprint Delivery Schedule

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	8 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

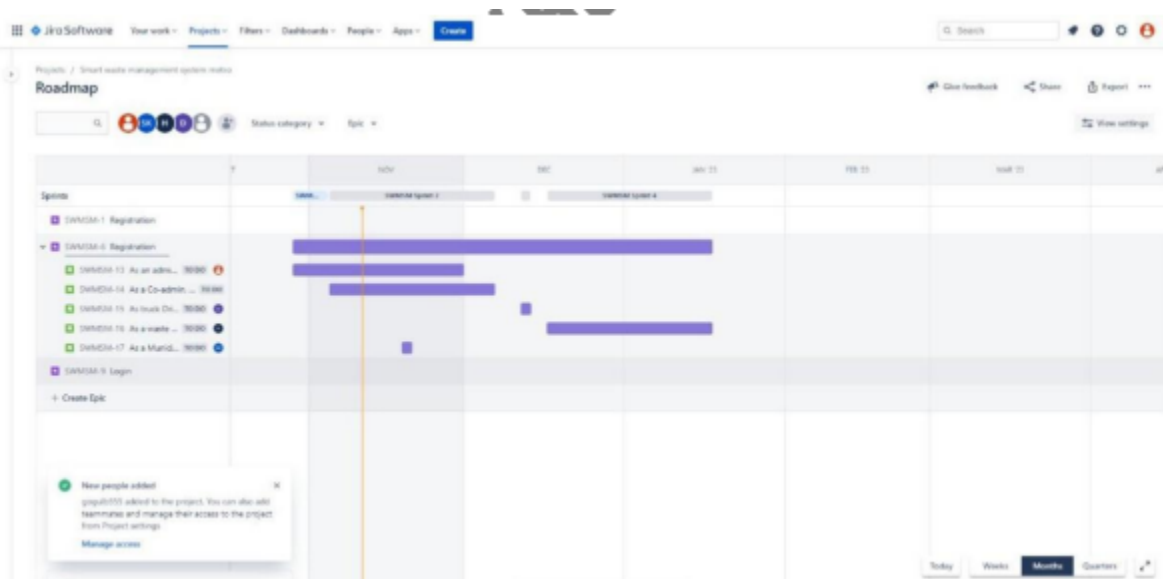
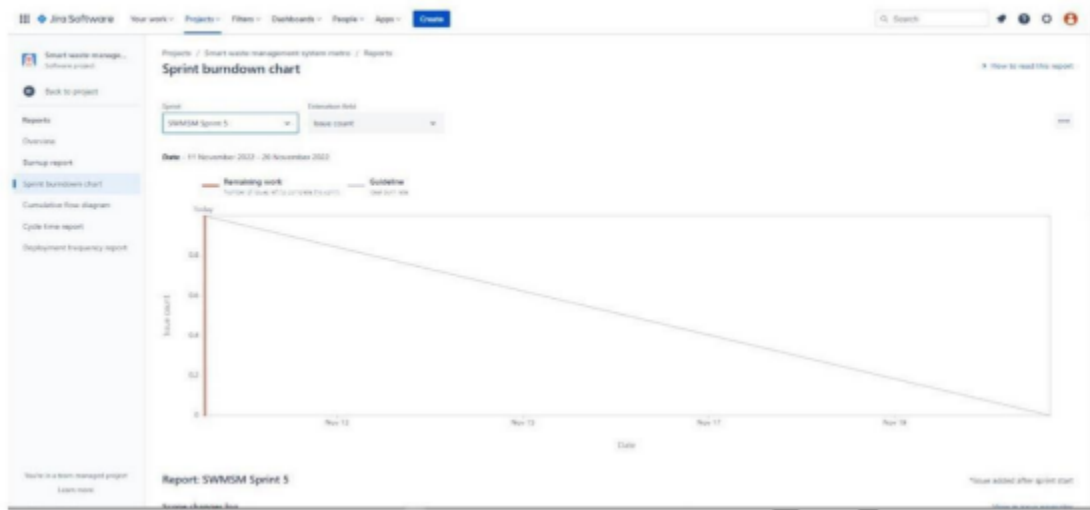
Velocity:

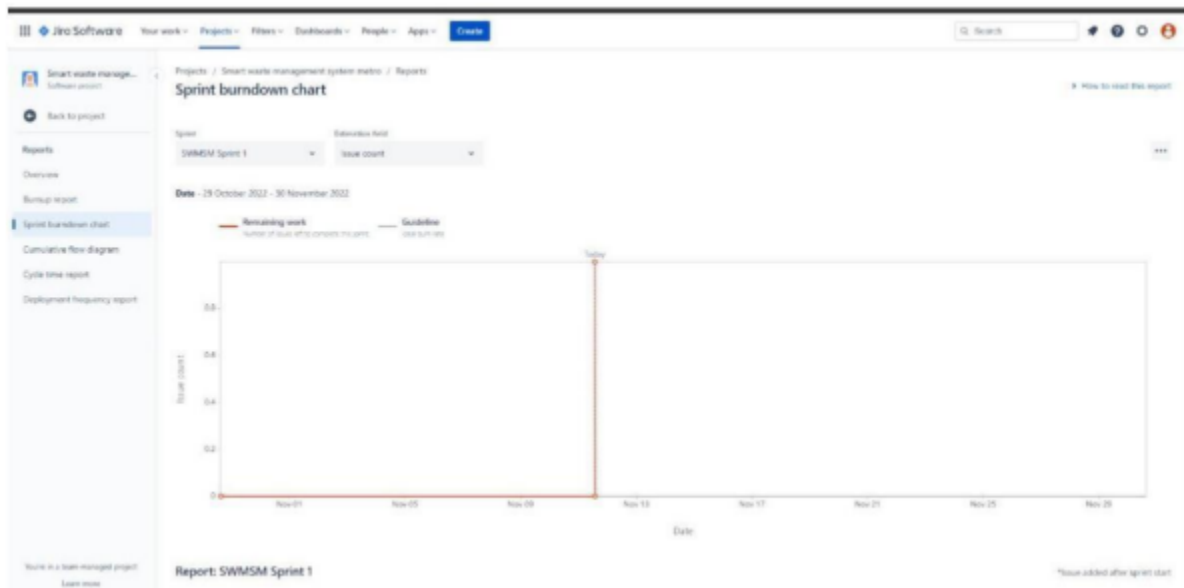
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

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

6.3 Reports from JIRA

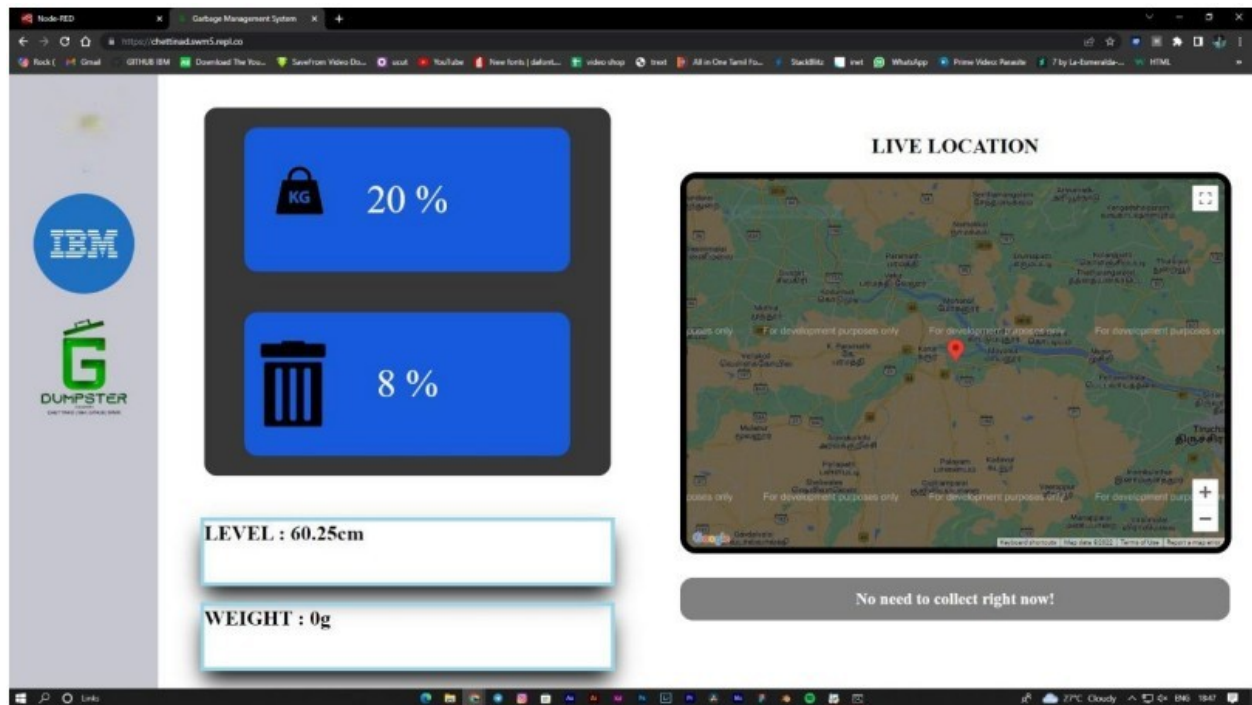
BURNDOWN CHART



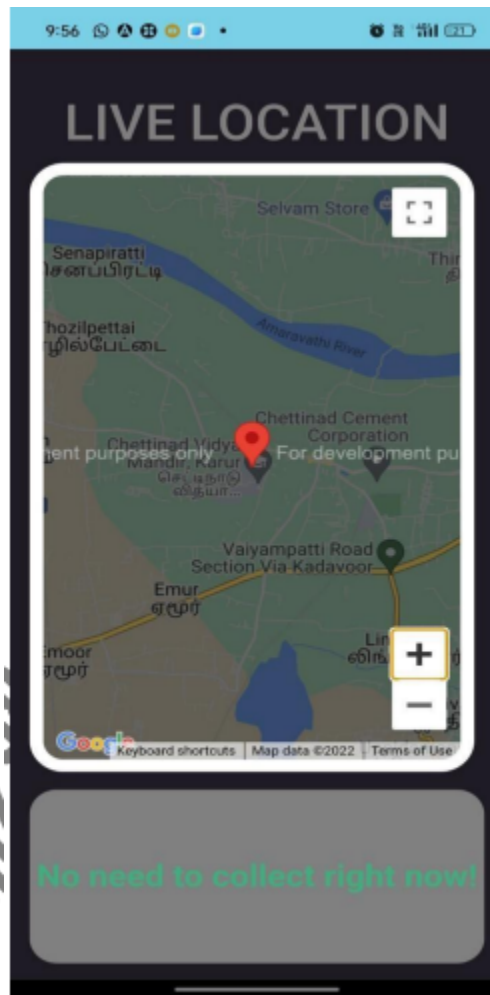
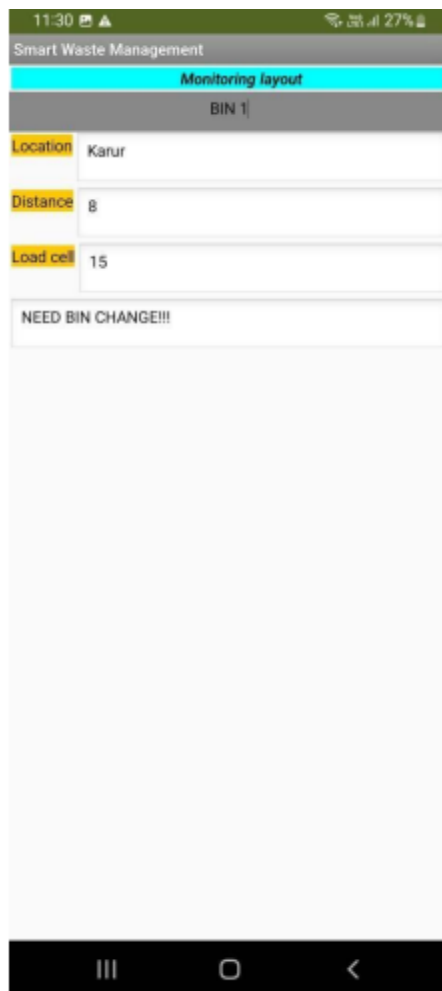


7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1- LOCATION TRACKER



7.2 Feature 2- LIVE UPDATE ON COLLECTED DATA

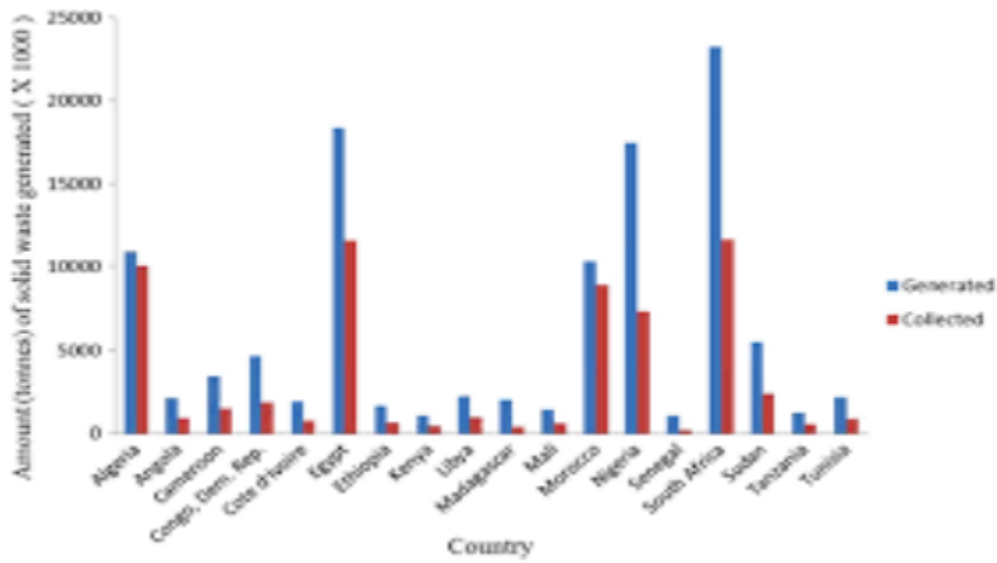
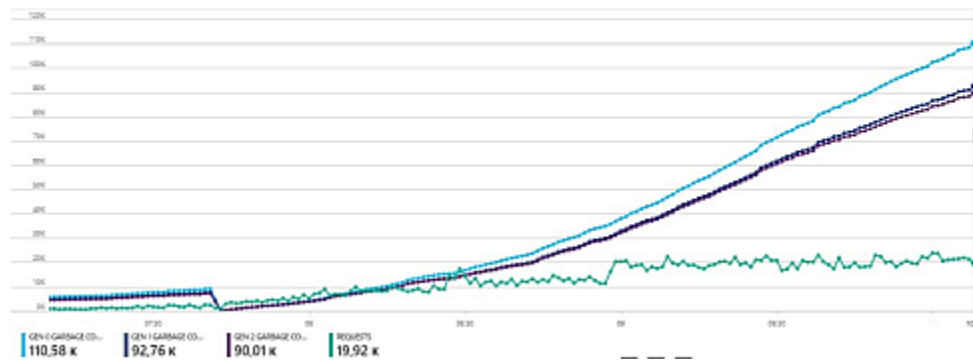


8.RESULTS & TESTING

8.1 Performance Metrics

No title
No subtitle

Chart type: Line
Time range: Day 0 Hours 3 Minutes 0 Seconds
Pin to dashboard

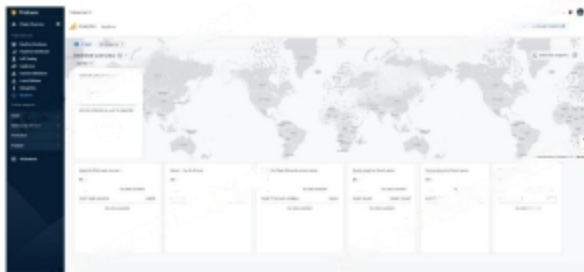


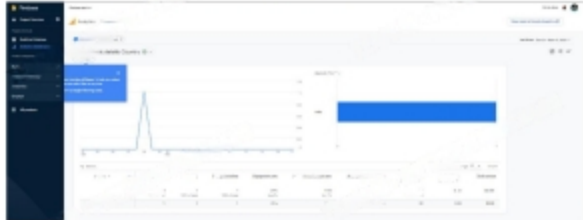
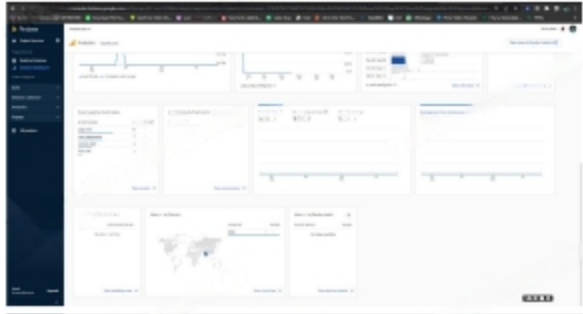


Year	Year	Year	Year
2019	2020	2021	2022
2019	2020	2021	2022
2019	2020	2021	2022

Year	Year	Year	Year
2019	2020	2021	2022
2019	2020	2021	2022
2019	2020	2021	2022
2019	2020	2021	2022

Year	Year	Year	Year
2019	2020	2021	2022
2019	2020	2021	2022
2019	2020	2021	2022
2019	2020	2021	2022





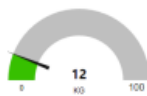
≡ control

control

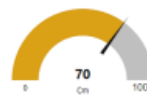
Distance 1



LOAD CELL 1



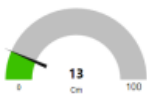
Distance 2



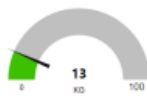
LOAD CELL 2



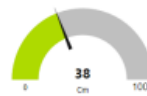
Distance 3



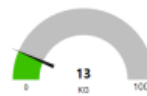
LOAD CELL 3

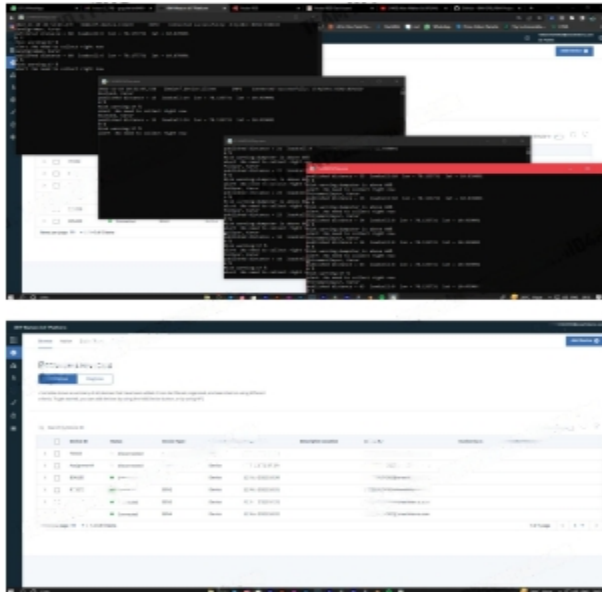


Distance 4



LOAD CELL 4





9. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Reduction in Collection Cost
- No Missed Pickups
- Reduced Overflows
- Waste Generation Analysis
- CO2 Emission Reduction

DISADVANTAGES:

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

Project : Smart Waste Management

Team ID : PNT2022TMID38381

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)

```

PNT2022TMID38381

```

print("data pushed")
c = 1
break

```

LOAD.py

```

import
time

import sys

EMULATE_HX711=False

referenceUnit = 1

if not EMULATE_HX711:
    import RPi.GPIO as GPIO
    from hx711 import HX711
else:

```

```
from emulated_hx711 import HX711
```

```
def cleanAndExit():  
    print("Cleaning...")
```

```
if not EMULATE_HX711:  
    GPIO.cleanup()  
    print("Bye!")  
    sys.exit()
```

```
hx = HX711(5, 6)
```

```
# I've found out that, for some reason, the order of the bytes is not always the same  
between versions of python, numpy and the hx711 itself.
```

```
# Still need to figure out why does it change.
```

```
# If you're experiencing super random values, change these values to MSB or LSB  
until to get more stable values. # There is some code below to debug and log the  
order of the bits and the bytes.
```

```
# The first parameter is the order in which the bytes are used to build the "long" value.
```

```
# The second paramter is the order of the bits inside each byte.
```

```
# According to the HX711 Datasheet, the second parameter is MSB so you  
shouldn't need to modify it. hx.set_reading_format("MSB", "MSB")
```

PNT2022TMID38381

```
# HOW TO CALCULATE THE REFFERENCE UNIT
```

```
# To set the reference unit to 1. Put 1kg on your sensor or anything you have and  
know exactly how much it weights.
```

```
# In this case, 92 is 1 gram because, with 1 as a reference unit I got  
numbers near 0 without any weight # and I got numbers around 184000  
when I added 2kg. So, according to the rule of thirds:
```

```
# If 2000 grams is 184000 then 1000 grams is  $184000 / 2000 = 92$ .
```

```
hx.set_reference_unit(113)
```

```
#hx.set_reference_unit(referenceUnit)
```

```
hx.reset()
```

```
hx.tare()
```

```
print("Tare done! Add weight now...")
```

```
# to use both channels, you'll need to tare them both
```

```
#hx.tare_A()
```

```
#hx.tare_B()
```

```
def loop():
```

```
    try:
```

```
        # These three lines are usefull to debug wether to use MSB or LSB in the reading formats
```

```
            # for the first parameter of "hx.set_reading_format("LSB", "MSB")".
```

```
            # Comment the two lines "val = hx.get_weight(5)" and "print val" and uncomment  
            these three lines to see what it prints.
```

```
            # np_arr8_string = hx.get_np_arr8_string()
```

```
            # binary_string = hx.get_binary_string()
```

```
            # print binary_string + " " + np_arr8_string
```

```
            # Prints the weight. Comment if you're debbuging the MSB and LSB issue.
```

```
            val = hx.get_weight(5)
```

```
            print(val)
```

```
            return val
```

```
# To get weight from both channels (if you have load cells hooked up
```

```
# to both channel A and B), do something like this
```

```
#val_A = hx.get_weight_A(5)
```

```
#val_B = hx.get_weight_B(5)
```

```
#print "A: %s B: %s" % ( val_A, val_B )
```

```
PNT2022TMID38381
```

```
hx.power_down()
```

```
    hx.power_up()
```

```
time.sleep(0.1)
```

```
except (KeyboardInterrupt, SystemExit):
```

```
    cleanAndExit()
```

DISTANCE.py

```
import RPi.GPIO as GPIO
```

```
import time
```

```
def distancesensor():
```

```
    try:
```

```
        GPIO.setmode(GPIO.BOARD)
```

```
        GPIO.setwarnings(False)
```

```
        PIN_TRIGGER = 23
```

```
        PIN_ECHO = 33
```

```
        GPIO.setup(PIN_TRIGGER, GPIO.OUT)
```

```
        GPIO.setup(PIN_ECHO, GPIO.IN)
```

```
        GPIO.output(PIN_TRIGGER, GPIO.LOW)
```

```
        time.sleep(2)
```

```
        GPIO.output(PIN_TRIGGER, GPIO.HIGH)
```

```
        time.sleep(0.00001)
```

```
        GPIO.output(PIN_TRIGGER, GPIO.LOW)
```

```
        while GPIO.input(PIN_ECHO)==0:
```

```
            pulse_start_time = time.time()
```

```
            while GPIO.input(PIN_ECHO)==1:
```

```
                pulse_end_time = time.time()
```

```
            pulse_duration = pulse_end_time - pulse_start_time
```

```
            global distance
```

```
            distance = round(pulse_duration * 17150, 2)
```

```
            print(distance)
```

```
            return distance
```

```

finally:
    GPIO.cleanup()

HX711.py import RPi.GPIO as
GPIO
PNT2022TMID38381

import time
import threading
class HX711:

    def init (self, dout, pd_sck, gain=128):
self.PD_SCK = pd_sck

self.DOUT = dout

    # Mutex for reading from the HX711, in case multiple threads in
client
# software try to access get values from the class at the same time.
self.readLock = threading.Lock()
GPIO.setmode(GPIO.BCM)
GPIO.setwarnings(False)
GPIO.setup(self.PD_SCK, GPIO.OUT)
GPIO.setup(self.DOUT, GPIO.IN)

self.GAIN = 0

    # The value returned by the hx711 that corresponds to your
reference
# unit AFTER dividing by the SCALE.
self.REFERENCE_UNIT = 1
self.REFERENCE_UNIT_B = 1

```

```
self.OFFSET = 1
self.OFFSET_B = 1
self.lastVal = int(0)
```

```
self.DEBUG_PRINTING = False
```

```
self.byte_format = 'MSB'
self.bit_format = 'MSB'
```

```
self.set_gain(gain)
```

PNT2022TMID38381

```
# Think about whether this is necessary.
time.sleep(1)
```

```
def convertFromTwosComplement24bit(self, inputValue):
    return -(inputValue & 0x800000) + (inputValue & 0x7fffff)
```

```
def is_ready(self):
    return GPIO.input(self.DOUT) == 0
```

```
def set_gain(self, gain):
    if gain is 128:
        self.GAIN = 1
    elif gain is 64:
        self.GAIN = 3
    elif gain is 32:
        self.GAIN = 2
```

```
GPIO.output(self.PD_SCK, False)
```

```
# Read out a set of raw bytes and throw it away.  
self.readRawBytes()
```

```
def get_gain(self):  
    if self.GAIN == 1:  
        return 128  
    if self.GAIN == 3:  
        return 64  
    if self.GAIN == 2:  
        return 32
```

```
# Shouldn't get here.  
return 0
```

```
def readNextBit(self):  
    # Clock HX711 Digital Serial Clock (PD_SCK). DOUT will be  
    # ready 1us after PD_SCK rising edge, so we sample after  
    # lowering PD_SCK, when we know DOUT will be stable.
```

PNT2022TMID38381

```
GPIO.output(self.PD_SCK, True)  
GPIO.output(self.PD_SCK, False)  
value = GPIO.input(self.DOUT)
```

```
# Convert Boolean to int and return it.  
return int(value)
```

```
def readNextByte(self):  
    byteValue = 0
```

```

# Read bits and build the byte from top, or bottom, depending
# on whether we are in MSB or LSB bit mode.
for x in range(8):
    if self.bit_format == 'MSB':
        byteValue <<= 1
        byteValue |= self.readNextBit()
    else:
        byteValue >>= 1
        byteValue |= self.readNextBit() * 0x80

# Return the packed byte.
return byteValue

def readRawBytes(self):
    # Wait for and get the Read Lock, incase another thread is already
    # driving the HX711 serial interface.
    self.readLock.acquire()

    # Wait until HX711 is ready for us to read a sample.
    while not self.is_ready():
        pass

    # Read three bytes of data from the HX711.
    firstByte = self.readNextByte()
    secondByte = self.readNextByte()
    thirdByte = self.readNextByte()

    # HX711 Channel and gain factor are set by number of bits read
    # after 24 data bits.
    for i in range(self.GAIN):
        # Clock a bit out of the HX711 and throw it away.

```

PNT2022TMID38381


```
self.readNextBit()
```

```
        # Release the Read Lock, now that we've finished driving the  
        HX711  
        # serial interface.  
        self.readLock.release()
```

```
# Depending on how we're configured, return an ordered list of raw  
byte  
# values.
```

```
if self.byte_format == 'LSB':  
    return [thirdByte, secondByte, firstByte]  
else:  
    return [firstByte, secondByte, thirdByte]
```

```
def read_long(self):
```

```
    # Get a sample from the HX711 in the form of raw bytes.
```

```
    dataBytes = self.readRawBytes()
```

```
    if self.DEBUG_PRINTING:
```

```
        print(dataBytes,)
```

```
    # Join the raw bytes into a single 24bit 2s complement value.
```

```
    twosComplementValue = ((dataBytes[0] << 16) |  
        (dataBytes[1] << 8) |  
        dataBytes[2])
```

```
    if self.DEBUG_PRINTING:
```

```
        print("Twos: 0x%06x" % twosComplementValue)
```

```
    # Convert from 24bit twos-complement to a signed value.
```

```
        signedIntValue =
```

```
        self.convertFromTwosComplement24bit(twosComplementValue)
```

```
    # Record the latest sample value we've read.
```

```
    self.lastVal = signedIntValue
```

PNT2022TMID38381

```
# Return the sample value we've read from the HX711.
return int(signedIntValue)

def read_average(self, times=3):

# Make sure we've been asked to take a rational amount of samples.
if times <= 0:
    raise ValueError("HX711():read_average(): times must >= 1!!")

# If we're only average across one value, just read it and return it.
if times == 1:
    return self.read_long()

# If we're averaging across a low amount of values, just take the
# median.
if times < 5:
    return self.read_median(times)

# If we're taking a lot of samples, we'll collect them in a list,
remove
# the outliers, then take the mean of the remaining set.
valueList = []

for x in range(times):
    valueList += [self.read_long()]

valueList.sort()

# We'll be trimming 20% of outlier samples from top and bottom
of collected set.
trimAmount = int(len(valueList) * 0.2)
```

```

# Trim the edge case values.
valueList = valueList[trimAmount:-trimAmount]

# Return the mean of remaining samples.
return sum(valueList) / len(valueList)

# A median-based read method, might help when getting random
value spikes
# for unknown or CPU-related reasons
def read_median(self, times=3):
    if times <= 0:
raise ValueError("HX711::read_median():
times must be greater

    than zero!")
# If times == 1, just return a single reading.
if times == 1:
    return self.read_long()
    valueList = []
    for x in range(times):
        valueList += [self.read_long()]
    valueList.sort()

# If times is odd we can just take the centre value.
if (times & 0x1) == 0x1:
    return valueList[len(valueList) // 2]
else:
# If times is even we have to take the arithmetic mean of
# the two middle values.
    midpoint = len(valueList) / 2
    return sum(valueList[midpoint:midpoint+2]) / 2.0
# Compatibility function, uses channel A version
def get_value(self, times=3):
    return self.get_value_A(times)
def get_value_A(self, times=3):
    return self.read_median(times) - self.get_offset_A()
def get_value_B(self, times=3):

```

```

# for channel B, we need to set_gain(32)
g = self.get_gain()
self.set_gain(32)
value = self.read_median(times) - self.get_offset_B()
self.set_gain(g)
return value

# Compatibility function, uses channel A version
def get_weight(self, times=3):
    return self.get_weight_A(times)
def get_weight_A(self, times=3):
    value = self.get_value_A(times)
    value = value / self.REFERENCE_UNIT
    return value
def get_weight_B(self, times=3):
    value = self.get_value_B(times)
    value = value / self.REFERENCE_UNIT_B
    return value

# Sets tare for channel A for compatibility purposes
def tare(self, times=15):
    return self.tare_A(times)
def tare_A(self, times=15):
    # Backup REFERENCE_UNIT value

```

PNT2022TMID38381

```

backupReferenceUnit = self.get_reference_unit_A()
self.set_reference_unit_A(1)
value = self.read_average(times)

```

```

if self.DEBUG_PRINTING:
    print("Tare A value:", value)
    self.set_offset_A(value)

```

```

# Restore the reference unit, now that we've got our offset.
self.set_reference_unit_A(backupReferenceUnit)
return value
def tare_B(self, times=15):

```

```

# Backup REFERENCE_UNIT value
backupReferenceUnit = self.get_reference_unit_B()
self.set_reference_unit_B(1)

# for channel B, we need to set_gain(32)
backupGain = self.get_gain()
self.set_gain(32)

value = self.read_average(times)
if self.DEBUG_PRINTING:
    print("Tare B value:", value)
    self.set_offset_B(value)
# Restore gain/channel/reference unit settings.
self.set_gain(backupGain)
self.set_reference_unit_B(backupReferenceUnit)
return value

        def set_reading_format(self, byte_format="LSB",
bit_format="MSB"):
    if byte_format == "LSB":
        self.byte_format = byte_format
    elif byte_format == "MSB":
        self.byte_format = byte_format
    else:
        raise ValueError("Unrecognised byte_format: \"%s\" %
byte_format)
    if bit_format == "LSB":
        self.bit_format = bit_format
    elif bit_format == "MSB":
        self.bit_format = bit_format
    else:

        raise ValueError("Unrecognised bitformat: \"%s\" % bit_format)
# sets offset for channel A for compatibility reasons
def set_offset(self, offset):
    self.set_offset_A(offset)

```

PNT2022TMID38381

```
def set_offset_A(self, offset):
    self.OFFSET = offset

def set_offset_B(self, offset):
    self.OFFSET_B = offset
```

```
def get_offset(self):
    return self.get_offset_A()
```

```
def get_offset_A(self):
    return self.OFFSET
```

```
def get_offset_B(self):
    return self.OFFSET_B

def set_reference_unit(self, reference_unit):
    self.set_reference_unit_A(reference_unit)

def set_reference_unit_A(self, reference_unit):
    # Make sure we aren't asked to use an invalid reference unit.
    if reference_unit == 0:
        raise ValueError("HX711::set_reference_unit_A() can't accept 0
as a reference unit!")
    return
```

```
self.REFERENCE_UNIT = reference_unit

def set_reference_unit_B(self, reference_unit):
    # Make sure we aren't asked to use an invalid reference unit.
    if reference_unit == 0:
        raise ValueError("HX711::set_reference_unit_A() can't accept 0
as a reference unit!")
    return

self.REFERENCE_UNIT_B = reference_unit

def get_reference_unit(self):
    return get_reference_unit_A()
```

PNT2022TMID38381

```
def get_reference_unit_A(self):
    return self.REFERENCE_UNIT

def get_reference_unit_B(self):
    return self.REFERENCE_UNIT_B

def power_down(self):
    # Wait for and get the Read Lock, incase another thread is already
    # driving the HX711 serial interface.
    self.readLock.acquire()

    # Cause a rising edge on HX711 Digital Serial Clock (PD_SCK).
    # We then
    # leave it held up and wait 100 us. After 60us the HX711 should
    # be
    # powered down.
    GPIO.output(self.PD_SCK, False)
    GPIO.output(self.PD_SCK, True)

    time.sleep(0.0001)

    # Release the Read Lock, now that we've finished driving the
    # HX711
    # serial interface.
    self.readLock.release()

def power_up(self):
    # Wait for and get the Read Lock, incase another thread is already
    # driving the HX711 serial interface.
    self.readLock.acquire()

    # Lower the HX711 Digital Serial Clock (PD_SCK) line.
    GPIO.output(self.PD_SCK, False)

    # Wait 100 us for the HX711 to power back up.
    time.sleep(0.0001)

    # Release the Read Lock, now that we've finished driving the
```

```

HX711
# serial interface.
self.readLock.release()
# HX711 will now be defaulted to Channel A with gain of 128. If
this
# isn't what client software has requested from us, take a sample
and
# throw it away, so that next sample from the HX711 will be from
the
# correct channel/gain.
if self.get_gain() != 128:
self.readRawBytes()
def reset(self):

PNT2022TMID38381

self.power_down()
self.power_up()

```

WEBSITE CODING

Index.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="map"></div>
        <div id="alert_msg">ALERT MESSAGE!</div>
    </div>
    </div>
<center><a href="https://goo.gl/maps/G9XET5mzSw1ynHQ18"
type="button" class="btn btn-dark">DUMPSTER</a></center>

    <script
        src="https://maps.googleapis.com/maps/api/js?key=AIzaSyBBLyWj
3FWtCbCXGW3ysEiI2fDfrv2v0Q&callback=myMap"></script></div>
</body>

</html>

```

Database.js

```

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

var ref = firebase.database().ref();
    PNT2022TMID38381

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;
    }

```

```

        alert_msg.innerHTML= `${alert_msg_val}`;
    });
    }, function (error) {
    console.log("Error: " + error.code);
    });
}

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.getElementById("map"), mapProp);

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

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

```

Style.css

```

html, body
{
    height: 100%;

    margin: 0px;
    padding: 0px;
}

#container
{
    display: flex;
    flex-direction: row;
    height: 100%;
    width: 100%;
    position: relative;
}

#logo_container
{
    height: 100%;
}

```

```

        width: 12%;
        background-color: #C5C6D0;
        display: flex;
        flex-direction: column;
        vertical-align: text-bottom;
    }
    .logo
    {
        width:70%;
        PNT2022TMID38381

        margin: 5% 15%;

        /* border-radius: 50%; */

    }
    #logo_3
    {
        vertical-align: text-bottom;

    }
    #data_container
    {
        height: 100%;
        width: 20%;
        margin-left: 1%;
        margin-right: 1%;
        display: flex;
        flex-direction: column;
    }
    #data_status
    {
        height:60%;
        width:8%;
        margin:7%;
        background-color: #691F6E;
        display: flex;
        flex-direction: column;
        border-radius:20px;
    }
    #load_status
    {
        background-image: url("/Images/KG.png");
        background-repeat: no-repeat;
        background-size: 170px;
        background-position: left center;
    }
    #cap_status
    {
        background-image: url("/Images/dust.png");
        background-repeat: no-repeat;
        background-size: 150px;
        background-position: left center;
    }
    .status
    {

```

```

        width: 80%;
        height: 40%;
        margin: 5% 10%;
        background-color: #185adc;
        border-radius: 20px;
        display: flex;
        justify-content: center;
    align-items: center;
        color: white;
        font-size: 60px;

}
.datas
{
        width: 86%;
        margin: 2.5% 7%;
        height: 10%;
background: url(water.png);
background-repeat: repeat-x;
animation: datas 10s linear infinite;

box-shadow: 0 0 0 6px #98d7eb, 0 20px 35px rgba(0,0,0,1);

}
#map_container
{
        height: 100%;
        width: 100%;
        display: flex;
        flex-direction: column;

}

PNT2022TMID38381

```

```

#live_location_heading
{
        margin-top: 10%;
        text-align: center;
color: GREY;
}

```

```

#map
{
        height: 70%;
        width: 90%;
        margin-left: 4%;
        margin-right: 4%;
        border: 10px solid white;
        border-radius: 25px;

}
#alert_msg
{
        width: 92%;

```

```

        height:20%;
        margin:4%;
        background-color:grey;
        border-radius: 20px;
        display: flex;
        justify-content: center;
    align-items: center;
        color: #41af7f;
        font-size: 25px;
        font-weight: bold;
    }
    .lat
    {
        margin: 0px;
        font-size:0px;
    }

```

```

@keyframes datas{
0%
{

```

```

background
d-
position: -
500px
100px; }
40%
{

```

```

background
d-
position:
1000px -
10px; }

```

```

80% {

```

```

backgrou
nd-
position:
2000px
40px; }
100% {

```

```

backgrou
nd-
position:
2700px
95px; }

```

```

}

```

PNT2022TMID38381

For simulator python code

BIN1.PY

```
import requests
```

```
import json
```

```
import ibmiotf.application
```

```
import ibmiotf.device
```

```
import time
```

```
import random
```

```
import sys
```

```
# watson device details
```

```
organization = "o1zpr"
```

```
devicType = "BIN1"
```

```
deviceId = "BIN1ID"
```

```
authMethod= "token"
```

```
authToken= "123456789"
```

```
#generate random values for randomo variables (temperature&humidity)
```

```
def myCommandCallback(cmd):
```

```
    global a
```

```
    print("command recieved:%s" %cmd.data['command'])
```

```
    control=cmd.data['command']
```

```
    print(control)
```

```
try:
```

```
    deviceOptions={"org": organization, "type": devicType,"id": deviceId,"auth-  
method":authMethod,"auth token":authToken}
```

```
    deviceCli = ibmiotf.device.Client(deviceOptions)
```

```
except Exception as e:
```

```
    print("caught exception connecting device %s" %str(e))
```

```
    sys.exit()
```

```
#connect and send a datapoint "temp" with value integer value into the cloud as a type of  
event for every 10 seconds deviceCli.connect()
```

```
while True:
```

```
    distance= random.randint(10,70)
```

```
    loadcell= random.randint(5,15)
```

```
    data= {'dist':distance,'load':loadcell}
```

```
    if loadcell < 13 and loadcell > 15:
```

```
        load = "90 %"
```

```
    elif loadcell < 8 and loadcell > 12:
```

```
        load = "60 %"
```

```
PNT2022TMID48488
```

```
    elif loadcell < 4 and loadcell > 7:
```

```
        load = "40 %"
```

```
    else:
```

```
        load = "0 %"
```

```
    if distance < 15:
```

```
        dist = 'alert : ' ' Dumpster poundage getting high, Time to collect :) ' '90 %'
```

```
    elif distance < 40 and distance >16:
```

```
        dist = 'alert : ' ' dumpster is above ' '60%'
```

```
    elif distance < 60 and distance > 41:
```

```
        dist = 'alert : ' ' dumpster is above ' '40 %'
```

```
    else:
```

```
        dist = 'alert : ' 'No need to collect right now ' '17 %'
```

```
    if load == "90 %" or distance == "90 %":
```

```
        warn = 'alert pushed to ibm sucessfully :'
```

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

```
        warn = 'alert pushed to ibm sucessfully :'
```

```

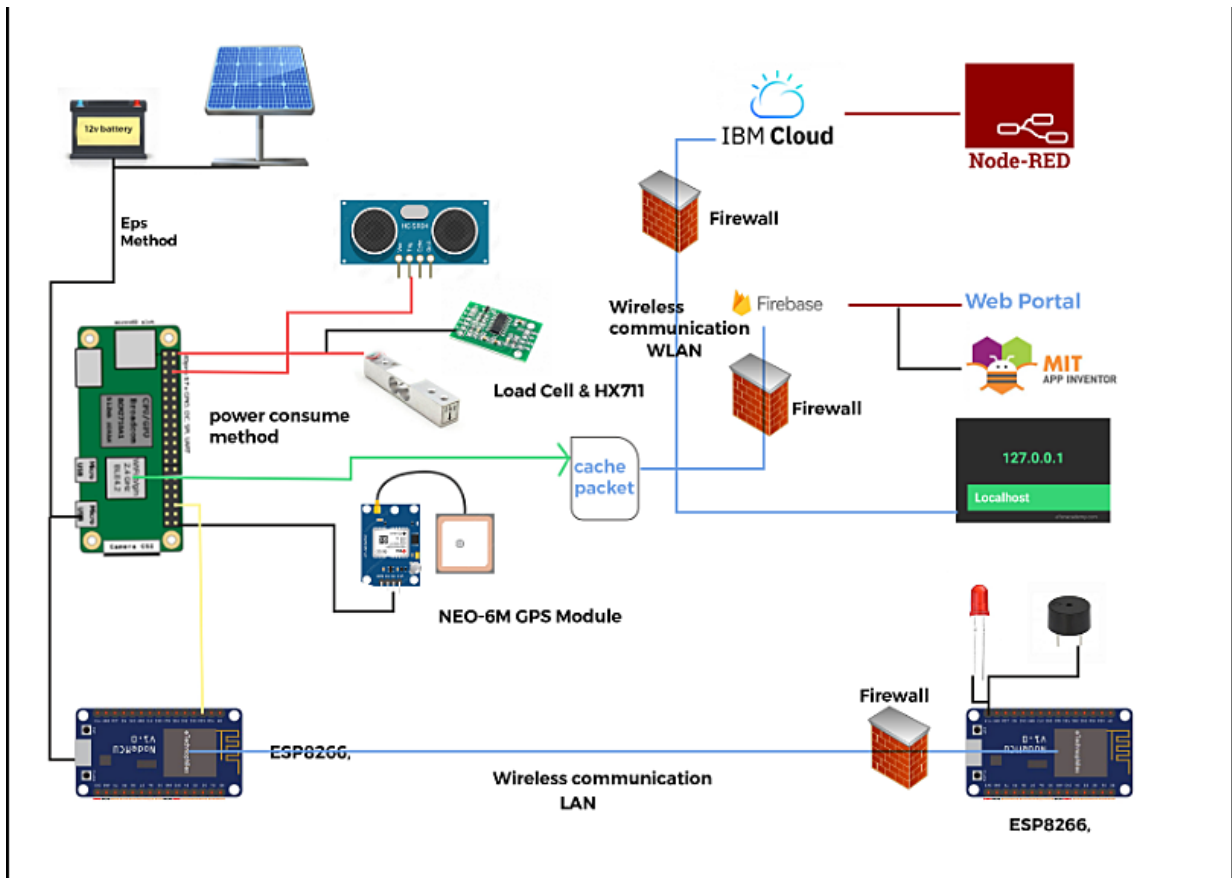
else :
warn = 'alert pushed to ibm sucessfully :'
def myOnPublishCallback(lat=10.678991,long=78.177731):
print("Gandigramam, Karur")
print("published distance = %s " %distance,"loadcell:%s " %loadcell,"lon = %s "
%long,"lat = %s" %lat) print(load)
print(dist)
print(warn)

time.sleep(4)
success=deviceCli.publishEvent ("IoTSensor","json",warn,qos=0,on_publish=
myOnPublishCallback)
success=deviceCli.publishEvent ("IoTSensor","json",data,qos=0,on_publish=
myOnPublishCallback) if not success:
print("not connected to ibmiot")
time.sleep(4)
deviceCli.commandCallback=myCommandCallback
#disconnect the device
deviceCli.disconnect()

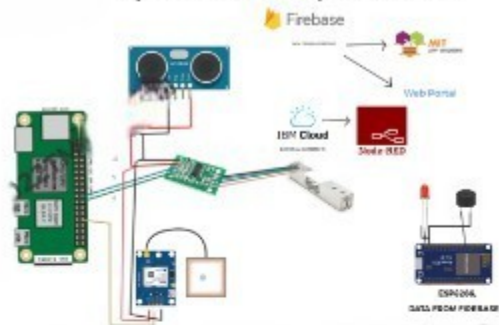
```

PNT2022TMID38381

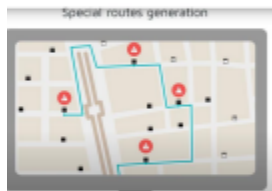
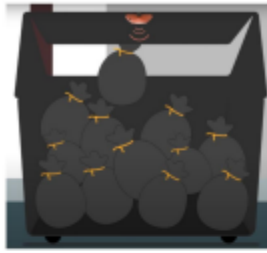
3.2 OUTPUT PICTURE



Smart Waste Management System For Metropolitan Cities



BENIFITS OF DUMPSTER



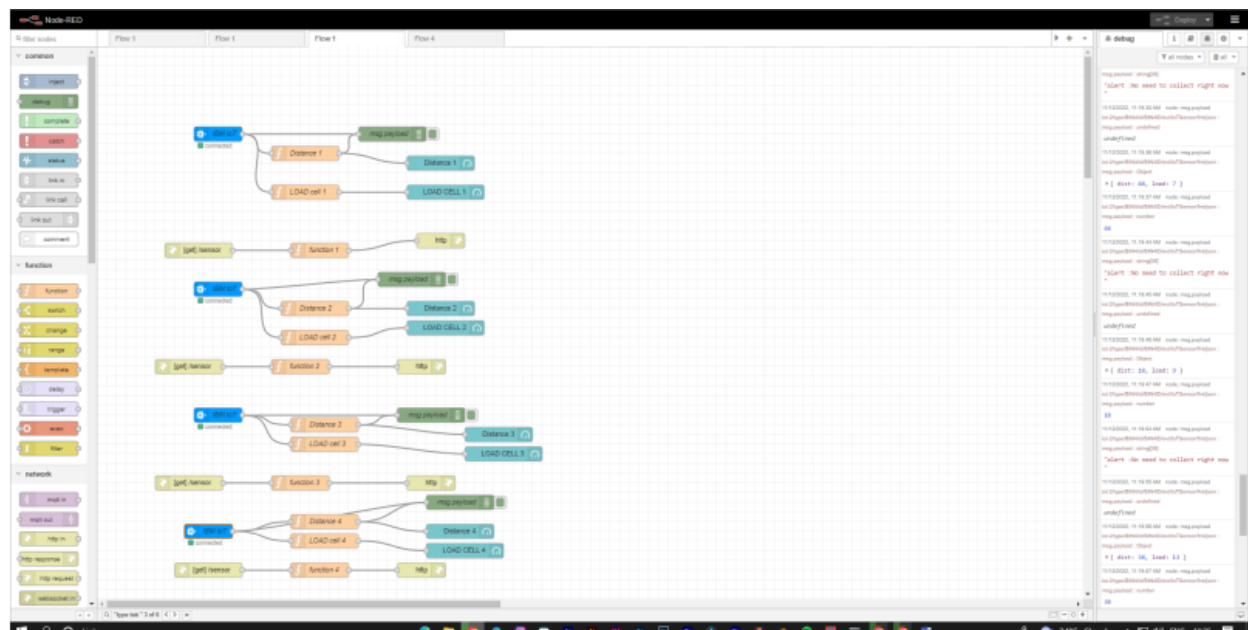
- WE CONNECT WITH YOUR ASSETS
- YOUR BUSSINESS BECOME EFFICIENT
- WE GIVE INFORMATION IN REAL TIME
- TO MAKE BETTER ANALYSIS FOR BIG DATA
- ALL CIVILIZED PERSONS RESPOSIBILITY TO KEEP WORLD CLEAN IS BASIC NEED



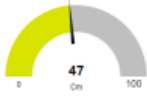
RECYCLE QUOTES :)

OUTPUT IMAGES FROM SIMULATOR:

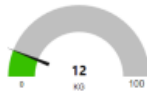




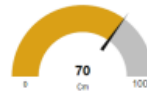
Distance 1



LOAD CELL 1



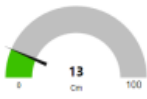
Distance 2



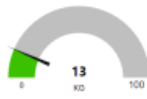
LOAD CELL 2



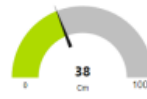
Distance 3



LOAD CELL 3

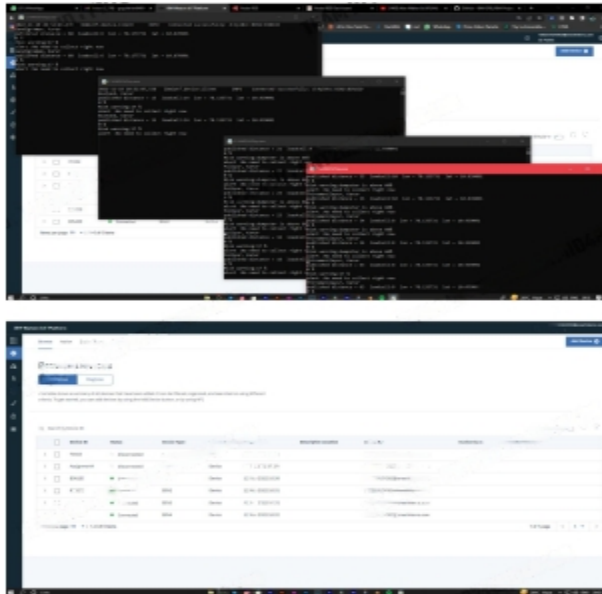


Distance 4



LOAD CELL 4





BENIFITS OF DUMPSTER



- WE CONNECT WITH YOUR ASSETS
- YOUR BUSSINESS BECOME EFFICIENT
- WE GIVE INFORMATION IN REAL TIME
- TO MAKE BETTER ANALYSIS FOR BIG DATA
- ALL CIVILIZED PERSONS RESPONSIBILITY TO KEEP WORLD CLEAN IS BASIC NEED



RECYCLE QUOTES :)

13.3 LINKS

GitHub Link:

<https://github.com/IBM-EPBL/IBM-Project-42299-1660658593>

DEMO LINK:

https://drive.google.com/file/d/1QiOY_8Eg_D47WTRL_RWViZuWYvCpOF7I/view?usp=drivesdk

