# Project Report

| Team ID | PNT2022TMID05259 |
|---|---|
| Project Name | Smart waste management system for metropolitan cities |
| Team Lead | MUTHUMARI   M |
| Team Member 1 | MUTHUKUMARI   T |
| Team Member 2 | MADHUMITHA   C |
| Team Member 3 | PRINCY FUELA I |

## 1. INTRODUCTION

### 1.1  Project Overview:

Our waste generation is constantly growing to form a global garbage crisis. Even though we indulge in creating a more sustainable and greener, we still fail to handle our waste generation and management. Combining technology support with a vision of social, economic and environmental sustainability is the best way out of this problem. It is done in the following manner. The smart bin system undergoes a thorough system check and battery level monitoring in order to function efficiently. If the battery level is found to be low, it has to be recharged immediately, else it can proceed to the next step. The threshold level levels of the bin are indicated my multiple sensors attached to bin. If the garbage exceeds the level, then an alert message is sent to the garbage collectors as well as to the municipality or area administration. The area in which garbage is found to overflow is allocated to respective garbage collectors in the form of messages through GSM system. Once the waste bin is emptied, an information update is sent to the municipality and server is updated. This is how the waste from bins can be efficiently handled and managed using technology which in turn keeps the environment clean and healthy.

### 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

# 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.

## 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. To use the recycle bin, the user must tap his card to the designated RFID reader. Doors to recycling bins are opened, and rubbish is placed one by one.

## 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:

| Problem Statement (PS) | I am (Customer) | I am trying to | But | Because | Which makes me feel |
|---|---|---|---|---|---|
| PS-1 | Council | Monitor the waste in my city | I have not much effective system for monitoring | Because of high cost | unhygienic |
| PS-2 | Council | Manage the waste in my city | I have not much effective system for managing | Because of more time consuming | unsafe |

# 3.IDEATION & PROPOSED SOLUTION:

## 3.1 Empathy map canvas:

## 3.2 Ideation & Brainstorming:
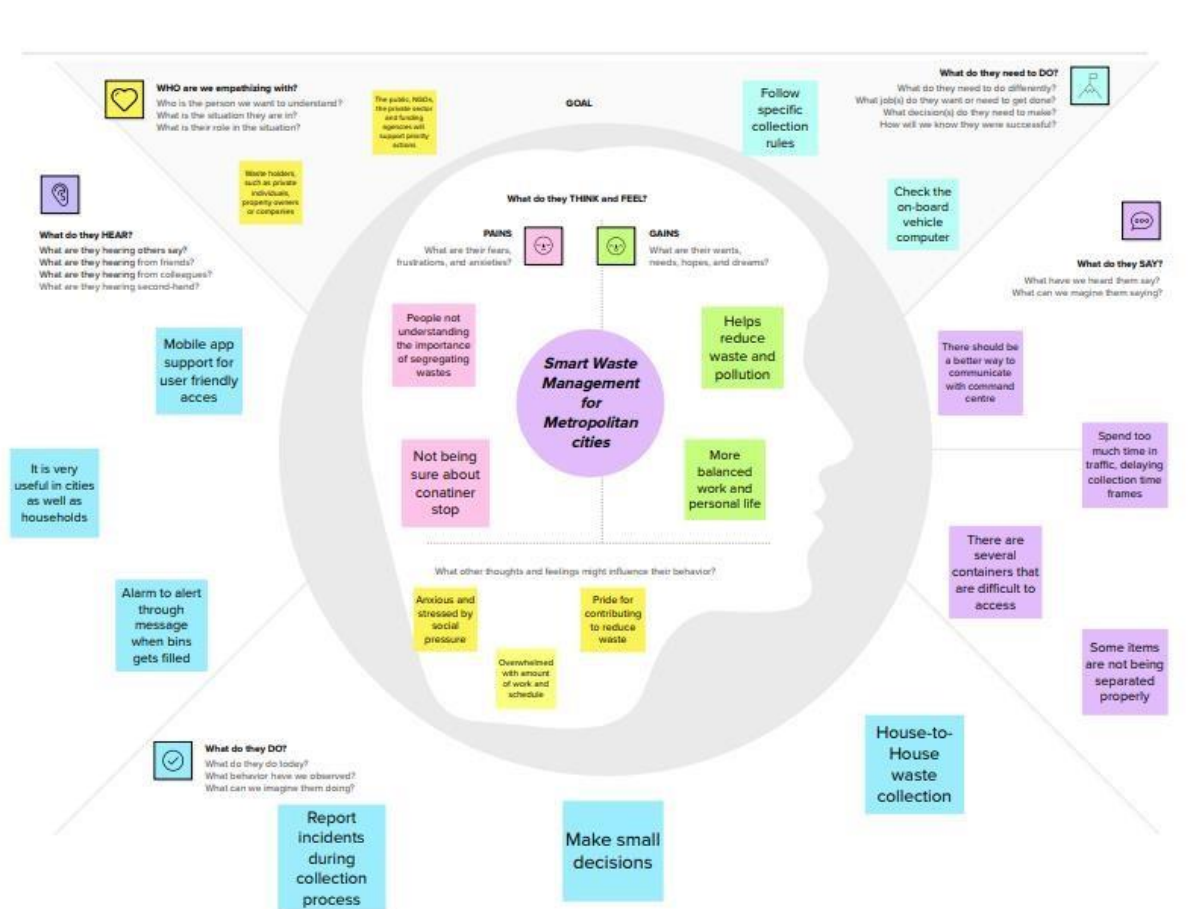


### Brainstorm & idea prioritization

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

**Define your problem statement**

Smart Waste Management System For Metropolitan Cities

**Brainstorm**

**Muthumari M**

| Maximise utilisation of resources | Determine Optimisation Parameters | Leverage Data Inputs from Fleet Technology | Superior Customer Engagement |

**Madhumitha C**

| Precise Collection Time and Weight Reporting | No missed Pickups | Reduced Overflows | Co2 Emission Reduction |

**PrincyFuela I**

| Power Up with Smart Bin Sensors | Fast Digitalization of Inventory | Map Overview of Container Locations | Understand Waste Generation Patterns |

**Muthukumari T**

| Automated Resource & Route Planning | Execute with Mobile In-Cab Technology | Monitor Operations with Live-Tracking | Respond to Live Events with Route Editing |

**Group ideas**

**user identity**

| Messages send to the municipality | Alerting by sending the unique ID |

**Technology used**

IBM watson IOT platform

**Advantages**

Resource Optimization    Fewer smells -cleaner city    Reduce pollution

**Prioritise**

## 3.3 Proposed Solution:

| SI No. | Parameter | Description |
|--------|-----------|-------------|
| 1. | Problem Statement (Problem to be solved) | Detecting the level of garbage and informing the garbage collectors through a proper communication channel about the garbage level and alerts them to collect it at a specified time efficiently. |
| 2. | Idea / Solution description | By using fill level sensors we can detect the garbage level. Improving the communication channel using proper technology like WiMAX. Using GPS for tracking the location of bin and sorting out the short routes. Using cloud service for the storage purpose. |
| 3. | Novelty / Uniqueness | By using IoT, GPS and GSM like technologies which if properly used in the establishment of this project helps to detect the garbage level and intimating about it to the authority and initiating them to collect the garbage on time. |
| 4. | Social Impact / Customer Satisfaction | It keeps our surroundings clean and green and free from bad odour of wastes, emphasizes on healthy environment. Reduces air pollution |
| 5. | Business Model (Revenue Model) | Smart waste management system is an innovative and effective step to analyze the production of waste annually and it helps to find the ways to reduce the factors which increases the waste produced. |
| 6. | Scalability of the Solution | Smart waste management can attain its scalability by still more advancement in IoT and using many sensors to detect its accurate level accurately. Its implementation can be enhanced by using 5G type of technology for faster communication. AI recycling robots can be used in the nearer future. |

## 3.4 Problem solution fit:

### 1. CUSTOMER SEGMENT(S)

Smart waste management is about using technology and data to create a more efficient waste industry. Based on IoT technology , smart waste management aims to optimize resource allocation , reduce running costs and increase the sustainability of waste services.

### 6. CUSTOMER CONSTRAINTS

No separation bits are provided , people leave waste in plastic bags beside roads. Some households purchased waste bins but then others used these bins too. People do not know where to put their garbage because there are no fixed waste collection points or times for garbage collection.

### 5. AVAILABLE SOLUTIONS

Smart waste management is characterized by the usage of technology in order to be more efficient when it comes to managing waste. 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.

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

Identify the pre-incident WMP that best aligns with the specific incident , If applicable. Identify waste management related policy or implementation issues that require resolution.

### 9. PROBLEM ROOT CAUSE | RC

There are significant safety challenges facing the waste/recycling industry. They include chemical exposure combustible dust explosions , machine guarding hazards , and exposure to powerful equipment with moving parts.

### 7. BEHAVIOUR | BE

A reduction in the number of waste collections needed by up to 80% resulting in less manpower , emissions , fuel use and traffic congestion. A reduction in the number of waste bins needed. Analytics data to manage collection routes and the placement of bins more effectively.

### 3. TRIGGERS | TR

By installing this project we can trigger peoples by seeing their neighbour peoples make the utilization of technology more useful and reading about a more efficient solution in the news.

### 10. YOUR SOLUTION

You can put that reusable bottle to use, save money and reduce waste. By taking your own water with you, you'll also reduce your chances of purchasing more expensive beverages on-the-go. This will eliminate the one-time use containers they come in. While most cans and bottles can be recycled, they require a lot of energy to be produced, shipped to the bottling facility and then to the store for purchase.

### 8. CHANNELS of BEHAVIOUR | CH

8.1 ONLINE
People may provide review and rating for the system.

8.2 OFFLINE
People may provide a valuable resource and contribution to the organization.

### 4. EMOTIONS: BEFORE / AFTER | EM

After the implementation of smart waste management system our environment will be neat and clean.

## 4.REQUIREMENT ANALYSIS

## 4.1 Functional requirement

| 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 semiautomated 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:

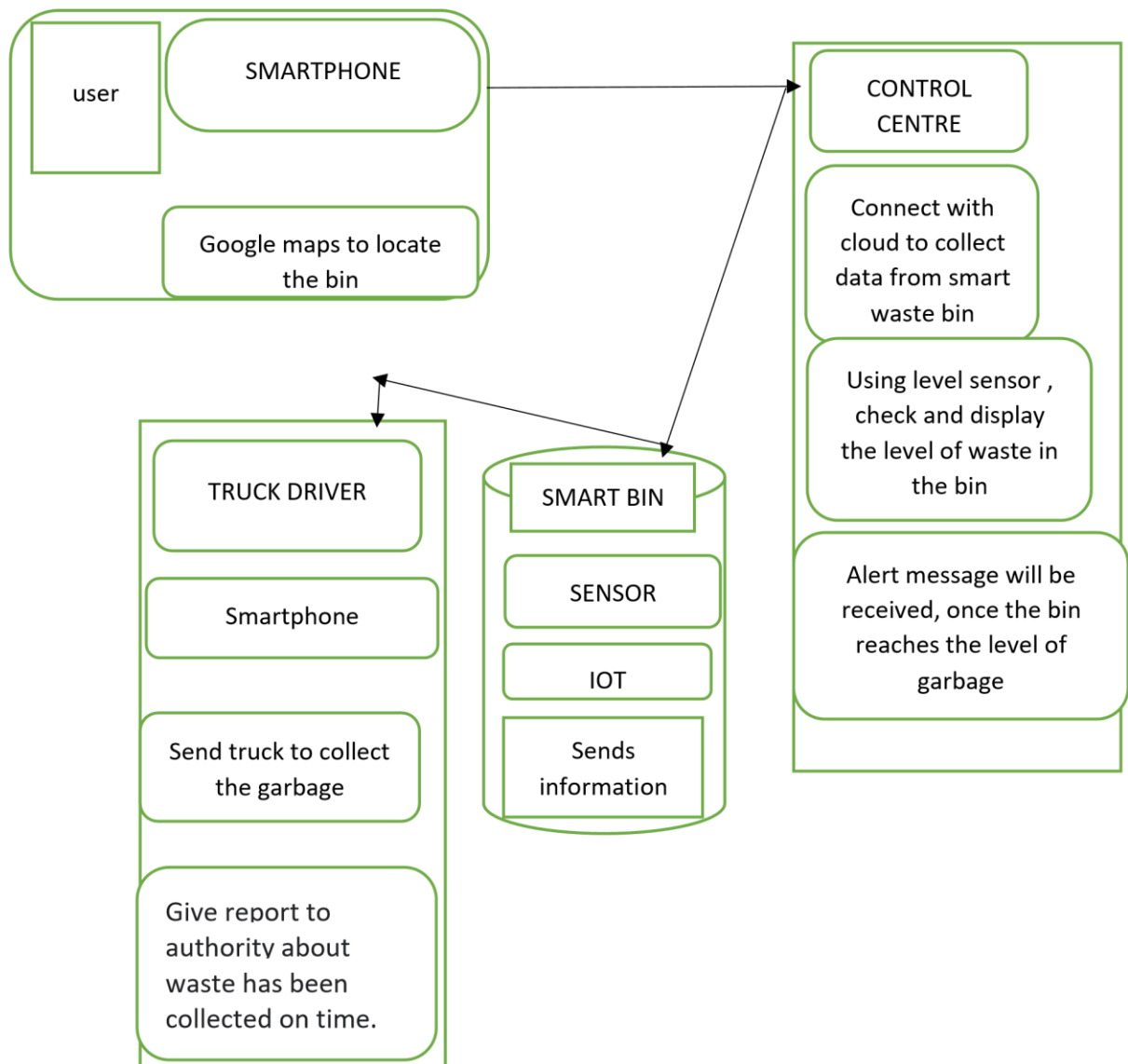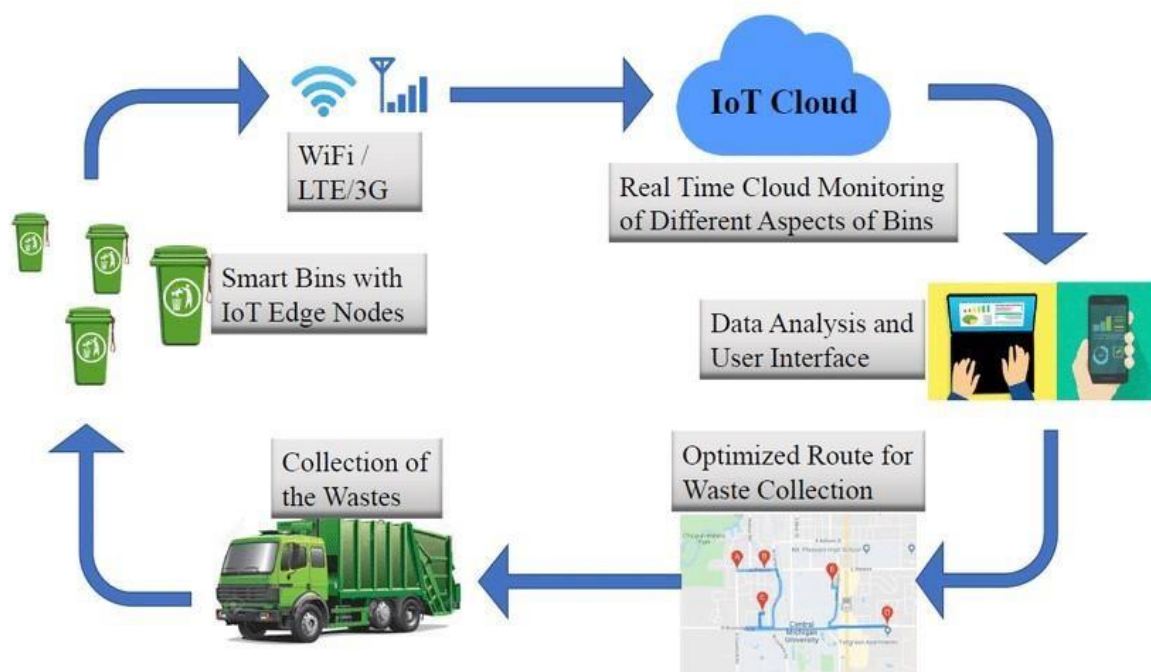| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | Usability is a unique and significant perspective to examine user needs, which may further enhance the design quality, according to IoT devices. Analysing how well people interact with a product may help designers better understand customers' prospective demands for waste management, behaviour, and experience in the design process when user experience is at the Centre. |
| NFR-2 | **Security** | Utilize recyclable bottles. Utilize reusable shopping bags. Spend responsibly and recycle Eat and drink in limited-use containers. |
| NFR-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. |
| NFR-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. |
| NFR-5 | **Availability** | By creating and implementing robust hardware and gorgeous software, we enable cities, companies, and nations to manage garbage more intelligently. |
| NFR-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 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:**

## SMARTPHONE

user

Google maps to locate the bin

## CONTROL CENTRE

Connect with cloud to collect data from smart waste bin

Using level sensor , check and display the level of waste in the bin

Alert message will be received, once the bin reaches the level of garbage

## TRUCK DRIVER

Smartphone

Send truck to collect the garbage

Give report to authority about waste has been collected on time.

## SMART BIN

SENSOR

IOT

Sends information

**5.2 Solution & Technical Architecture:**



**5.3 User stories:**

| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|-----------|-------------------------------|-------------------|-------------------|---------------------|----------|---------|
| Admin(who manages server) | Web server login | USN-1 | As a admin, I can able to track the truck driver name, id, contact number, location, and also the location of the dustbin. | I can Manage and direct workers through web server | High | Sprint-1 |

| Co-Admin | Login | USN-2 | As a co-admin I'll monitor the workers, whether the work has been done properly, checking the availability of workers and also monitor the waste collected by the truck driver within the scheduled time | I can monitor the garbage bin activity | High | Sprint-1 |
|---|---|---|---|---|---|---|
| Customer (Web user) | User | USN-3 | As a user , I can able to raise queries to higher authorities about the maintenance and disposal of waste | I can raise queries | Medium | Sprint-2 |
| Customer Care Executive | Worker | USN-4 | As a customer care executive I will try to rectify the queries from customers by contacting coadmin. In case of emergency situation query can be reported to Admin. | I can attend calls and respond people and solve their problems | High | Sprint-1 |

| Truck driver | Worker | USN-5 | The truck driver is a worker who has been assigned to collect the garbage and he have to report to admin about when and where and also the timings , the garbage has been picked up according the daily schedule. | I will do the work properly and report the data at the scheduled time | High | Sprint1 |
|---|---|---|---|---|---|---|

## 6.PROJECT PLANNING & SCHEDULING:

### 6.1 Sprint Planning & Estimation:

| PHASE | TITLE | DESCRIPTION |
|---|---|---|
| Ideation Phase | Literature Survey & Information Gathering | Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc. |
| | Prepare Empathy Map | Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements |
| | Ideation | List the by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance. |

| Phase-1 | Proposed Solution | Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc. |
|---|---|---|
| | Problem Solution Fit | Prepare problem - solution fit document. |
| | Solution Architecture | Prepare solution architecture document. |
| Phase-2 | Customer Journey | Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit). |
| | Functional Requirement | Prepare the functional and Nonfunctional requirement document. |
| | | |
| | Data Flow Diagrams | Draw the data flow diagrams and submit for review. |
| | Technology Architecture | Prepare the technology architecture diagram. |
| Project planning phase | Prepare Milestone & Activity List | Prepare the milestones & activity list of the project. |
| Project development phase | Project Development - Delivery of Sprint-1, 2, 3 & 4 | Develop & submit the developed code by testing it. |

## 6.2 **Sprint Delivery Schedule:**

| Sprint | Functional Requirement (Epic) | Task | Story Point-s | Priority | Team Members |
|---|---|---|---|---|---|
| Sprint-1 | Registration | As a team lead, I can enrolled for the project by entering my email, password and within that I can enter my team members name and their email. | 2 | High | Muthumari |
| Sprint-1 | | As a team lead, I will receive confirmation email once, I have enrolled for the project with team id and along with team members name. | 2 | High | Muthumari |
| Sprint-2 | Login | As a team member, I can login to the IBM portal by entering email & password | 1 | Medium | Madhumitha |
| Sprint-2 | | As a team member, I can login to the IBM portal by entering email & password | 1 | Medium | Princy fuela |
| Sprint-2 | | As a team member, I can login to the IBM portal by entering email & password | 1 | Medium | Muthukumari |
| Sprint-2 | | As a team member, I can login to the IBM portal by entering email & password | 1 | Medium | Madhumitha |

## **Project Tracker, Velocity & Burndown Chart:**

| Sprint | Total Story Points | Duration | Sprint StartDate | Sprint End Date (Planned) | Story Points Completed ( Planned End Date) | Sprint Release Date (Actual) |
|---|---|---|---|---|---|---|
| Sprint-1 | 20 | 6 Days | 22 Oct 2022 | 27 Oct 2022 | 20 | 06 Nov 2022 |
| Sprint-2 | 20 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | 30 | 07 Nov 2022 |
| Sprint-3 | 20 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | 49 | 08 Nov 2022 |
| Sprint-4 | 20 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | 50 | 09 Nov 2022 |

# 6.3 Reports from JIRA:

**Burnout Chart:**
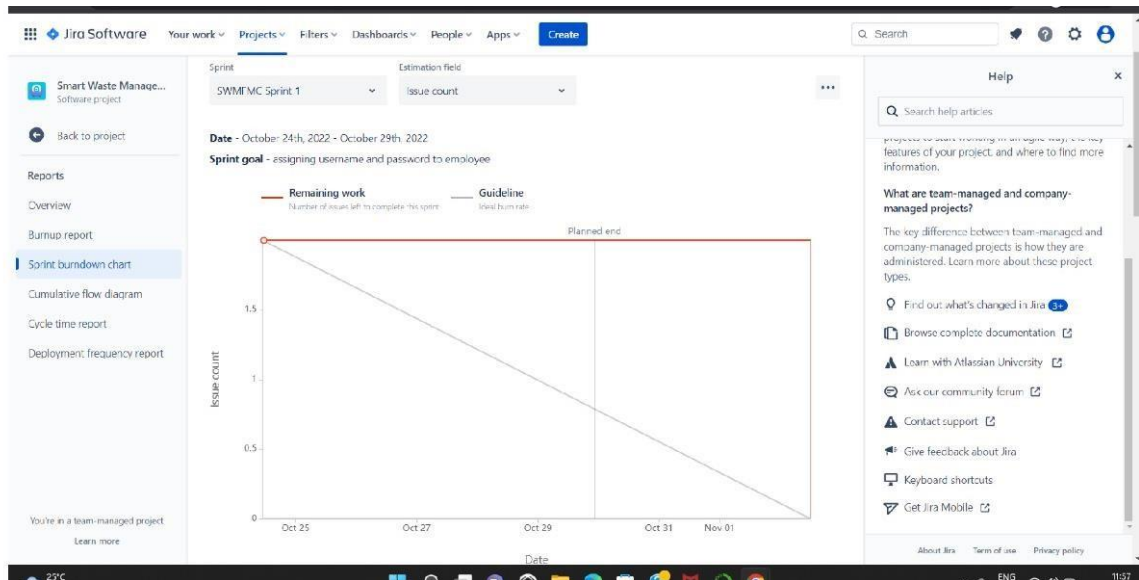


**Road map:**
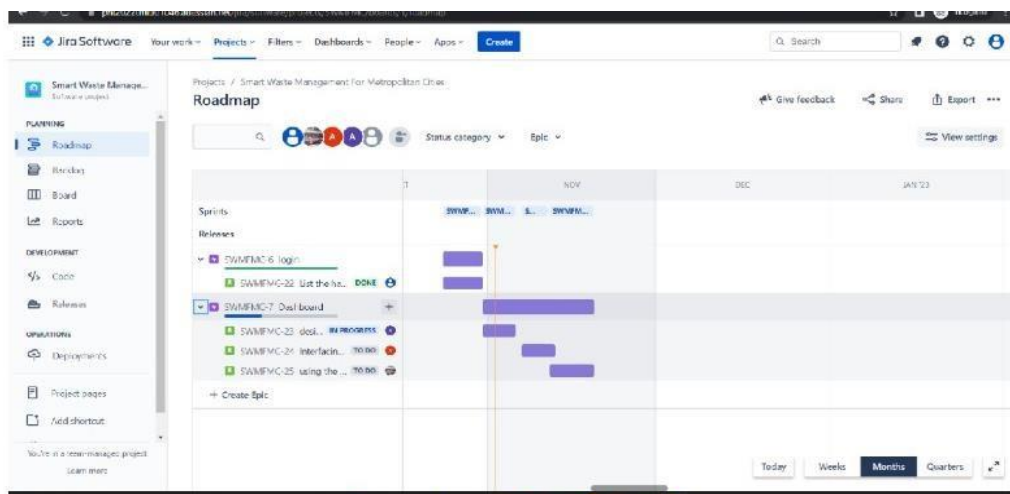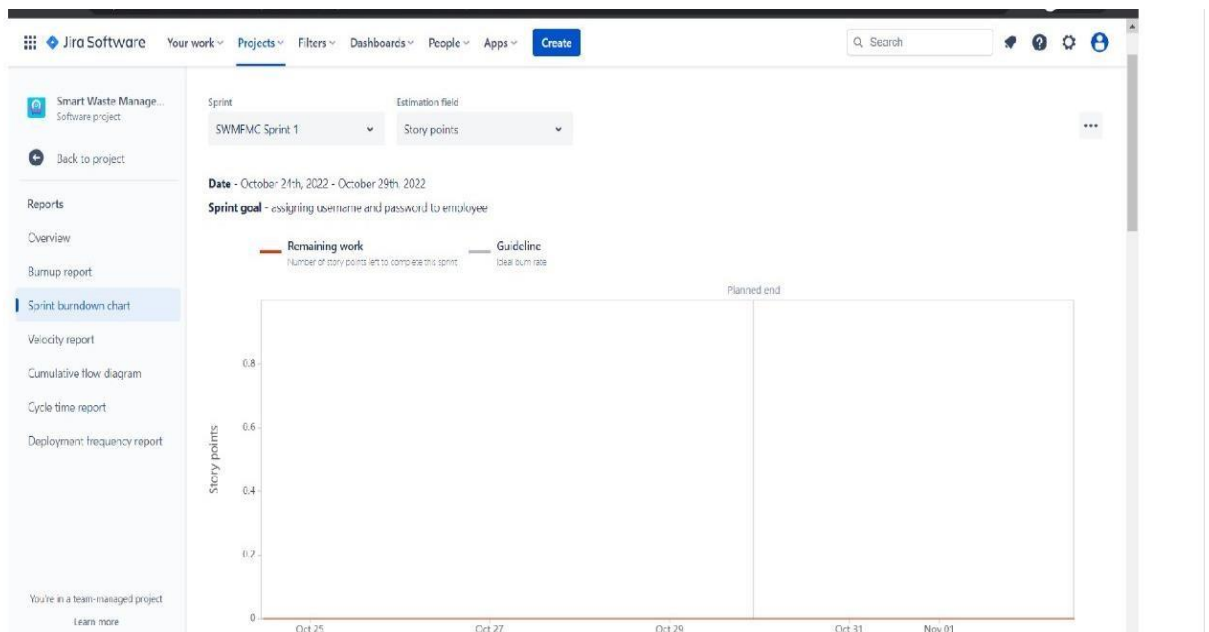
# 7.CODING & SOLUTIONING:

## 7.1 Feature 1- LOCATION TRACKER:
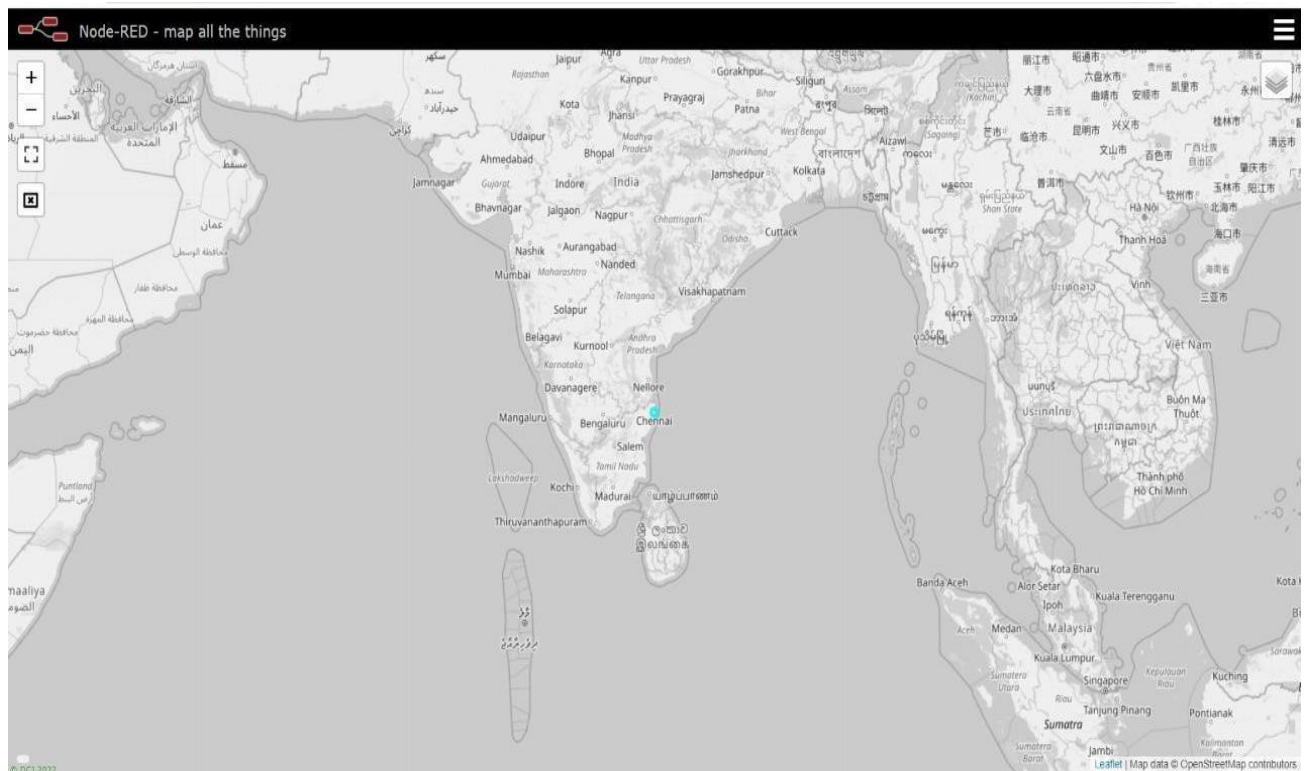
## 7.2 Feature 2- LIVE UPDATE ON COLLECTED DATA:



## 8. Testing:
### 8.1 Testcases:

| TEST CASE ID | FEATURE TYPE | COMPONENT | TEST SCENARIO | PRE REQUISITE | STEPS TO EXECUTE | TEST DATA | EXPECTED RESULT | ACTUAL RESULT | STATUS | COMMENTS | TC FOR AUTOMATION( Y/N) | BUG ID | EXECUTED BY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOGIN PAGE_TC _001 | FUNCTIONA L | HOME PAGE | VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIG N UP WEN USER CLICK ON MY ACCOUNT BUTTON | | 1.ENT ER URL AND CLICK GO 2.VER IFY LOGIN/SI GN UP | https:// 169.51.20 4.219.30 106 | L0gin page is visible | Working as expected | PASS | **Successful** | | | **MADHUMITHA C** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOGIN PAGE_TC _002 | UI | HOME PAGE | VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIG N UP WEN USER CLICK ON MY ACCOUNT BUTTON | | 1.ENT ER URL AND CLICK GO 2.VER IFY LOGI N/SI GN UP Eleme nts a.ID text b o x B . passw ord text box c..logi n butto n D.ne w user E.alre ady have an accou nt | https:// 1 69.51.2 0 4.219.3 0 106 | Applicat ion should show below UI elemen t | Workin g as expecte d | PASS | Succ ess full | | | **PRINCY FUELA I** |
| LOGIN PAGE_TC _003 | FUNCTI ONA L | LOGI N PAGE | VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIG N UP WEN USER CLICK ON MY ACCOUNT BUTTON | | 1.ent er url and click go 2.click on my accou nt 3.Ent er valid ID 4.Ent er valid passw ord 5.click on login | Id:1111 passwo r d:5678 | User should navigat e your home page. | Workin g as expecte d | PASS | Succ ess ful | | | **PRINCY FUELA I** |

| | | | | | button | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOGIN | FUNCTIONA | LOGIN | VERIFY | | 1.enter url | Id:1111 | Confirm | Workin | PASS | Success | | | **MUTHUKUMARI T** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PAGE_TC_004 | L | | PAGE | THE USER IS ABLE TO SEE THE LOGIN/SIGN UP WEN USER CLICK ON MY ACCOUNT BUTTON | and click go 2.click on my account 3.Enter valid ID 4.Enter valid password 5.click on login butvton | password:5678 | ation message sent | g as expected | | ful | | | |
| LOGIN PAGE_TC_005 | UI | | LOGIN PAGE | VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIGN UP WEN USER CLICK ON MY ACCOUNT BUTTON | 1.enter url and click go 2.click on my account 3.Enter valid ID 4.Enter valid password 5.click on login button | Id:1111 password:5678 | Confirmation message sent | Working as expected | PASS | Successful | | | **MUTHUMARI M** |

| LOGIN PAGE_TC_006 | FUNCTIONAL | LOGIN PAGE FOR ADMIN | VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIGN UP WEN USER CLICK ON MY ACCOUNT BUTTON | 1.enter url and click go 2.click on my account 3.Enter valid ID 4.Enter valid password 5.click on login button | Id:1111 password:5678 | Customer database is visible | Working as expected | PASS | Successful | | | **MUTHUMARIM** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

8.2 **User acceptance Testing:**

**¹. Purpose of Document**

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

**2. Defect Analysis**

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

| Resolution | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|---|---|---|---|---|---|
| By Design | 10 | 4 | 2 | 3 | 20 |
| Duplicate | 1 | 0 | 3 | 0 | 4 |
| External | 2 | 3 | 0 | 1 | 6 |
| Fixed | 11 | 2 | 4 | 20 | 37 |

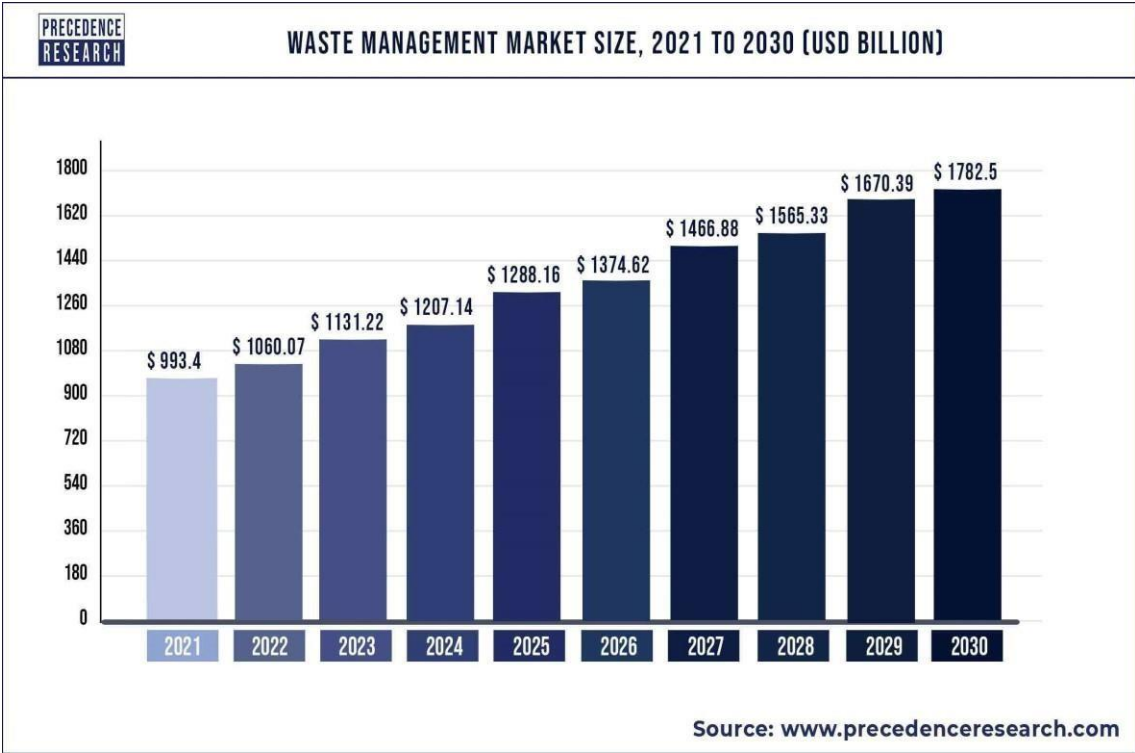| | | | | | |
|---|---|---|---|---|---|
| Not Reproduced | 0 | 0 | 1 | 0 | 1 |
| Skipped | 0 | 0 | 1 | 1 | 2 |
| Won't Fix | 0 | 5 | 2 | 1 | 8 |
| Totals | 24 | 14 | 13 | 26 | 7 |

**1. Test Case Analysis:**

This report shows the number of test cases that have passed, failed, and untested

| Section | Total Cases | Not Tested | Fai l | Pas s |
|---|---|---|---|---|
| Print Engine | 7 | 0 | 0 | 7 |
| Client Application | 51 | 0 | 0 | 51 |
| Security | 2 | 0 | 0 | 2 |
| Outsource Shipping | 3 | 0 | 0 | 3 |
| Exception Reporting | 9 | 0 | 0 | 9 |
| Final Report Output | 4 | 0 | 0 | 4 |
| Version Control | 2 | 0 | 0 | 2 |

## 9.RESULTS:

### 9.1 Performance Metrics:



Global Waste Management Market Value and Growth, 2016 – 2026 (US$ Mn) (Y-o-Y %)

Revenue (US$ Bn) — Y-o-Y %

Source: Credence Research Analysis



WASTE MANAGEMENT MARKET SIZE, 2021 TO 2030 (USD BILLION)

$ 993.4, $ 1060.07, $ 1131.22, $ 1207.14, $ 1288.16, $ 1374.62, $ 1466.88, $ 1565.33, $ 1670.39, $ 1782.5

Source: www.precedenceresearch.com
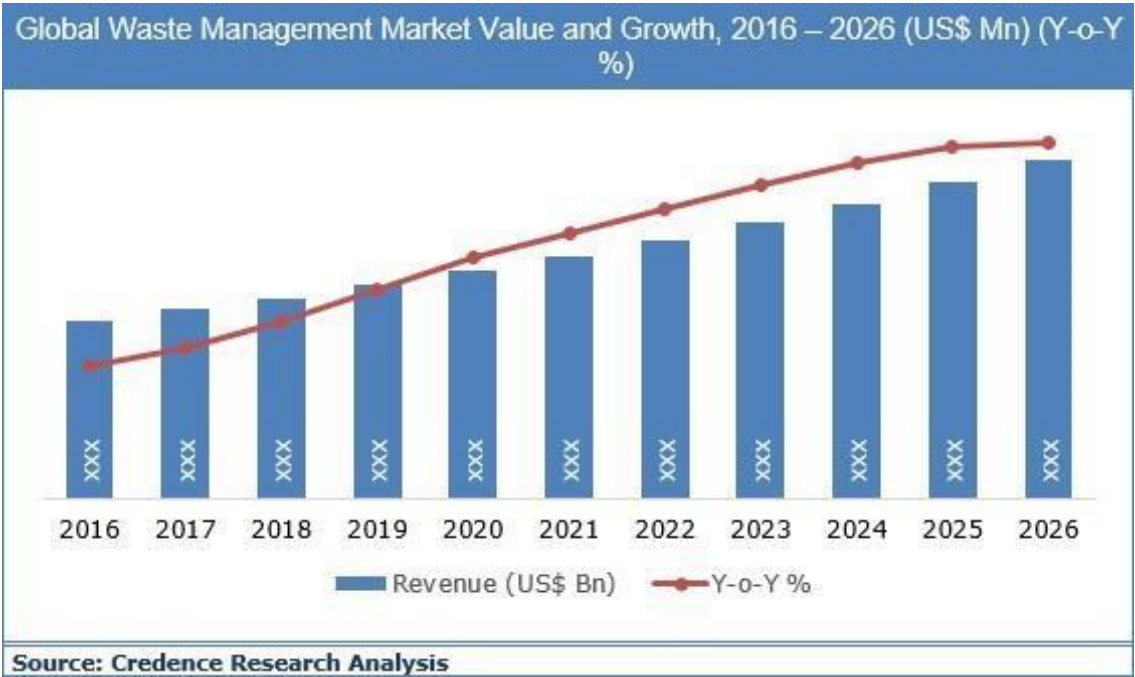
# 10. ADVANTAGES & DISADVANTAGES

### 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.

# 11. 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.

# 12. 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

# 13. Appendix:

```
# Project : Smart Waste
Management # Team ID :
PNT2022TMID01046 import requests
import json import
ibmiotf.application import
ibmiotf.device import time import
random import sys

# watson device details
 organization        =
"ms9s4l"   devicType  =
"Project"  deviceId   =
"TMID01046" authMethod=
"token"     authToken=
"13150415"

#generate random values for randomo variables for distance and loadcell


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:
```

```
deviceCli = ibmiotf.device.Client(deviceOptions) except
Exception as e:
        print("caught exception connecting device %s" %str(e))
sys.exit()

#connect and send a datapoint "distance and loadcell" 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 %"
 elif loadcell < 4 and loadcell > 7:
        load = "40 %"
else:
        load = "0
%"
if distance < 15:
        dist = 'Risk warning:' 'Dumpster poundage getting high, Time to
collect :) 90 %'

                elif distance < 40
and distance >16:
        dist = 'Risk warning:' 'dumpster is above 60%'
                elif distance < 60
and distance > 41:        dist =
'Risk warning:' '40 %'    else:
        dist = 'Risk warning:' '17 %'

                        if
load == "90 %" or distance == "90 %":
        warn = 'alert :' 'Risk Warning: Dumpster poundage getting high,
Time to collect :)'                  elif
load == "60 %" or distance == "60 %":
                warn = 'alert :'
```

```
                warn   = 'alert :' 'Risk Warning: Dumpster poundage getting high,
    Time to collect :)'                             elif
    load == "60 %" or distance == "60 %":
                            warn = 'alert :'
    'dumpster is above 60%'       else :
            warn = 'alert :' 'No need to collect right now '
    if distance <20:
            warn={'alert':'NEED BIN CHANGE!!!!!!'}
            def
    myOnPublishCallback(lat=10.939091,long=78.135731):
        print("Chennai")          print("published distance = %s
    " %distance."loadcell:%s "
    %loadcell,"lon = %s " %long,"lat = %s"
    %lat)         print(load)
    print(dist)          print(warn)
```

```
    time.sleep(10)


    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(10)




    deviceCli.commandCallback=myCommandCallback
#disconnect the device
deviceCli.disconnect()
```

## GitHub Link: