SONA COLLEGE OF TECHNOLOGY
SALEM.

IBM PROJECT REPORT

Team ID	**PNT2022TMID19022**
Project Name	**Smart waste management system for metropolitan cities**

Team members:
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1)INTRODUCTION

PROJECT OVERVIEW:

Our waste generation is constantly growing to form global garbage crisis. Even though we indulge in creating a more sustainable and genuine, we still fail to handle out 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 levels of the bin are indicated my multiple sensors attached to bin. If the garbage exceeds the level, then an alertmessage 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 inthe form of messages through GSM system. Once the waste bin is emptied, an informationupdate 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.

ABSTRACT:

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.

They make well possible and more efficient routes for the trash collectors who empty the bins, butalso 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 make 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. The smart waste management provides us with the most optimal way of managing the waste in an efficient manner using technology.

2)LITERATURE SURVEY:

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.

3)REFERENCES

PAPER 1:

Development of automatic smart waste sorter Machine.Mahmudul Hasan Russel, Mehdi Hasan Chowdhury, Md Shekh Naim Uddin, Ashif Newaz, Md Mehdi Masud Talukder International Conference on Mechanical, Industrial and Materials Engineering 1, 2013

At present solid waste management is a major concern in the metropolitan cities of the developing and developed countries. As the population is growing, the garbage is also increasing. This huge unmanaged accumulation of garbage is polluting the environment, spoiling the beauty of the area and also leading to health hazards. In this era of Internet, IOT (Internet of Things) can be used effectively to manage this solid waste. In this paper, we have discussed the definition of Internet of Things and its elements, testing and prototyping tool cooja simulator and finally the study of various literatures available on smart waste management system using IOT.Managing waste effectively and recycling efficiently, a nation can ahead one step forward. For sorting metal and glass conventional sensors are used and for sorting paper and plastics a sensor using LASER and LDR is developed. A weight sensor and counter is used to find out the amount of sorted materials. By using the proper recycling system, the curse of waste will turn into blessings for civilization. The sorting procedure will make recycling more efficient. By means of this waste sorter, the conventional waste management system will be transformed into a Smart system. This Smart system will help to make our environment more suitable for living,reducing global warming and making the world healthier

PAPER 2:

Smart waste management using Internet of Things: A survey

KN Fallavi, V Ravi Kumar, BM Chaithra

2017 International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC), 60-64, 2017

At present solid waste management is a major concern in the metropolitan cities of the developing and developed countries. As the population is growing, the garbage is also increasing. This huge unmanaged accumulation of garbage is polluting the environment, spoiling the beauty of the area and also leading to the health hazard. In this era of Internet, IOT (Internet of Things) can be used effectively to manage this solid waste. In this paper, we have discussed the definition of Internet of Things and its elements, testing and prototyping tool cooja simulator and finally the study of various literatures available on smart waste management system using IOT.

PAPER 3:

IoT enabled smart waste bin with real time monitoring for efficient waste management in metropolitan cities Manju Mohan, R Chetty, Vijay ram Sriram, Mohd Azeem, P Vishal, G Pranav International Journal of Advanced Science and Convergence 1 (3), 13-19, 2019

Background/Objectives:Waste bins are part of our lives for decades and mostly its condition are overflowing due to improper waste dumping, collection and management, which leads in foul smell and unhygienic condition, thus inherently results in environment pollution.Methods/Statistical analysis: Therefore, in this paper, design of a Waste Bin with real time monitoring is presented and a smart waste management system is proposed using the recent technical advancements of automation and Internet of Things (IoT). Findings: The capacitance sensor in the bin continuously monitors the level of the bin in real time and communicates to the central cloud where the bins are connected. Ultrasonic sensor is used to open and close the lid of the bin whenever the persons are nearby the bin. Such smart bins are connected to the cloud, where the bin status are communicated, recorded and monitored by the local bodies through and android app or a centralized server. Improvements/Applications: Thus the designed smart bin and proposed waste management system have better level of smartness compared to existing ones in metropolitan cities in a centralized manner.

PAPER 4:

Smart Waste Management using Internet-of-Things (IoT) Gopal Krishna Shyam, Sunilkumar S. Manvi, Priyanka Bharti

To make the cities greener, safer, and more efficient, Internet of Things (IoT) can play an important role. The proposed system is based on the foundation of geographic information systems (GIS), and optimization algorithms. It consists of an IoT based prototype with sensors to measure the waste volume in containers or wastebins, with facility to transmit information over the Internet. The data obtained through sensors is transmitted over the Internet to a server for storage and processing mechanisms. It is used for monitoring the daily selection of wastebins, based on which the routes to pick several of the wastebins from different locations are decided. Every day, the workers receive the updated optimized routes in their navigational devices. The significant feature of this system is that it is designed to update from the previous experience and decide not only on the daily waste level status but also the predict future state with respect to factors like traffic congestion in an area where the wastebins are placed, cost-efficiency balance, and other factors that is difficult for humans to observe and analyze.

PAPER 5:

IoT-Based Smart Waste Bin Monitoring and Municipal Solid Waste Management System for Smart Cities Tariq Ali, Muhammad Irfan, Abdullah Saeed Alwadie, Adam Glowacz

The design of an IoT-based smart waste collection and monitoring system is accomplished with the help of required hardware, software/programming tools and other IoT devices. This system aims to provide support in solid waste management for the municipality of Najran city of Saudi Arabia in order to handle the collection of waste generating at rapid growth. In addition, this system is enabled to detect the fire (faming) inside the bins that would help in saving human life and economic losses. The proposed system is developed based on the waste level data from the smart bins in a city. Three fill-up levels have been defined in the system to check the status of waste in the bins-Full level, Half level and Empty level. It has been observed in the results that waste collected through IoT-based system is more effective as compared to traditional methods. The real-time filling status monitoring improves the efficiency of average waste collection due to same-day collection of bins as it becomes full and by reducing the effect of pollution ratio into the environment.

PAPER 6:

Smart Garbage Monitoring System Vijayaganth V, Sanjaykumar D, Ravi Varma K,Yukisedhu R

Every year, enormous amounts of plastics and other debris are created that are not currently recycled in any facilities. We created an application called “Smart Garbage Monitoring Application Using IOT” to provide a solution for the garbage. Technology has a critical role in making human life more convenient and comfortable. The environment shall be preserved, and the Swachh Bharat Mission for cleanliness will be supported. We are gathering sensor values for display in the android application in this project. The sensor values are uploaded to the cloud (Think speak), retrieved from the cloud, then the retrieved data are shown in android app. An alert will besent to the Android app when the waste reaches the garbage bin's threshold value, or when the weight surpasses the threshold value,or when pollution levels rise within the garbage bin.

PAPER 7:

IoT Based Smart City Garbage Bin for Waste ManagementE Shanthini, V Sangeetha, M Jagadeeshwari, B Shivani, P Selvapriya, K Anandita, D Divyashree U Suryanarayanan

Waste disposal is one of the most strenuous tasks in urban planning. One of the key problems in waste management is negligence which eventually causes the overflowing of the garbage bins. The traditional way of garbage vehicles picking up the trash at a certain is highly ineffective as they are poorly monitored and cause an imbalance in the proper clearing of garbage. The residual garbage that is overflowing is a serious health and societal hazard causing troubles such as bad odor, spreading of diseases, and even pest infestation. To optimize and organize the issue this paper puts forward an “IoT-based smart city garbage bin” as a solution. The smart garbage bin is

equipped with a Node MCU microcontroller with open wi-fi and water proof sensors is mounted on the lids of the bin to ensure the status of the bin. To facilitate the entire system to the user, a mobile application is developed for optimal monitoring of garbage.

PAPER 8:

Smart bin Waste Segregator System Helen, Karthika, Selvakumar, Thenmozhi

Rapid population growth has led to the daily volume of waste increasing by leaps and bounds A serious problem for local governments is to take prudent measures to manage landfill waste and to classify and transport it. This paper explains the design of a system to properly collect and separate waste from the public trash can, using the Internet of Things (IoT). In this paper, the trash level is measured and monitored with an ultrasonic sensor and the Blynk app. An automatic locking system prevents trash from overflowing. It also submits the garbage level details to the authority using the Blynk app and the Node Microcontroller Unit (NodeMCU). It alsoexplains the disposal mechanisms using intelligent waste segregator. This smart IOT-based system is accurate, easy to use, and inexpensive.

PAPER 9:

Smart Waste Monitoring System using IoT Hemangi Lonkar, Shiwali Charjan , Arpit Bansod, Amisha Ganvir

The concept of the Internet of Things (IoT) is something in which surrounding things are connected using wired or wireless communication without manual intervention. Internet of Things as a technology performs sensing, activate, data assembly, storing, and processing by connecting devices to the Internet. This paper aims to plan for a handy solution to the problem that most economies are facing today. The monitoring system enables the period by which the bin will be filled. Ultrasonic sensors will measure the distance between the lid and communicate it to the server and it can also be seen through mobile applications. The proposed waste management is based on a cluster of sensors and controllers. It is done using the moisture sensor and IR sensor where the moisture sensor detects the wetness in the waste only when the wet container is opened. Once the garbage container is filled in a particular area, the garbage collector can locate the filled garbage container and can collect the waste. Two of the important features include is checking the volume that the bin can hold and the other is interpreting the data and sending it to the cloud system for monitoring.

PAPER 10:

Smart and Integrated Garbage Management Application using IoT Kuntan Paul, Arpan Mukherjee, Debarita Debnath, Tiya Dey Malakar

One of many burning problems of our society now is littering, even in the circumstances where sufficient garbage disposal measures are implemented. This is caused due to poorly maintained dustbin management system and irregular cleansing of the bins. This problem alone is resulting in lots of other issues, as well, which can sometimes cause harm to our social aesthetics. So, this paper is a proposal of an IoTbased smart and easy-to-implement-in-any-place solution, consisting of hardware, software, database and communication in between them, to optimize this problem with real-time analysis of data and responding to them accordingly. This smart garbage management system will fetch data from its hardware systems installed in the critical end-points and upload all the data received to the database which can be easily accessible to user (or customer) end. The data collected by each hardware will be checked against a threshold to send logical commands which dustbin is to be emptied and when—which will solve the unwanted littering problems caused due to unnoticed filling of bins.

PAPER 11:

An IoT Based Approach in Automatic Garbage Segregator Amara Aditya Manikanda, Rohit Tanwar, Aviral Kumar Srivastava, Kratika Arora

Effective waste management is a major problem across the world. The lack of dumping space, less awareness among people and requirement of high economical resources are some of the issues that add on to the criticality of the problem. Segregation of waste is the preliminary step to manage waste. Scarcity of adequate knowledge on the same makes most of the population unable to segregate and store waste at the domestic level or while dumping. Generally, the waste is segregated at dumping sites manually, and from there different types of waste are scheduled to their destinations. This uses more workforce and money for providing daily wages to the workers. In this paper, a brief study of smart bins has been done. A smart device has been proposed to segregate garbage using an IoT-based approach. The main aim of the project is segregation of the waste into biodegradable and non-biodegradable.

PAPER 12:

SMART GARBAGE DISPOSAL SYSTEM Prof. Vaibhav Anil Kamble, Shivaraj Manik Gaikwad, Ganesh Sanjay Misal

Waste collection and management is often discerning as a low tech undertaking. However, IoT- and ML- based solutions have the power totransform individual waste containers into a web of smart, connected objects. A dumper truck database has been generated in the given system so that data and details of dumper truck ID, meeting date, meeting time of garbage collection, and so on are collected. 'is technique keeps track of all the truck driver’s activities and the waste gathering system of waste management. 'Is system allows on-time waste gathering and allows

automobile trace through database making use of Global Positioning System (GPS) automation.i'e system proposed.

PAPER 13:

Garbage Level Monitoring Device Using Internet of Things with ESP8266Jubin Dipakkumar Kothari

Jubin Dipakkumar Kothari (2018). Garbage Level Monitoring Device Using Internet of Things with ESP8266. International Journal of Innovative Research in Computer and …, 2018Generally, in metropolitan cities, we see that the refuse repositories or dustbins put at public spots are over-trouble. It makes unhygienic conditions for people similarly as unpalatable to that Place, leaving a horrible odor. To avoid every such situation, we will execute an IoT-based Smart Garbage and Waste Collection canisters. These dustbins are interfaced with a microcontroller-based structure having IR remotesystems close by the central structure showing the current status of waste on portable web programs with HTML page by wi-fi. In this manner, the status will be invigorated onto the HTML page. A critical part of our endeavor depends on the wi-fi module's working, fundamental for its utilization. This current endeavor's central point is to diminish HR and attempts close by a smart city vision's overhaul.

PAPER 14:

Trash Management for Smart Cities-An Intelligent Approach for Garbage CollectionAmit Sinha, Kanika Gupta, Rajnesh Kumar Singh, Aatif Jamshed

Proceedings of the International Conference on Innovative Computing & Communication (ICICC), 2021

The paper proposes a new approach for trash management in the form ofintelligent Garbage Bins. The bins are assembled with different sensors and handled by a mobile application. The input signals received from different sensors and properties of image processing are the two significant features of the proposed model. In today’s environment, the amount of solid waste is increasing day by day. It is a big concern for municipal persons also. The initiative of Government ofIndia to develop smart cities contains trash management (Garbage collection and monitoring) in the priority list. This must be handled in the initial phase of the development of smart cities. The existing garbage collection and disposal system need lots of improvement as they are unable to handle real life problem. The present paper proposes an intelligent model for garbage collection with automatic features which is very useful for smart cities. It uses GPRS theory and works through communication network technology. The formation of intelligent garbagebins, its positioning system and overflow monitoring system are the major points of the

proposed work. A unique identifier is assigned to every bin that helps to locate the bin and to reach at the specified position of the bin.

PAPER 15:

Smart waste management paradigm in perspective of IoT and forecasting models Mohd Anjum, Sana Shahab, Mohammad Sarosh Umar

International Journal of Environment and Waste Management 29 (1),

34-79, 2022

Municipal solid waste management has evolved as a major component of smart city services that encompasses a variety of tasks from household collection to final disposal/recycling. This paper critically discusses, firstly, mathematical and statistical aspect of solid waste management services in the direction of smart city development. Secondly, it proposes novel and intelligent waste management architecture through adoption of state-of-art internet of things (IoT) technologies.Mathematical and statistical aspect covers the comprehensive information of forecasting models. This paper classifies the models on the basis of influencing factors (socio-economic and demographic), planning period (short, medium and long) and ranking methods in order to foresee the amount of waste generated. Paper also emphasises on adoption of IoT technologies in proposed wastemanagement architecture and a comprehensive and thorough survey of IoT technologies is also presented to explore their characteristics and applications in waste management system. Further, an intelligent waste management architecture is proposed for real-time monitoring of smart bin, collecting vehicle, dynamic scheduling, and route optimisation

Problem Statement Definition:

Problem Statement (PS)	**I am (Customer)**	**I'm trying to**	**But**	**Because**	**Which makes mefeel**
PS-1	Municipal corporation authority	Get notified when the trash cans are full and be made aware of wheather fullcans are located.	Don't have the facilities at the moment	There is no tool available to determine the level of bins.	Fructuated

PS-2	Individual working for a private limited corporation	Get rid of theexample of asus plus of waste	The rash cans are always filled	I occupy a metropolitan where there is activity is in valiably crowd.	Worried

4)IDEATION & PROPOSED SOLUTION

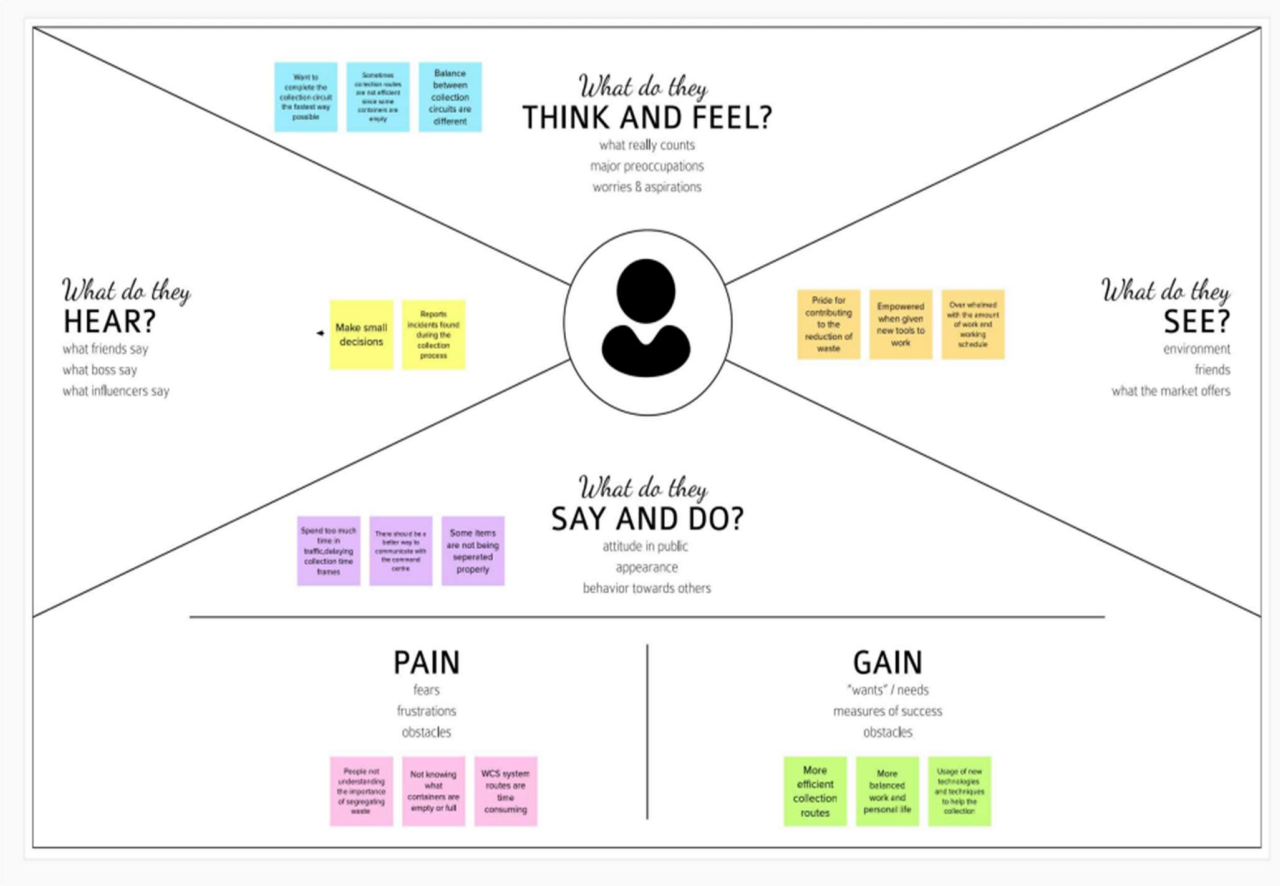
THIS SECTION HAS,

EMPATHY MAP,

BRAINSTORMING,

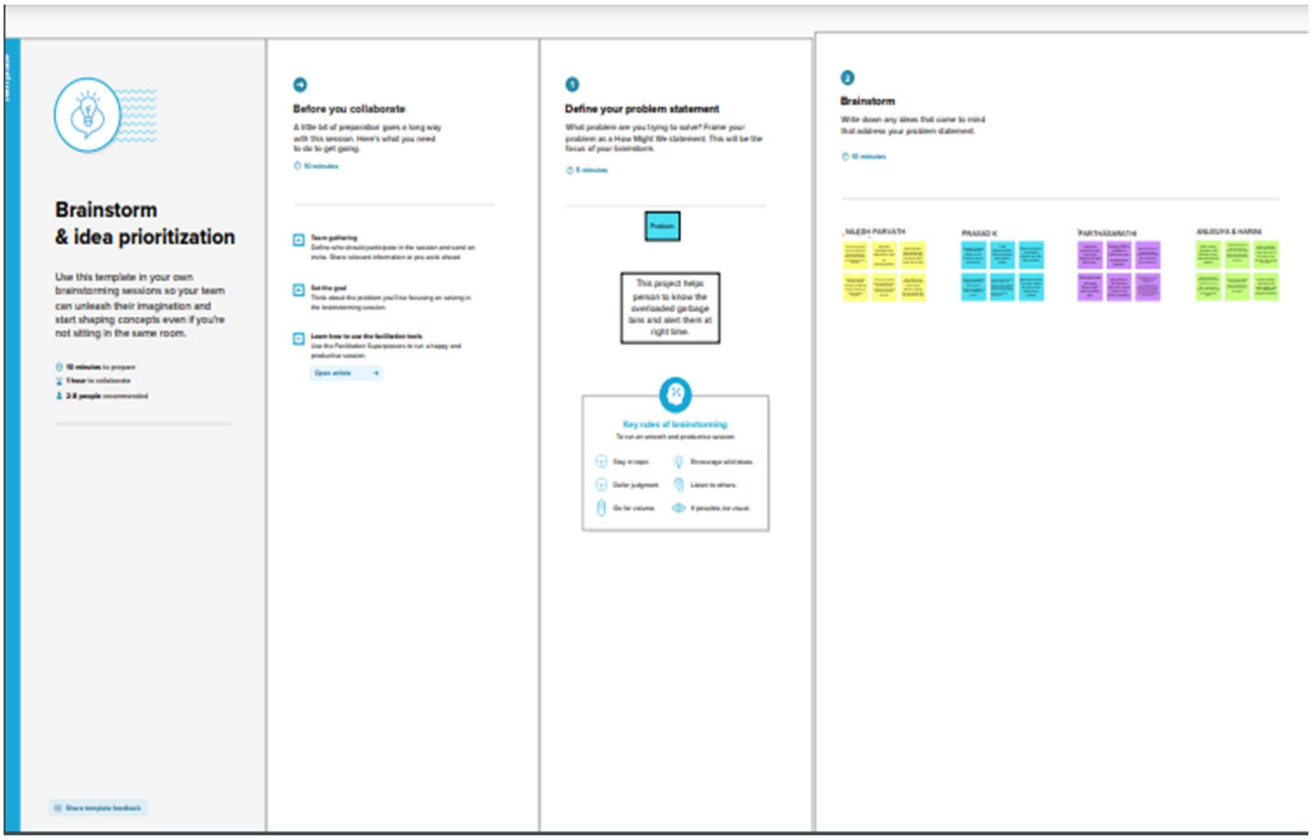
PROPOSED SOLUTION.

EMPATHY MAP CANVAS

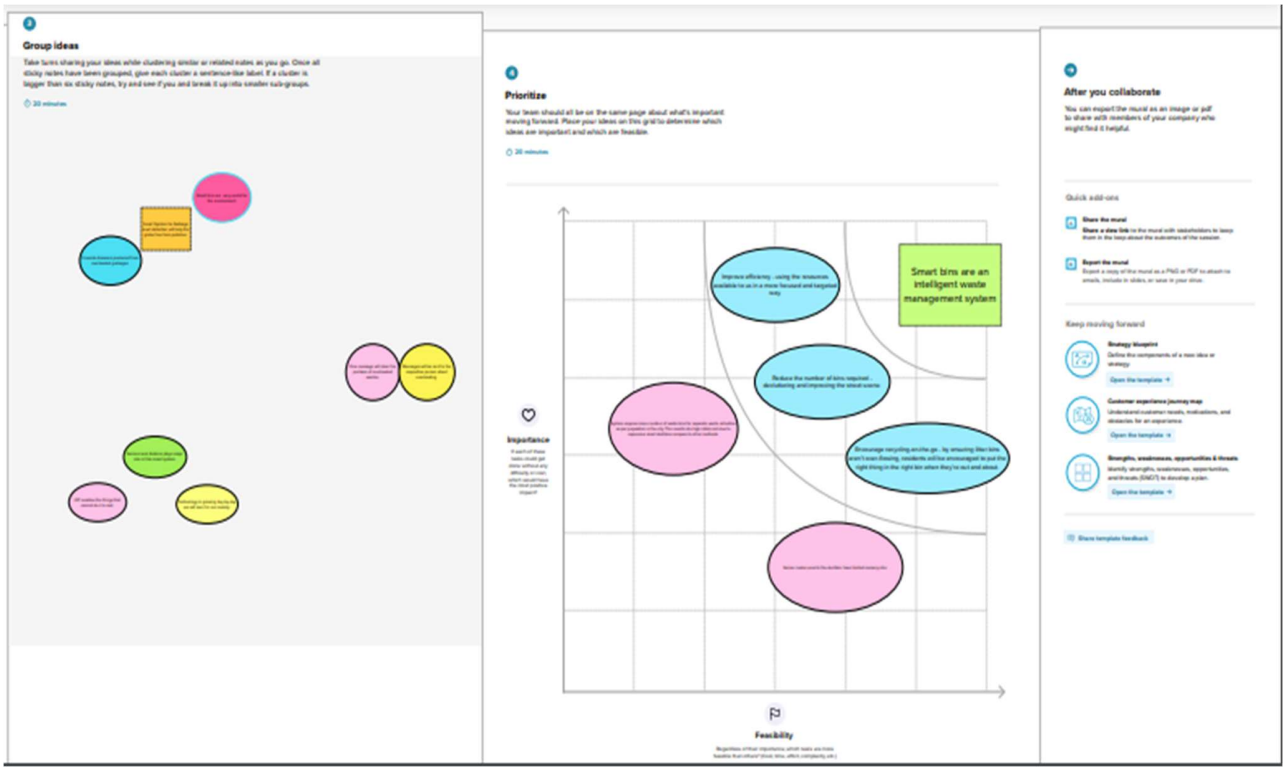


The above figure 1 shows the Empathy Map Canvas

Ideation & Brainstorming



The above figure 2 shows the half image of brain storming



The above figure 3 shows the remaining half of brainstorming.

Proposed Solution

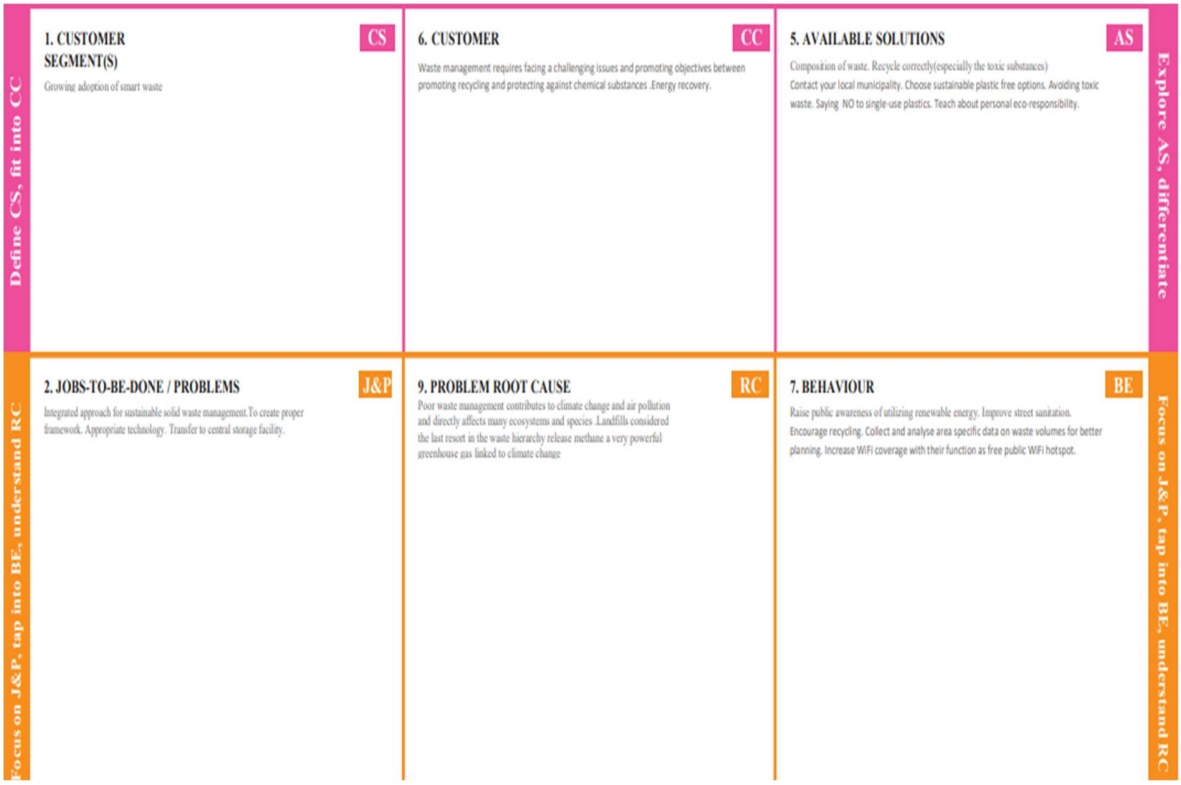
S. No	Parameter	Description
1.	Problem Statement (Problem tobe solved)	• The manual monitoring of wastes in trash cans is a laborious operation that requires additional time, money,and human labor • Unsafe trash disposal is generating problems for people. • Bad odor all around the place from uncollected trash or rubbish.

2.	Idea / Solution description	• This procedure uses a cloud connection and non-bio degradable wastes and an ultrasonic sensor to determine the level of a rubbish container • By developing an app, the company of a certain neighborhood inside a large metropolis will be able to check the trash cans to see if they are full or not.
3.	Novelty / Uniqueness	• In contrast to the traditional ways for collecting trash cans, this strategy instructs us to utilize the transportation only when necessary. • Keeping an eye on the trash canseasier and less labor-intensive for humans.
4.	Social Impact / CustomerSatisfaction	• People can experience aclean atmosphere. • Reduces the amount of laborrequired from humans for waste disposal. • For a municipal corporation to monitor the cleanliness of differentareas of the city, this proposal will be quite helpful.
5.	Business Model (Revenue Model)	• By cutting back on unneeded transportation costs to pointless locations, this lowers a significant amount offuel costs for city businesses. • This initiative intends toassist municipal corporation . • Provide a sanitary atmosphere.

Problem Solution fit

What does the problem affect?	Overflowing waste causes air pollution and respiratory diseases. One of the outcomes of overflowing garbage is air pollution, which causes various respiratory diseases and other adverse health effects as contaminants are absorbed from lungs into other parts of the body
What are the boundaries of the problem?	Contamination of Surface Water – Liquid household waste from overflowing trash cans seeps into the ground and impacts the chemical composition of the water.
What is the issue?	One of the outcomes of overflowing garbage is air pollution, which causes various respiratory diseases and other adverse health effects as contaminants are absorbed from lungs into other parts of the body. The toxic substances in air contaminated by waste include carbon dioxide, nitrous oxide and methane.
When does the issue occurs?	Overflows can happen when heavy rainfall overloads the sewer system and also because of damage to pipes, power outages, or an equipment malfunction
Where is the issue occurring?	HYDERABAD: Amid the looming threat of Covid-19 and other vector borne diseases, heaps of a garbage long the roads and overflowing drains pose risk to the health of people of Old City.
Why is it important that we fix problem?	Overflowing dumpsters and bulky trash piles are breeding grounds for nasty bacteria. As waste decomposes, it creates microbes that can cause diseases and other health issues like gastroenteritis, malaria, typhoid, cholera, as well as stomach pains, vomiting, and diarrheoa

5)CUSTOMER JOURNEY:



The above figure 4 shows the customer journey.

The above figure 5 shows the customer journey.

6)REQUIREMENT ANALYSIS

Functional Requirement

Following are the functional Requirements of the proposed solution.

ÏR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Detailed Explanation of bin	You can see bin details in the Dashboard – capacity, waste type, last measurement, GPS location and collection schedule.
FR-2	Monitoring using real time examples	Displays real-time data on fill-levels of bins monitored by smart sensors. With real-time data and predictions, you can eliminate the overflowing bins and stop collecting half-empty ones
FR-3	Cost of bins	It helps to identify bins that drive up your collection costs. The tool calculates a rating for each bin in terms of collection costs.
FR-4	Adjusting level of garbage	Identify areas with either dense or sparse bin distribution. Make sure all trash types are represented within a stand.
FR-5	Eliminate unsufficient garbage	Eliminate the collection of half-empty bins. By using real-time data on fill-levels and pick recognition, we can show you how full the bins you collect are.

FR-6	Planning for waste collection	The tool semi-automates waste collection route planning. Based on current bin fill-levels and predictions of reaching full capacity, you are ready to respond and schedule waste collection.

Non-Functional requirements

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

SR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	In the design process with user experience as the core, the analysis of users' product usability can indeed help designers better understand users' potential needs in waste management, behavior and experience.
NFR-2	**Security**	Use a reusable garbage Purchase wisely and recycle Avoid single use food and drink containers
NFR-3	**Reliability**	Smart waste management is also about creating better working conditions for waste collectors and drivers.

NFR-4	**Performance**	Using a variety of IoT networks ((NB-IoT,GPRS), the sensors send the data to Sensoneo's Smart Waste Management Software System, a powerful cloud-based platform, for data driven daily operations, available also as a waste management app.
NFR-5	**Availability**	Another purpose of this project is to make the proposed waste management system as cheap as possible. By developing & deploying resilient hardware and beautiful software we empower cities, businesses, and countries to manage waste smarter.
NFR-6	**Scalability**	By using smart waste bins, we able to monitor the garbage frequently and number of bins will be reduced.

7)PROJECT DESIGN

Data Flow Diagrams

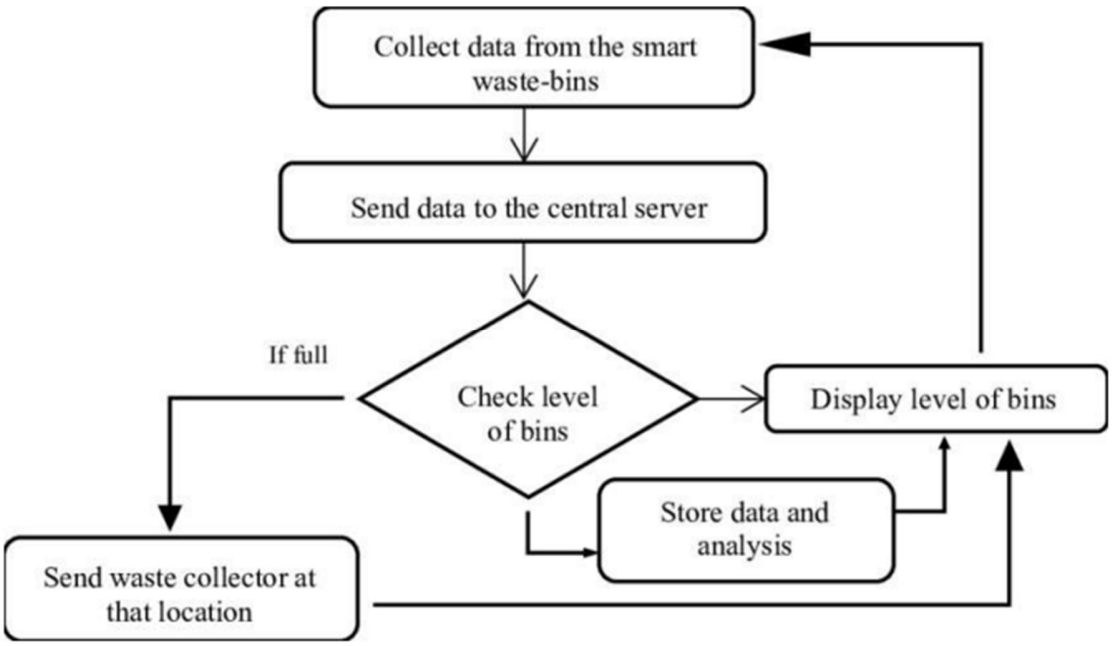
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows withina system. A neat and clear DFD can depict the light amount of the system requirement graphically.It shows how data enters and leaves the system, what changes the information, and where data is stored.

A smart waste management platform uses analytics to translate the data

- The test conducted is the situation where the garbage bin is empty or its garbage level is very low.
- Then, the bin is filled.
- The notification is sent by the system.
- The garbage needs to be collected immediately.
- Locations prone to overflow

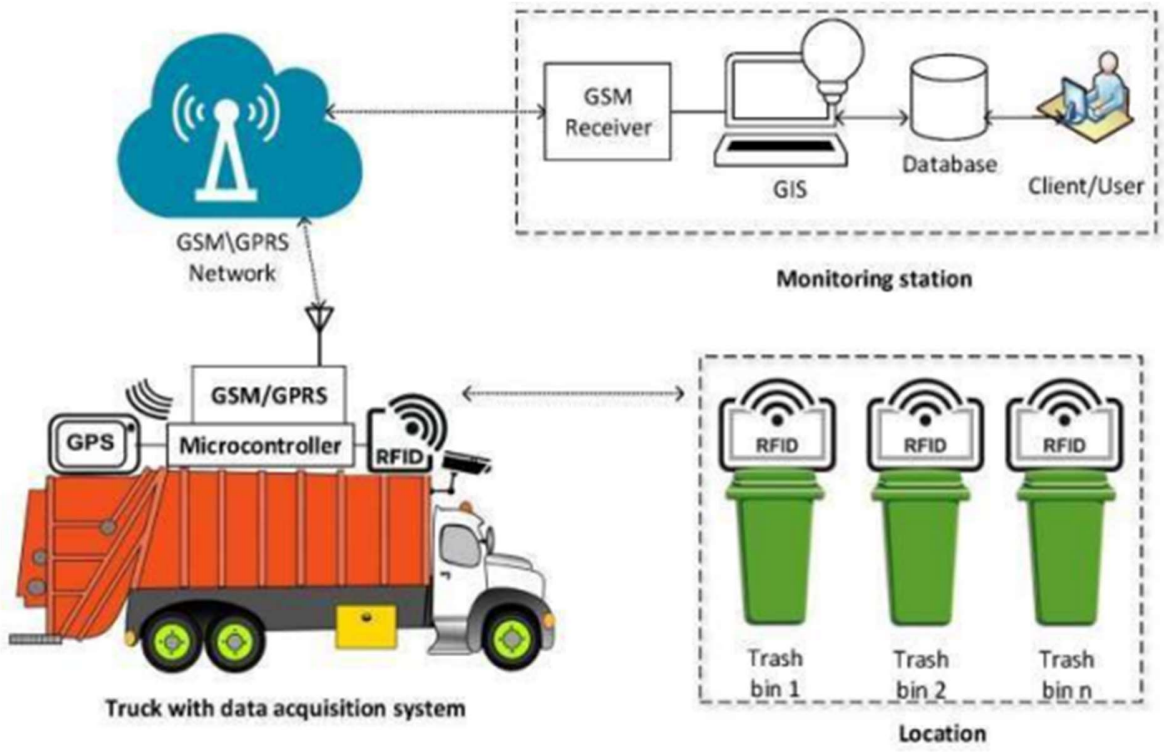
- The number of bins needed to avoid overflowing waste
- The number of collection services that could be saved
- The amount of fuel that could be saved
- The Driving distance that could be saved
- No missed pickups of trashcans.
- New smart dustbins can be install by just connecting the IOT device to the cloud.

Data flow diagram:



The above figure 6 shows the flowchart of our proposed system.

Solution & Technical Architecture:



The above figure 7 shows the 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	Java
3.	Database	Data Type, Configurations etc.	MySQL
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 onCloudLocal Server Configuration	Local and Cloud Foundry

Table-2: Application Characteristics:

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

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 / flask	Acceptance crritera	Prioity	Release
Admin	Login	USN-1	Admin gives a user id and password for each and every works and helps to manage	I can access my account/ dashboard	Medium	Sprint-2
Assistant Admin	Login	USN-2	They help us to monitor the garbage level once it is filled alert message will be thrown with location	I can manage and monitor the garbage level	High	Sprint-1
Driver	Login	USN-3	They will follow reach the location where the garbage is filled and collect them	I can drive to reach the garbage where it is filled using location and collect them	Medium	Sprint-2
Garbage Collector	Login	USN-4	It will collect the trash and load it into the garbage truck and send to landfill	I can collect the trash and load them in truck	Medium	Sprint-2

Government Municipality	Login	USN-5	It will check the process without involving any issues	I can manage the process smoothly	High	Sprint-1

8)PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation

Sprint Delivery Schedule

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	Nilesh Parvath
Sprint-1	Login	USN-2	As a Co-Admin, I'll control the waste level by monitoring them vai real time web portal. Once the filling happens, I'll notify trash truck with location of bin with bin ID	10	High	Prasad
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	Parthasarathi
Sprint-3	Dashboard	USN-4	As a Local Garbage Collector, I'll gather all the waste from the garbage, load it onto a garbage truck, and deliver it to Landfills	20	Medium	Anusuya
Sprint-4	Dashboard	USN-5	As a Municipality officer, I'll make sure everything is proceeding as planned and without any problems	20	High	Harini

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

Sprint	Total Story Points	Duration	Sprint Start Date	Story Points Completed
Sprint-1	20	6 Days	24 Oct 2022	20
Sprint-2	20	6 Days	31 Oct 2022	20
Sprint-3	20	6 Days	07 Nov 2022	20
Sprint-4	20	6 Days	14 Nov 2022	20

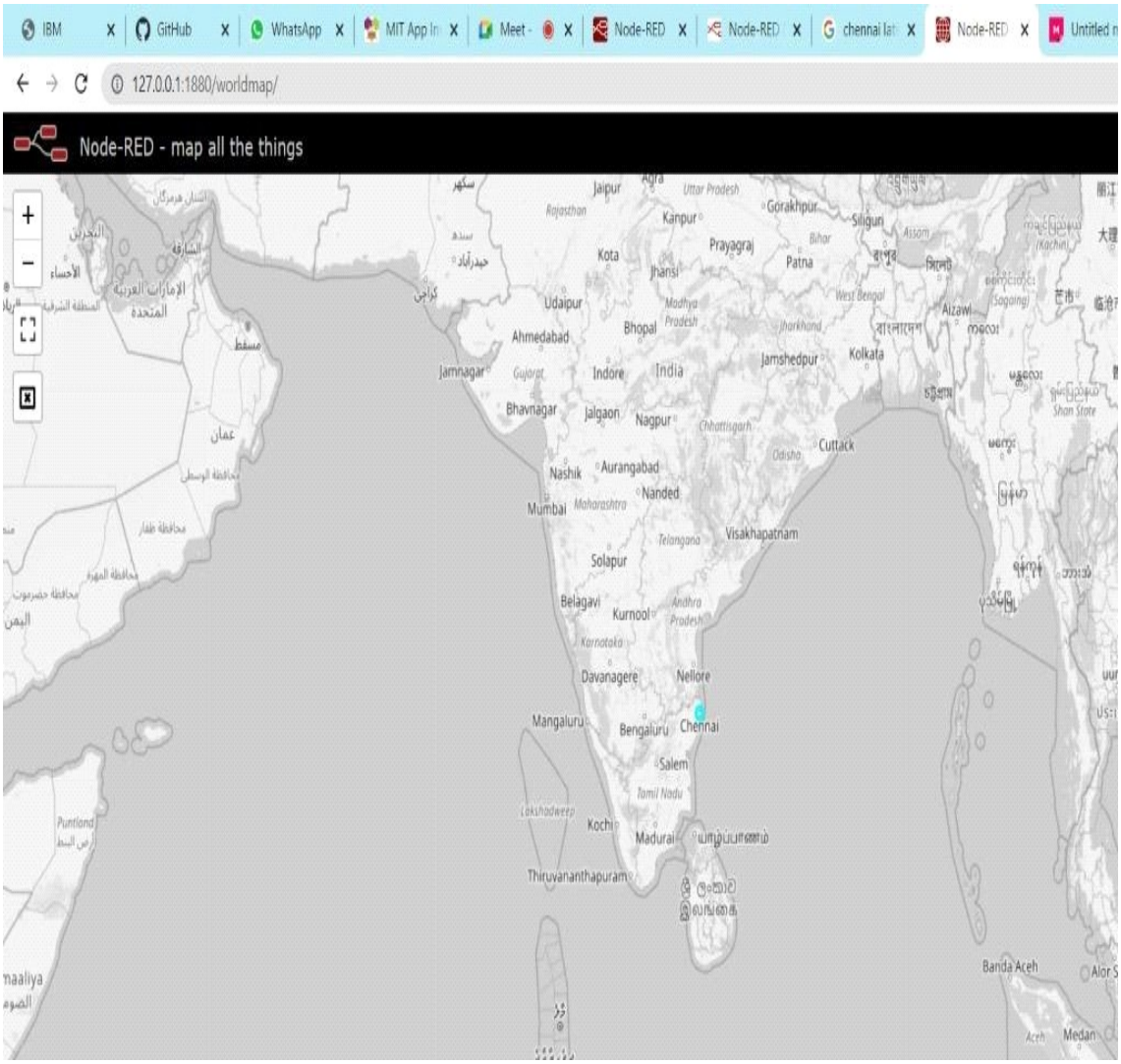
Velocity:

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

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

9)RESULTS:

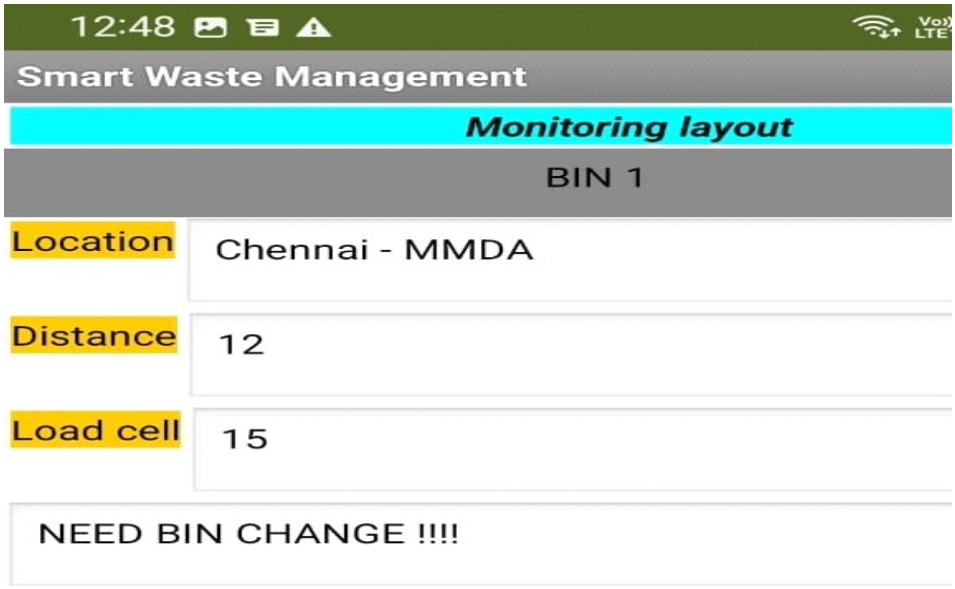
Team id: PNT2022TMID19022.



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

Leature 1- LOCATION TRACKER

Leature 2- LIVE UPDATE ON COLLECTED DATA.



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 perpopulation in the city.
- This results into high initial cost due to expensive smart dustbins compare to othermethods.
- 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, includingthe following:

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

- 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.

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

- Improving the Server's and Android's graphical interfaces

13)APPENDIX

Source Code

```
# Project : Smart Waste
Management# Team ID :
PNT2022TMID01046
impo
rt
reque
sts
impo
rt
json
import
ibmiotf.applicatio
nimport
ibmiotf.device
import time
im
po
rt
ran
do
m
im
po
```

```
rt
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
    myCommandC
    allback(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 "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
tocollect :) 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 :' '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)
        p
        r
        i
        n
        t
        (
        d
        i
        s
        t
        )
        p
        r
        i
        n
        t
        (
        w
        a
```

```
                r
                n
                )


    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()
```

14)Video Demo Link:

https://drive.google.com/file/d/1P3wKRfolvUymekmPEFCl-kIxJ5iGq5Oi/view?usp=drivesdk