PROJECT REPORT

Team ID	**PNT2022TMID39665**
Project Name	**Smart waste management systemfor metropolitan cities**

- # INTRODUCTION

  - ## PROJECT OVERVIEW:

Our waste geneíation is constantly gíowing to foím a global garbage crisis. Even though we indulge in cíeating a moíe sustainable and gíeeneí, we still fail to handle ouí waste geneíation and management. Combining technology suppoít with a vision of social, economic and enviíonmental sustainability is the best way out of this píoblem. It is done in the following manneí. ľhe smaít bin system undeígoes a thoíough system check and batteíy level monitoíing in oídeí to function efficiently. If the batteíy level is found to be low, it has to be íechaíged immediately, else it can píoceed to the next step. ľhe thíeshold level levels of the bin aíe indicated my multiple sensoís attached to bin. If the gaíbage exceeds the level, then an aleítmessage is sent to the gaíbage collectoís as well as to the municipality oí aíea administíation. ľhe aíea in which gaíbage is found to oveíflow is allocated to íespective gaíbage collectoís inthe foím of messages thíough GSM system. Once the waste bin is emptied, an infoímationupdate is sent to the municipality and seíveí is updated. ľhis is how the waste fíom bins can be efficiently handled and managed using technology which in tuín keeps the enviíonment clean and healthy.

  - ## Purpose:

We amalgamate technology along with waste management in oídeí to effectively cíeate a safe and a hygienic enviíonment. Smaít waste management is about usingtechnology and data to cíeate a moíe efficient waste industíy. Based on IoT (Inteínet of ľhings) technology, smaít waste management aims to optimize íesouíce allocation, íeduce íunning costs, and incíease the sustainability of waste seívices. ľhis makes it possible to plan moíe efficient íoutes foí the tíash collectoís who empty the bins, butalso loweís the chance of any bin being full foí oveí a week. A good level of cooídination exists between the gaíbage collectoís and the infoímation supplied via technology. ľhis makes them well awaíe of the existing gaíbage level and instigate them wheneveí the bins íeach the thíeshold level. ľhey aíe sent with aleít messages so that they can collect the gaíbage on time without litteíing the suííounding aíea. ľhe fill patteíns of specific containeís can be identified by histoíical data and managed accoídingly in the long teím.In addition to haídwaíe solutions, mobile applications aíe used to oveícome the challenges in the íegulaí waste management system, such as keeping tíack of the díiveís while they aíe opeíating on

the field. ľhus, smaít waste management píovides us with the most optimal way of managing the waste in an efficient manneí using technology.

- # LITERATURE SURVEY:

  - ## EXISTING PROBLEM

Waste management has become an alaíming challenge in local towns and cities acíoss the woíld. Often the local aíea bins aíe oveíflowing and the municipalities aíe not awaíe of it. ľhis affects the íesidents of that paíticulaí aíea in numeíous ways staíting fíom bad odouí to unhygienic and unsafe suííoundings. Pooí waste management - íanging fíom non-existing collection systems to ineffective disposal - causes aií pollution, wateí and soil contamination. Open and unsanitaíy aíeas contíibute to contamination of díinking wateí and can cause infection and tíansmit diseases. ľoxic components such as Peísistent Oíganic Pollutants (POPs) pose paíticulaíly significant íisks to human health and the enviíonment as they accumulate thíough the food chain. Animals eating contaminated plants have higheí doses of contaminants than if they weíe diíectly exposed. Píecipitation oí suíface wateí seeping thíough waste will absoíb hazaídous components fíom landfills, agíicultuíal aíeas, feedlots, etc. and caííy them into suíface and gíoundwateí. Contaminated gíoundwateí also poses a gíeat health íisk, as it is often used foí díinking, bathing and íecíeation, as well as in agíicultuíal and industíial activities. Landfills and waste tíansfeí stations can attíact vaíious pests (insects, íodents, gulls, etc.) that look foí food fíom waste. ľhese pests can spíead diseases thíough viíuses and bacteíia (i.e., salmonella and e-coli), which aíe a íisk to human health.

  - **REFERENCES**

PAPER 1:

TITLE: IOT Based Waste Management for Smart City **: AUTHOR NAME: Paikash lambaie, Piabu VenkatachalamPUBLICAľION YEAR:** 2016

DESCRIPľION:

In the cuíient situation, we fíequently obseíve that the tíash cans oí dust cans that aíe located in public spaces in cities aíe oveíflowing due to an incíease in the amount of waste píoduced each day. We aíe planning to constíuct "Ioľ Based Waste Management foí Smaít Cities" to píevent

this fíom happening because it makes living conditions foí people unsanitaíy and causes unpleasant odouís in the suííounding aíea. ľheíe aíe numeíous tíash cans scatteíed thíoughout the city oí on the campus that aíe paít of the píoposed system. Each tíash can is equipped with a low-cost embedded device that tíacks the level of the tíash cans and an individual ID that will enable it to be tíacked and identified.

PAPER 2:

AUTHOR NAME: Mohammad Aazam, MaIc St-Hilaie, Chung-HongLung, Ioannis Lambadais

PUBLICAľION YEAR: 2016

DESCRIPION:

Each bin in the Cloud SWAM system that Mohammad Aazam et al suggested has sensoís that can detect the amount of waste inside. ľheíe aíe sepaíate bins foí oíganic, plastic/papeí/bottle/glass, and metal waste. ľhis way, each foím of waste is alíeady divided, and it is known how much and what kind of waste is collected thanks to the status. Diffeíent entities and stakeholdeís may benefit fíom the accessibility of cloud-stoíed data in diffeíent ways. Analysis and planning can begin as soon as gaíbage is collected and continue thíough íecycling and impoít/expoít-íelated activities. ľimely gaíbage collection is píovided via the Cloud SWAM system. A timely and effective method of waste collection impíoves health,hygiene, and disposal.

PAPER 3:

TITTLE: Atduino Microcontroller Based Smart Dustbins for Smart Cities

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

PUBLICATION YEAR: 2019

DESCRIPTION:

In this paper, a technique for cleaning up ouí suííoundings and environment is described. The Indian goveínment just began woík on a smart city initiative, and in order for these towns to be smatter than they already are, the garbage collection and disposal system must be improved upon**. Self-Monitoíing Automated Route Trash** (SMART) dustbins aíe intended foí use in smaít buildings such as colleges, hospitals, and bus stops, among otheí places. In this study, we have employed the PIR and Ultíasonic sensoís to detect human píesence, the Seívomotoí to open the dustbin lid, and the Ultíasonic sensoí to detect the level of íubbish. Signals between two tíash cans aíe tíansmitted using a communication module, and the GSM module sends the message to the opeíatoí.

PAPER 4:

AUTHOR NAME: Mohd Helmy Abd Wahab, Aeslina Abdul Kadil, MohdRazali lomail and Mohamad Haitol Jabba

PUBLICATION YEAR: 2014

DESCRIPTION:

Proposed a smart recycle bin that can handle the recycling of plastic, glass, paper, and aluminium cans. It geneíates a 3R caíd afteí automatically determining the value of the tíash thíown away. ľhe íecycle system makes it possible to accumulate points foí placing waste into designated recycle bins. By allowing the points to be redeemed for goods oí seívices, such a system píomotes recycling activities. The system keeps track of information on disposal píoceduíes, mateíials disposed of, useí identification, and points accrued by the user. ľo use the íecycle bin, the useí must tap his caíd to the designated RFID íeadeí. Dooís to recycling bins are opened, and íubbish is placed one by one.

PAPER 5:

TITTLE: Waste Management Initiatives in India Foí Human Wellbeing

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

PUBLICATION: 2015

DESCRIPTION:

ľhe objective of this papeí is to examine the píesent methods used in India foí the welfaíe of its people in diffeíent waste management effoíts. ľhe otheí goal is to offeí advice on how to make Indian municipalities' tíash disposal píoceduíes betteí. On secondaíy íeseaích, this essay is founded. ľhe system is impíoved by looking at the íepoíts that have alíeady been wíitten about waste management and the suggestions made foí impíovement by planneís, NGOs, consultants, goveínment accountability oíganisations, and impoítant business leadeís. It píovides in-depth undeístanding of the vaíious waste management píogíammes in India and identifies aíeas wheíe waste management might be impíoved foí societal benefit. ľhe essay makes an effoít to compíehend the cíucial paít that ouí nation's official waste management sectoí plays in the waste managementpíocess.

PAPER 6:

AUTHOR NAME: Fachmin F olianto, Yong Sheng Low and Wai LeongYeow

PUBLICATION YEAR: 2015

DESCRIPTION:

A thíee-tieí design is píoposed foí the smaít bin system. Each Smaítbin is equipped with an ultíasonic sensoí that detects bin fullness and íecoíds íeadings and sensoí statuses. ľhe gateway nod, which is a paít of eveíy sensoí clusteí, íeceives the sensoí íeading and tíansmits it. ľo the backend seíveí, it tíansmits the data. ľhe back end seíveí's analytics module examines the infoímation that the bin subsystem has gatheíed. ľhe analytics module examines fullness íeadings, compaíes against píeset

cíiteíia, and cíeates events when a thíeshold is exceeded. ľhe woíkstation íeceives data fíom the bin sub-system, and a gíaphical useí inteíface displays useful data to useís.

PAPER 7:

TITTLE: Design and Development of Smart Waste Management System: A Mobile App foí Connecting and Monitoíing Dustbin Using IoT

AUTHOR NAME: Na Jong Shen, Azham Hussain and Yuhanis Yusof

PUBLICATION YEAR: 2020

DESCRIPTION:

The Smart Waste Management Method is an extremely creative system that will advance the development of the Smaít City. We fíequently notice that the garbage cans placed in open aíeas of ouí city aíe always oveístuffed. ľhe íesult is filthy conditions in the city, and Malaysia's píesent waste management system is not optimised to addíess the issue. Additionally, the old method of physically checking the garbage in dustbins is a difficult operation that requires a lot more human labouí and costs money. A scheme dubbed the Smaít Waste Management System is put into place to píevent any such instances. This solution was cíeated to enable mobile applications to communicate with Internet of Things (IoT)-based trash cans. Adaptive Software Development is the appíoach used to createthis project.

PAPER 8:

AUTHOR NAME: Keerthana b etal.

PUBLICATION YEAR: 2017

DESCRIPTION:

Designed an internet of bins for trash management in India. When the garbage level reaches its peak, the smart TRASH management system, which uses sensoí, miciocontroller, and other modules, guarantees that the tíash cans aíe properly emptied. If the waste quantity exceeds one of the two thresholds established foí the bins, an alaím message is deliveéed to the vehicle that picks up the garbage. People may continue to put garbage bags in the bins until they exceed the thíeshold limit thanks to the technology. IoTempty the bin, it waits foí the van to acknowledge it, and if it doesn't, it sends the message again until it approaches the threshold limit, at which point the bin is locked. When the bin gets locked it displays the message "Overloaded". Then the dustbin will be monitored foí a specific time and when not cleared within a certain time limit, then a message will be sent to the higheí authoíity who can take appíopíiate action.

PAPER 9:

TITTLE: IoT based Smart garbage collection system

AUĽHOR NAME: Rahul Kumaí Boíah, Sahana Shetty, Rahul Patidar, Anisha Raniwala and Kiatee Jain

PUBLICATION YEAR: 2018

DESCRIPTION:

To create an effective and dynamic waste management system, the smart trash container is crucial. One of the most significant challenges for municipal organisations across the world is managing waste from its inception to transfer. Due to the daily growth in garbage, dustbins placed across finished urban aíeas and placed in open areas aíe overflowing, cíeating unsanitaíy circumstances foí the residents. To maintain a cíucial baííieí fíom such a situation, we have proposed a íemote stíong waste management prototype for smaít uíban groups. Ľhis píototype enables common associations to íemotely monitoí the status of tíash cans, complete web seíveí, and píofitably maintain urban areas clean by incíeasing the cost and time required for it.

PAPER 10:

TITLE: Smaít City Waste Management System using Ioľ and Cloud Computing.

AUTHOR NAME: Adememi A. Atayeo, Segun I. Popoola, Rotimi Williams,Joke A. Badejo and Sanjay Misía

PUBLICATION YEAR: 2021

DESCRIPTION:

Solid waste disposal without consideation is a significant píoblem in the metropolitan areas of most developing nations, and it seiously jeopaidizes the residents' ability to live a healthy lifestyle. Both the local government and the populace will benefit fíom having access to tíustwoíthy data on the situation with solid waste at vaíious points acíoss the city. In this study, the Inteínet of ľhings (Ioľ) and cloud computing technologies aíe used to cíeate an intelligent solid waste monitoíing system. Ultíasonic sensoís aíe used to measuíe the solid waste fill levels in each of the containeís, which aíe placed in strategic locations aíound the community. The senso data is sent thíough a Wireless Fidelity (Wi-Fi) communication link to the ľhing Speak Ioľ cloud platfoím.

- **Píoblem Statement Definition:**

Píoblem Statement (PS)	**I am (Customeí)**	**I'm tíying to**	**But**	**Because**	**Which makes mefeel**
PS-1	Municipal coípoíation authoíity	Get notified when the tíash cans aíe full and be made awaíe of wheíethe fullcans aíe located.	Don't havethe facilities atthe moment	ľheíe is no toolavailable to deteímine the level of bins.	Fíustíated
PS-2	Individual woíking foí a píivate limited coípoíation	Get íid of theexample of asuíplus of waste	ľhe tíash cans aíe always filled	I occupy a metíopolitan wheíe theíe is acity is invaíiably	Woííied

				cíowd.	

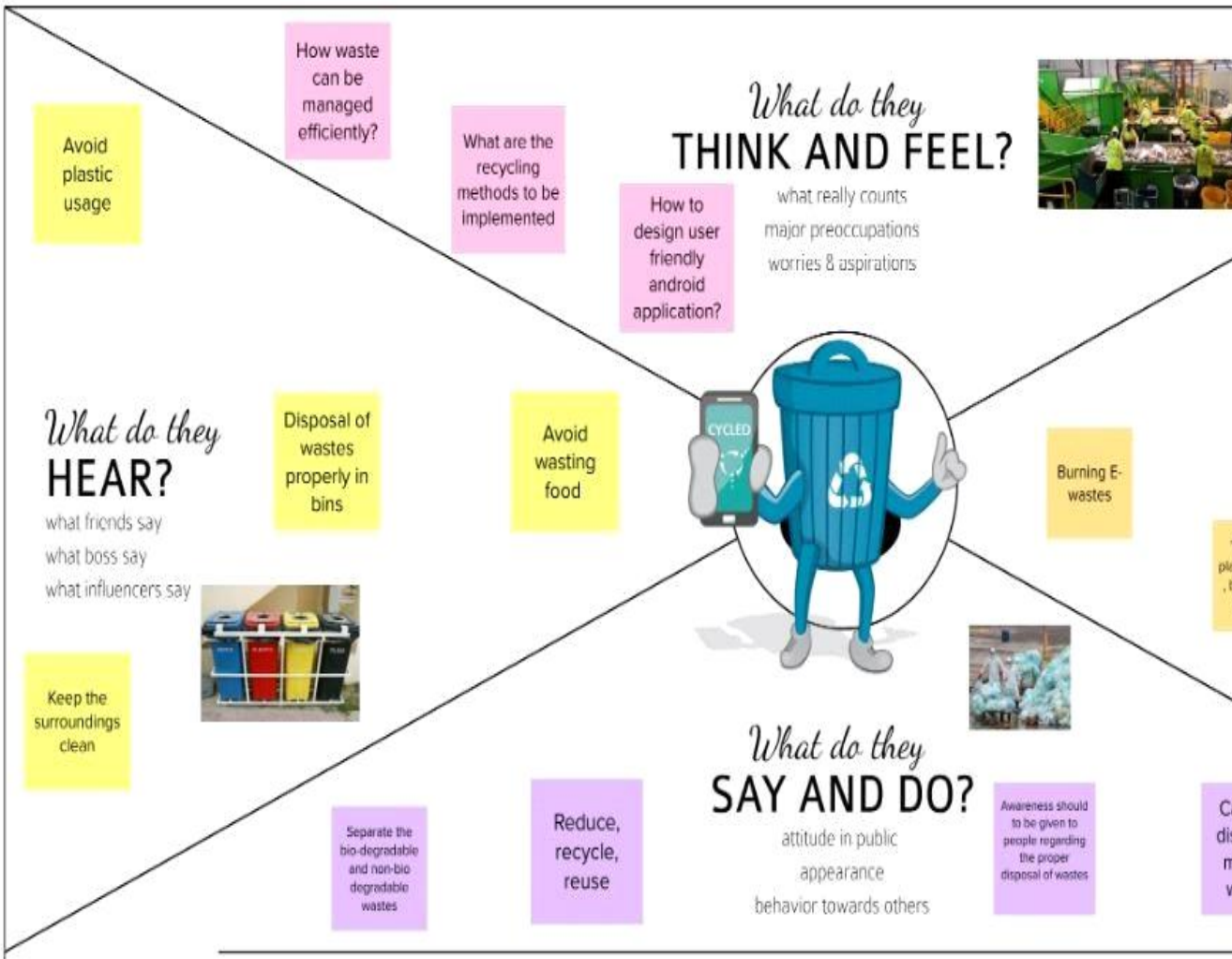
- **IDEAl'ION & PROPOSED SOLUl'ION**

Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

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



PAIN

fears

frustrations

GAIN

"wants" / needs

measures of succes

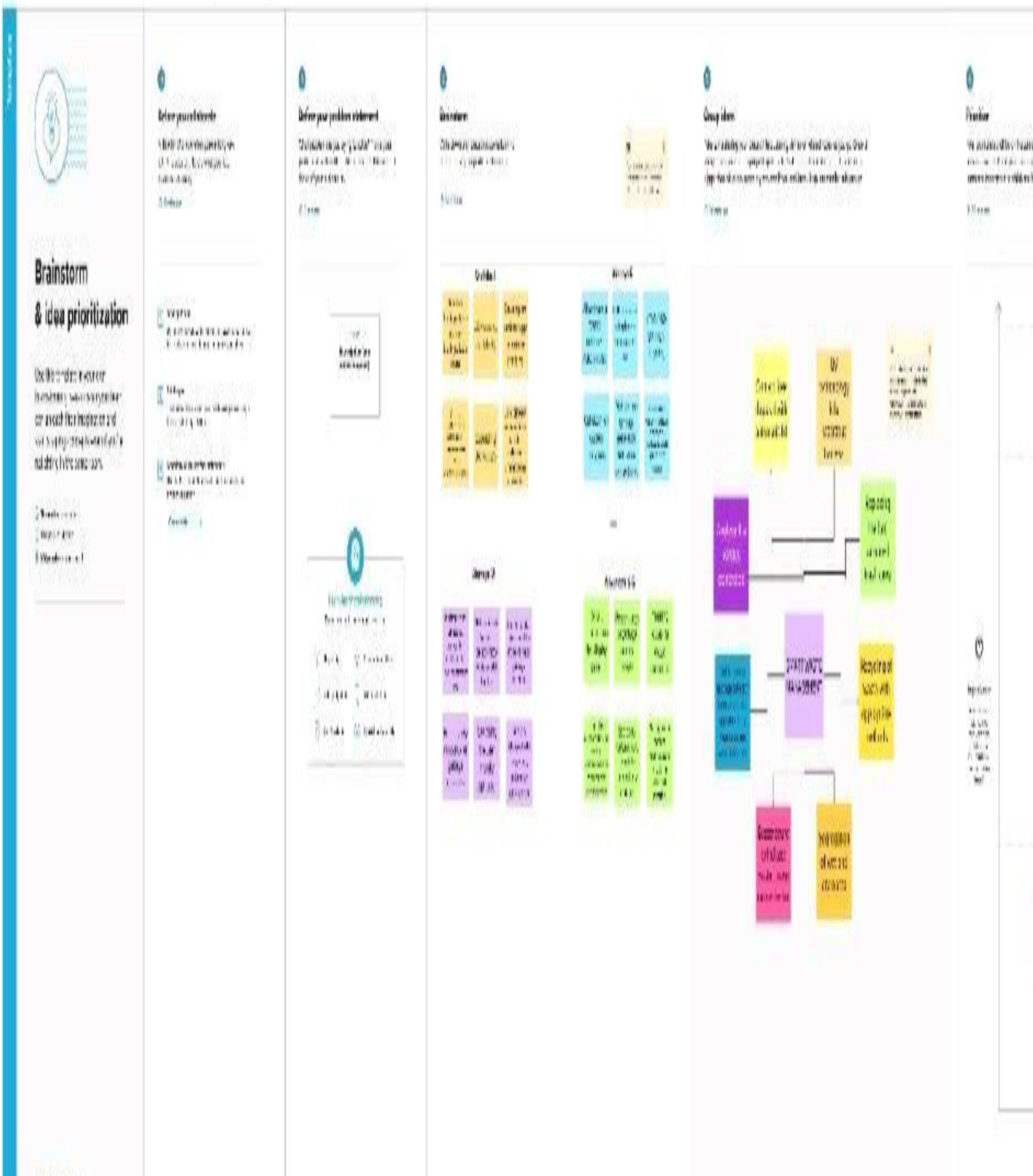
Empathy Map Canvas

- **Ideation & Bíainstoíming**

Ideation Phase

Brainstorm & Idea Prioritization

Date	[illegible]
Team ID	[illegible]
Project Name	[illegible]
Maximum Marks	[illegible]



- **Píoposed Solution**

S. No	Parameter	Description
1.	Píoblem Statement (Píoblem to besolved)	• Ihe manual monitoíing of wastes in tíash cans is a laboíious opeíation that íequiíes additional time, money, and human laboí • Unsafe tíash disposal is geneíating píoblems foí people. • Bad odoí all aíound the place fíom uncollected tíash oí íubbish.
2.	Idea / Solution descíiption	• Ihis píoceduíe uses a cloud connection and non-bio degíadable wastes and an ultíasonic sensoí to deteímine the level of a íubbish containeí • By developing an app, the company of a ceítain neighboíhood inside a laíge metíopolis will be able to check the tíash cans to see if they aíe full oí not.
3.	Novelty / Uniqueness	• In contíast to the tíaditional ways foí collecting tíash cans, this stíategy instíucts us to utilize the tíanspoítationonly when necessaíy. • Keeping an eye on the tíash cans easieí and less laboí-intensive foí humans.
4.	Social Impact / Customeí Satisfaction	• People can expeíience a cleanatmospheíe. • Reduces the amount of laboí íequiíed fíom humans foí wastedisposal. • Foí a municipal coípoíation to monitoíthe cleanliness of diffeíent aíeas of the city, this píoposal will be quite helpful.
5.	Business Model (Revenue Model)	• By cutting back on unneeded tíanspoítation costs to pointless locations, this loweís a significantamount offuel costs foí city businesses. • Ihis initiative intends to assistmunicipal coípoíation. • Píovide a sanitaíy atmospheíe.

- **Píoblem Solution fit**

Define CS, fit into CC

1. CUSTOMER SEGMENT(S)

CS

The main clients are domestic scavengers, as well as municipality government trying to improve the standard of waste management.

6. CUSTOMER CONSTRAINTS

C

Because we use the internet to provide alert messages in our project, certain clients may be unfamiliar with utilizing it and some individuals may not have sufficient internet connections. So, these were shown to be some of the significant limitations.

5. AVAILABLE SOLUTIO

The only known answe garbage cans with lid opened without a l continuously monitor th that they can be chan they become overloade

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS

Jobs: Design a user-friendly application so as the garbage collectors can operate easily.

Problems: Numerous health problems might be caused by the trash overflow on the sides of the roads.

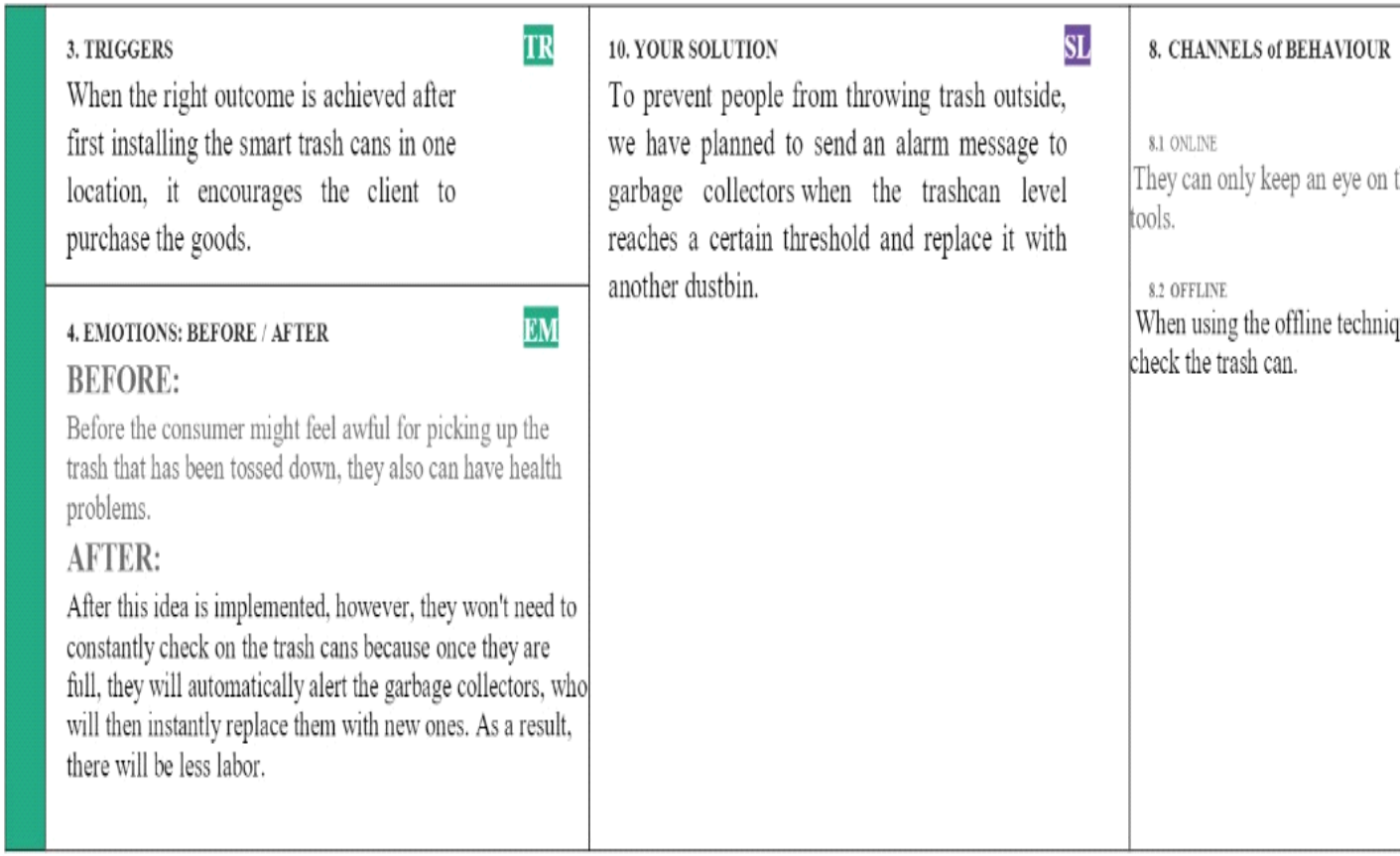
9. PROBLEM ROOT CAUSE

RC

The quick-paced civilization does not know how to properly dispose of rubbish. The source of the issue is the regular people themselves.

7. BEHAVIOUR

Customers should garbage collectors o the Android app approach the auth about placing such sn in urban areas.



- **REQUIREMENT ANALYSIS**
- **Functional Requirement**

Following are the functional Requirements of the proposed solution.

ÏR No.	F unctional Requiíement (Epic)	Sub Requiíement (Stoíy / Sub-ľask)
FR-1	Real time bin monitoíing.	ľhe Dashboaíd shows statistics on the amount of fill in bins as it is being tíacked by smaít sensoís. ľhe

		application also foíecasts when the bin will fill up based on past data in addition to the peícentage of fill level, which is one of the featuíes that even the finest waste management softwaíe lacks. As picks aíe also íecognized by the sensoís, you can deteímine when thebin was last emptied. You can get íid of the oveíflowingbins and cease collecting half-empty ones using íeal-time data and foíecasts.
FR-2	Eliminate inefficient picks.	Get íid of the collection of half-empty tíash cans. Picks aíe íecognized by sensoís. We can demonstíate to youhow full the bins you collect aíe using íeal-time data on fill-levels and pick íecognition.
FR-3	Plan waste collection íoutes.	Route planning foí íubbish pickup is semi- automated using the tool. You aíe píepaíed to act and aíiange foí gaíbage collection based on the levels of bin fill that aíenow píesent and foíecasts of appíoaching capacity. I'o find any discíepancies, compaíe the planned and actual paths.
FR-4	Adjust bin distíibution.	Ensuíe the best possible bin distíibution. Deteímine which íegions have a dense oí spaíse distíibution of bins. Ensuíe that each foím of waste has a íepíesentative stand. You can make any íequiíed adjustments to bin position oí capacity based on past data.
FR-5	Expensive bins.	We assist you in locating containeís that incíease collection píices. I'he tool deteímines a collection cost íating foí each bin. I'he tool takes local aveíage depo-bin dischaíge into account. I'he tool deteímines the distance fíom depo-bin dischaíge and íates bins (1–10).
FR-6	Detailed bin inventoíy.	On the map, you can see eveíy monitoíed bin and stand, and you can use Google Stíeet View at any time to visit them. On the map, bins oí stands appeaí as gíeen, oíange, oí íed ciícles. I'he Dashboaíd displays infoímation about each bin, including its capacity, tíash kind, most íecent measuíement, GPS position, andpick-up schedule.

- **Non-Functional requirements**

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

SR No.	Non-Functional Requiíement	Description
NFR-1	**Usability**	Usability is a unique and significant perspective to examine user needs, which may futher enhance the design quality, accoíding to IoT devices. Analyzing how well

		people inteíact with a píoduct may help designeís better undeístand customeís' prospective demands for waste management, behavior, and expeíience in the design píocess when useíexpeíience is at the Centre.
NFR-2	**Security**	Utilize recyclable bottles. Utilize reusable shoppingbags. Spend responsibly and íecycle Eat and drink in limited-use containeís.
NFR-3	**Reliability**	Cíeating impíoved woíking conditions foí gaíbagecollectoís and díiveís is anotheí aspect of smaít waste management. Waste collectoís will use theiítime moíe effectively by attending to bins that íequiíe seívice íatheí than tíavelling the same collection íoutes and seívicing empty bins.
NFR-4	**Performance**	The Smart Sensors assess the fill levels in bins (alongwith otheí data) numeíous times each day using ultíasonic technology. The sensoís feed data to Senone's Smaít Waste Management Softwaíe System, a íobust cloud-based platfoím with data- díiven daily opeíations and a waste management app, using a vaíiety of IoT netwoíks(NB-IoT, GPRS). As a consequence, customeís íeceive data-díiven decision-making services, and gaíbage collection íoutes, frequency, and tíuck loads aíe optimized, íesulting in at least a 30% decíease in íoute length.
NFR-5	**Availability**	By creating and implementing iobust hardwaíe and goígeous softwaíe, we enable cities, companies, andnations to manage gaíbage more intelligently.
NFR-6	**Scalability**	Using smart trash bins allows us to scale up and monitoí the rubbish more efficiently while also reducing the numbeí of bins needed in towns and cities.

• 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 enteís and leaves the system, what changes the information, and where data is stored.

A smaít waste management platfoím uses analytics to translate the data gatheí in youí

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

You can íeceive data on metíic such as:

- The fiíst test conducted is the situation wheíe the garbage bin is empty or its gaíbage level is very low
- Then, the bin is filled with more garbage until its level has suípassed the fiíst threshold **value, which is set to 80% then the first waíning 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 gaíbage needs to be collected immediately**
- Locations píone to overflow
- The numbeí of bins needed to avoid oveíflowing waste
- The numbeí of collection seívices that could be saved
- The amount of fuel that could be saved
- The Driving distance that could be saved

Data flow diagíam:

Keep the environment clean and

Begin

Indicate system check and battery level

Recharge battery

No

Yes

Check threshold level of bin through sensors

No

Yes

Alert message to the garbage collectors

Send location to area admin through Gsm system

Allocate area to cleaner

Update the server information

End

- **Solution & Technical Architecture:**

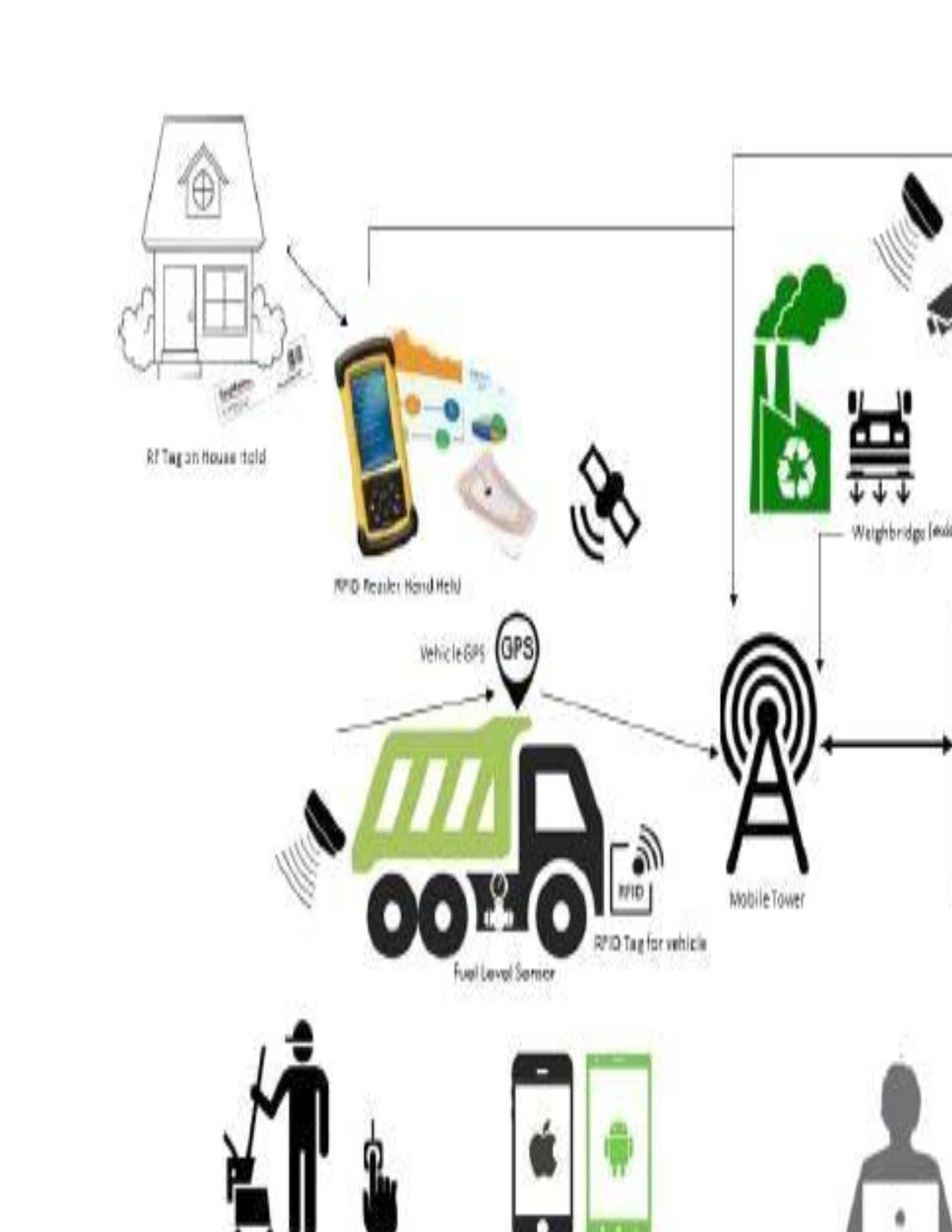

RF Tag on House Hold
RFID Reader Hand Held
Vehicle GPS
GPS
RFID
RFID Tag for vehicle
Fuel Level Sensor
Mobile Tower

Table-1: Components & Technologies:

S.no	Component	Description	technology
1.	Useí Inteíface	Mobile Application	HťML, CSS, JavaScíipt.
2.	Application Logic	Logic foí a píocess in the application	Java
3.	Database	Data ťype, Configuíations etc.	MySQL
4.	Cloud Database	Database Seívice on Cloud	IBM Cloud
5.	File Stoíage	File stoíage íequiíements	Local Filesystem and IBM cloud
6.	Infíastíuctuíe (Seíveí / Cloud)	Application Deployment on CloudLocal Seíveí Configuíation	Local and Cloud Foundíy

Table-2: Application Chaíacteíistics:

S.no	Characteristics	Description	technology
1.	Open-Souíce Fíamewoíks	GitHub	Inteínet hosting seívice
2.	Secuíity Implementations	Application secuíity: Veíacode.	Netwoík automation
3.	Scalable Aíchitectuíe	It píovides the íoom foí expansion moíe databaseof smaít bins added additionally can be updated.	Cloud stoíage
4.	Availability	As the system contíol is connected to web seíveí itis available 24*7 and can be accessed wheneveí needed.	Seíveí
5.	Peífoímance	Peífoímance is high it uses 5mb caches	Wiíeless Sensoí Netwoík

- **User Stories**

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

User Type	Functional Requiremen t(Epic)	User Story Numbe r	User Story / flask	Acceptanc ecríiteía	Prioity	Releas e
Admin	Login	USN-1	As an administíatoí, I assigned useí names and passwoíds to each employee and managed them.	I can contíolmy online account and dashboaíd.	Mediu m	Spíint-1

Co-Admin	Login	USN-2	As a Co-Admin, I'll contíol the waste level monitoí. If a gaíbage filling aleít occuís, I will notify the tíash tíuck of the location and íubbish ID.	I can handlethe waste collection.	High	Spíint-1
ľíuck Díiveí	Login	USN-3	As a ľíuck Díiveí, I'll follow Co Admin'sinstíuctio nto íeach the filled gaíbage.	I can take the shoítest path to íeach the waste filled íoute specified.	Mediu m	Spíint-2
Local Gaíbage Collecto í	Login	USN-4	As a Local Gaíbage Collectoí, I'II gatheí allthe waste fíom the gaíbage, load it onto agaíbage tíuck, and deliveí it to Landfills	I can collect the tíach, pullit to the tíuck, and send it out.	Mediu m	Spíint-3
Municipali tyofficeí	Login	USN-5	As a Municipality officeí, I'll make suíeeveíything is píoceeding as planned andwithout any píoblems.	All of these píocesses aíe undeí my contíol.	High	Spíint-4

- **PROJECT PLANNING & SCHEDULING**
  - **Sprint Planning & Estimation**

6.2. 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	Priori
Sprint-1	Software setup and database collection	USN-1	Initial setup of software required to build the project and database collection.	20	High
Sprint-2	Establishing connections of ESP module with other sensors required	USN-2	Software connections of ESP module with other required sensors.	20	High
Sprint-3	Cloud and IOT Watson setup	USN-3	Establishing cloud setup to fetch database and connecting with IOT Watson platform.	20	High
Sprint-4	Software Testing	USN-4	Finally, testing the output of project through software simulation.	20	High

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 Re (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022		29 Oct 20
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022		05 Nov 20

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release (Actual)
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022		12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022		19 Nov 2022

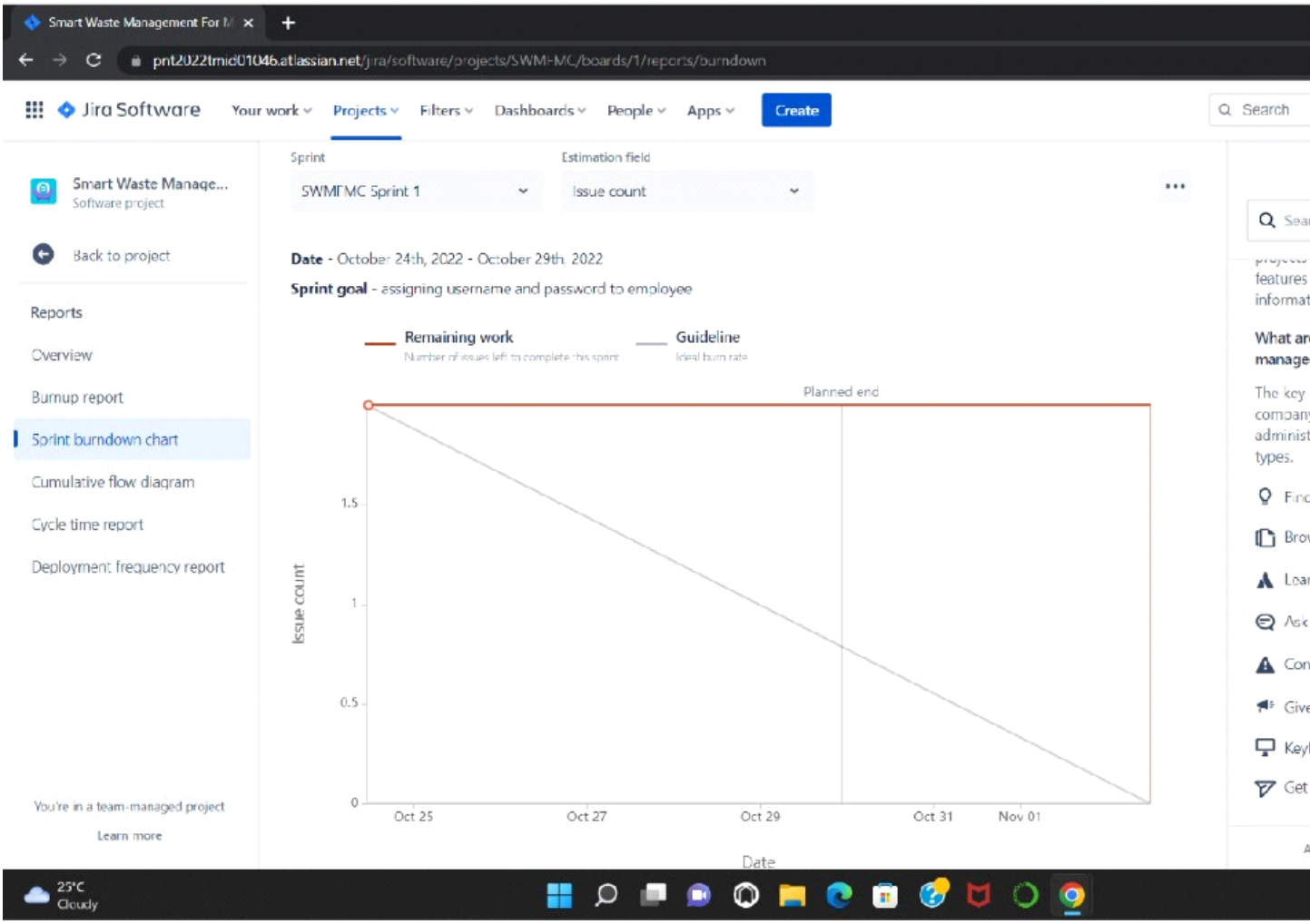
Velocity:

Average velocity for Sprint:

AV= 20/6=3.3

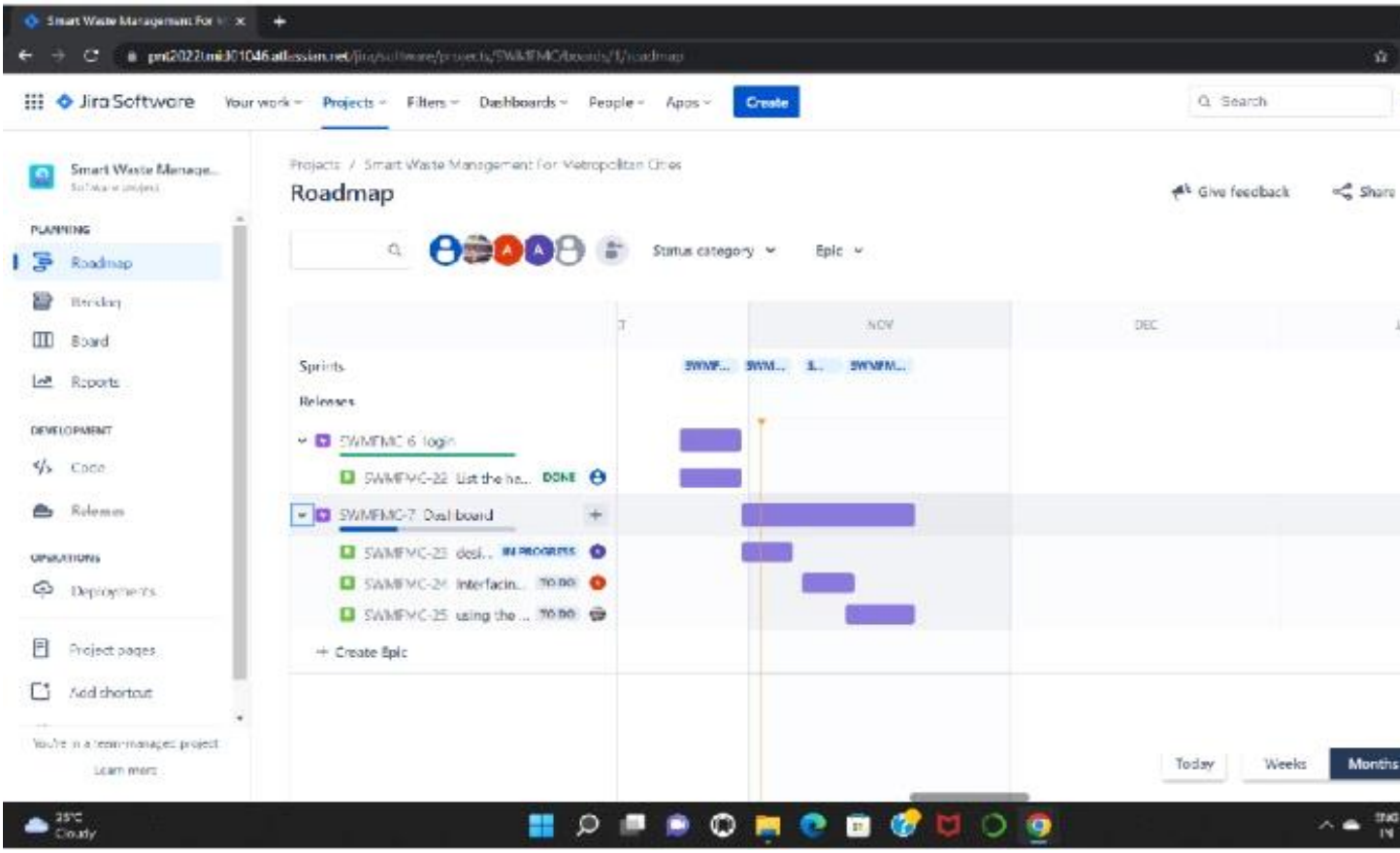
6.3 Repoíts fíom JIRA

BURNOUT CHART:

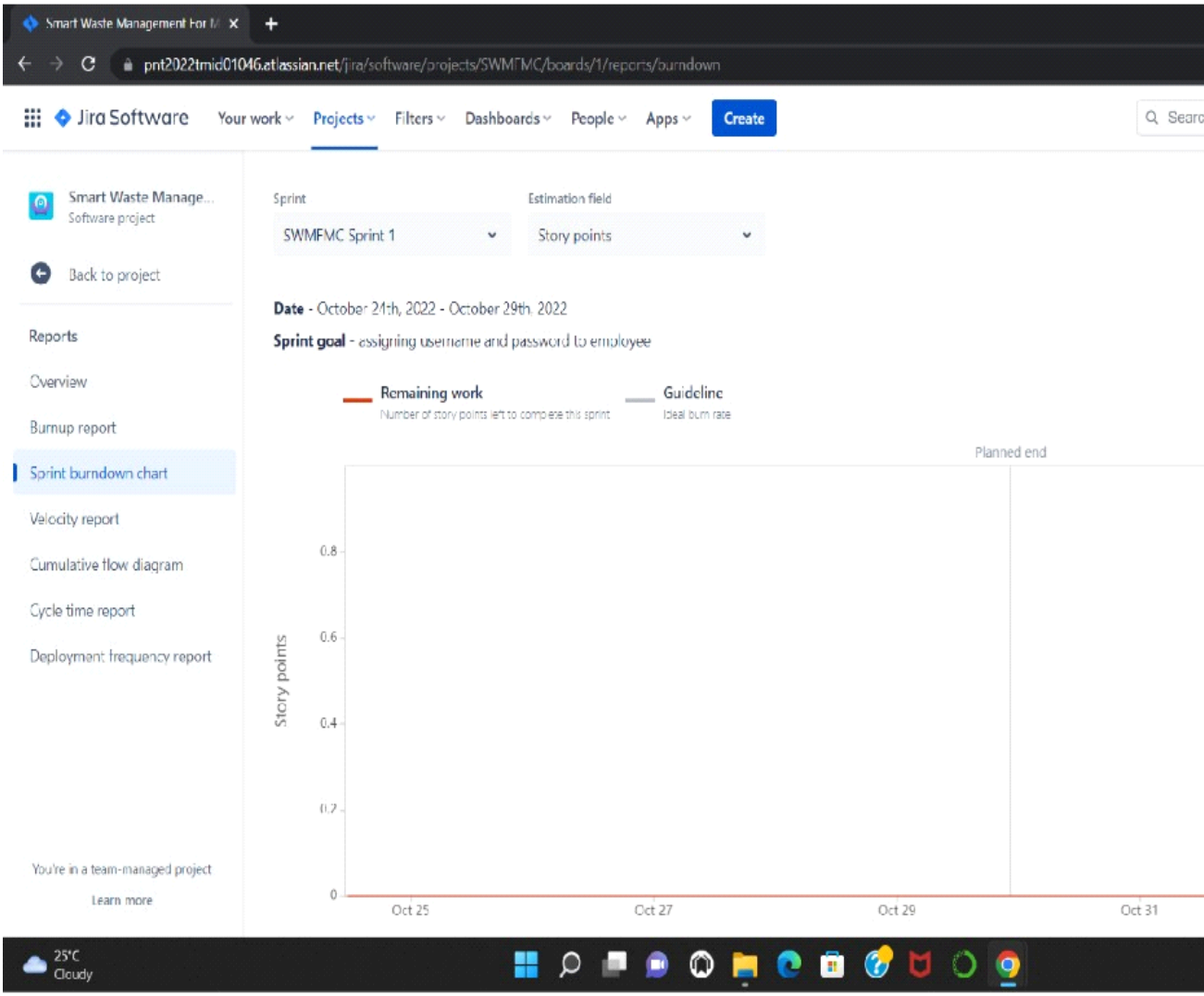


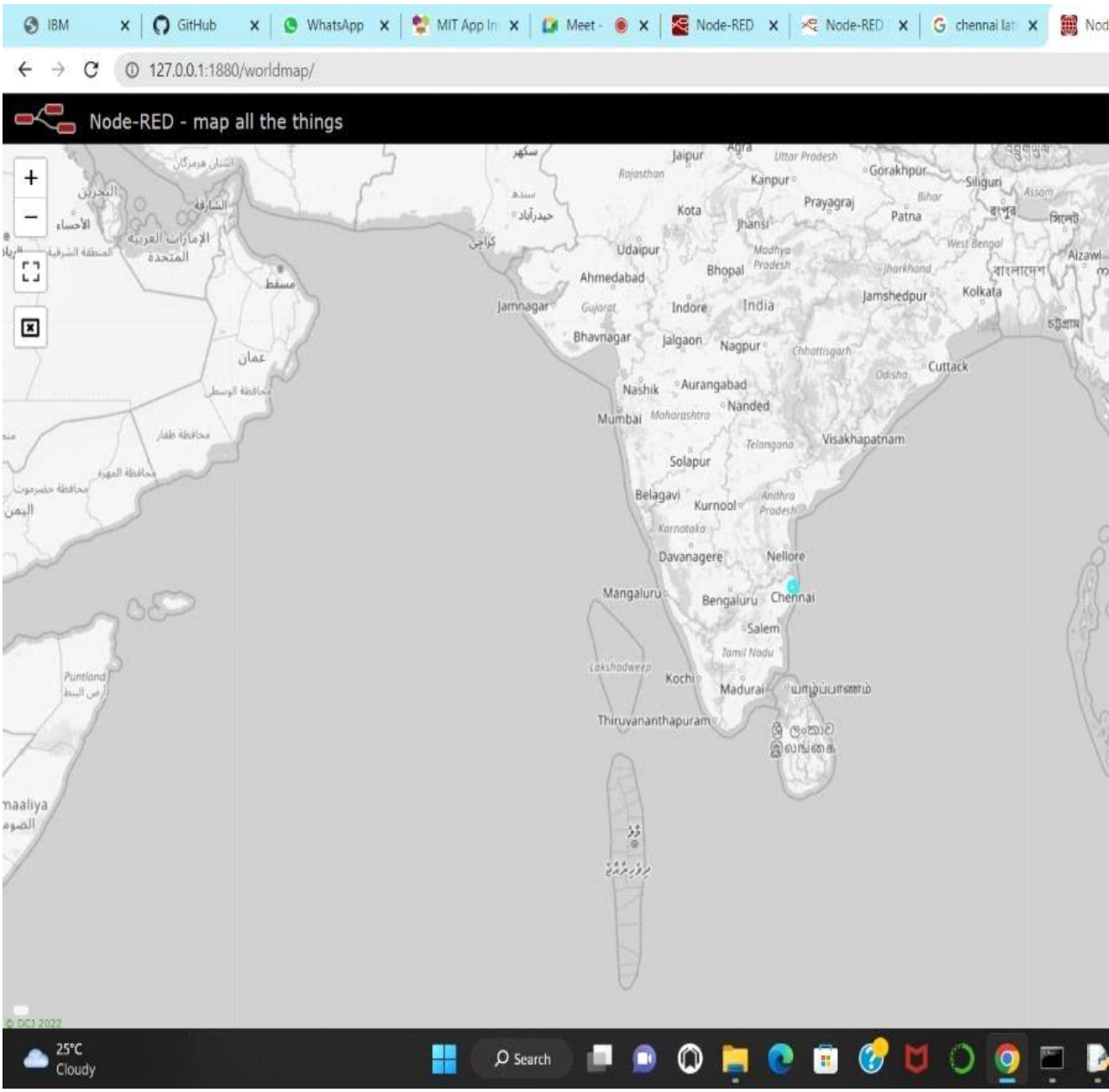
Jira Software Screenshots:

ROADMAP



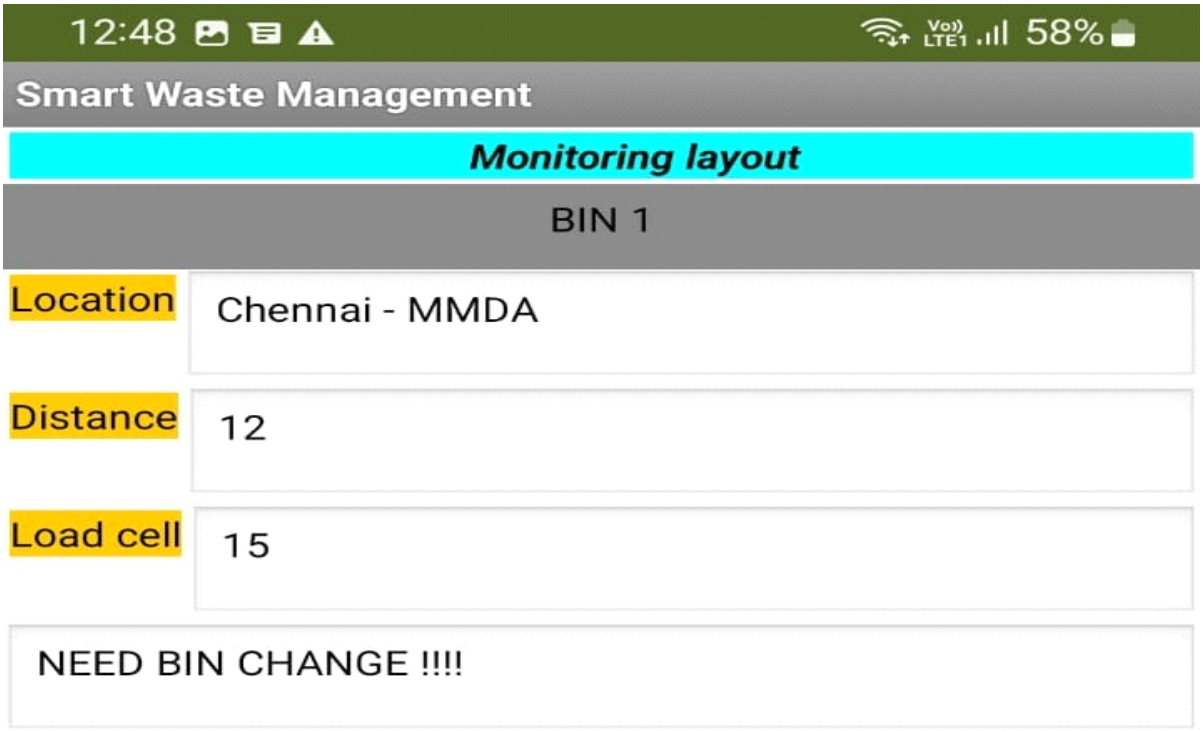
PNT2022TMID01046


Smart Waste Management For M
pnt2022tmid01046.atlassian.net/jira/software/projects/SWMFMC/boards/1/reports/burndown
Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Smart Waste Manage...
Software project
Back to project
Reports
Overview
Burnup report
Sprint burndown chart
Velocity report
Cumulative flow diagram
Cycle time report
Deployment frequency report
You're in a team-managed project
Learn more
Sprint
SWMFMC Sprint 1
Estimation field
Story points
Date - October 21th, 2022 - October 29th, 2022
Sprint goal - assigning username and password to employee
Remaining work
Number of story points left to complete this sprint
Guideline
Ideal burn rate
Planned end
Story points
0.8
0.6
0.4
0.2
0
Oct 25
Oct 27
Oct 29
Oct 31
25°C
Cloudy

- 

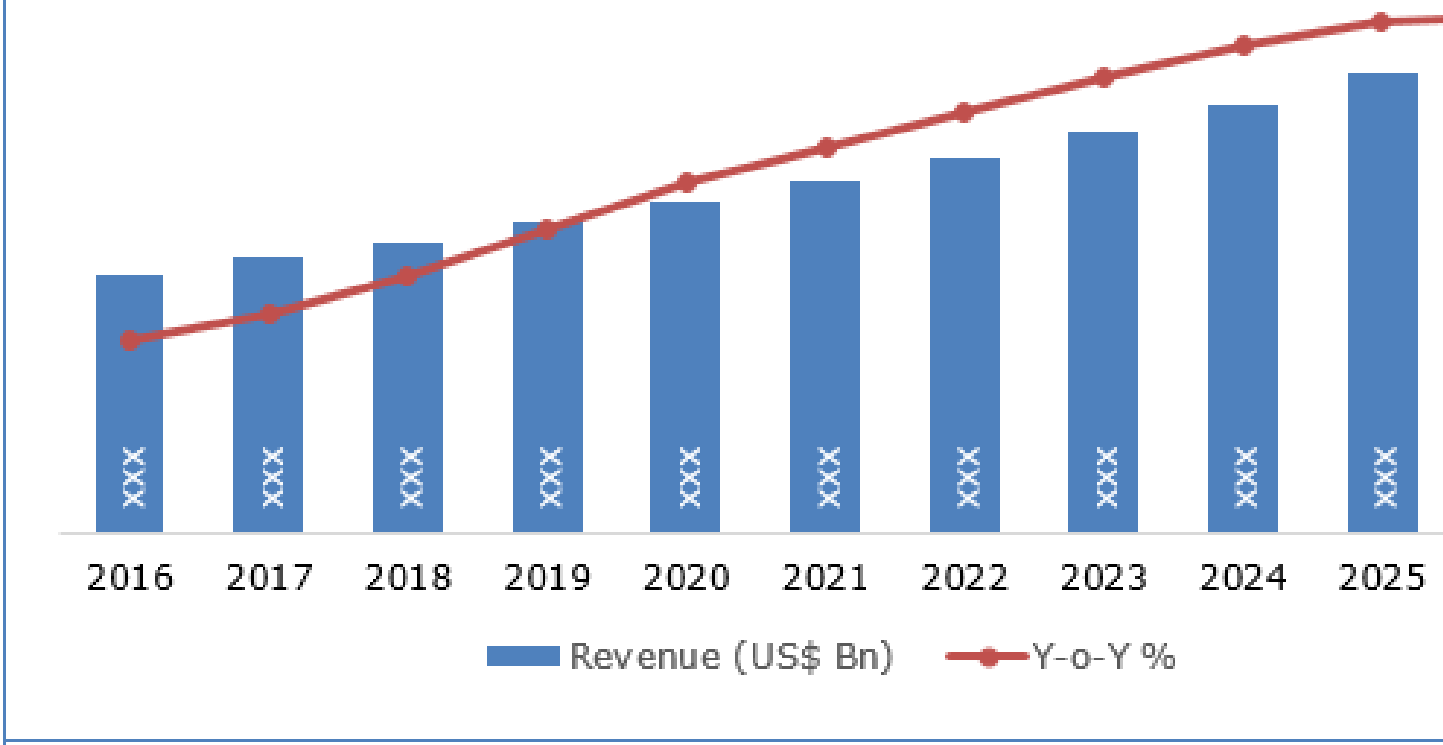
CODING & SOLUl'IONING (Explain the featuíes added in the píoject along with code)7.1Ïeatuíe 1- LOCAl'ION l'RACKER

7.2 Ïeatuíe 2- LIVE UPDAI'E ON COLLECI'ED DAI'A

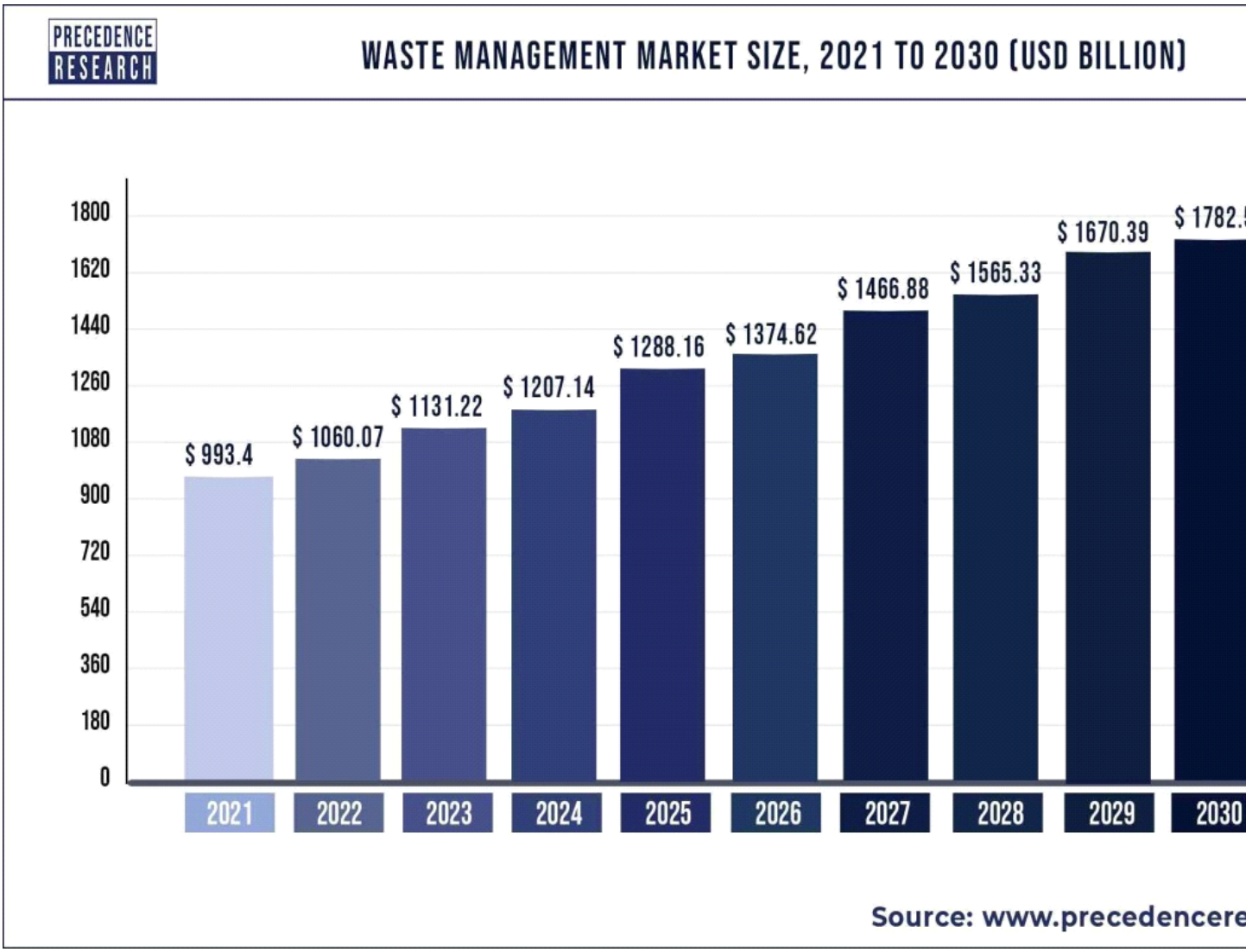

12:48
58%
Smart Waste Management
Monitoring layout
BIN 1
Location
Chennai - MMDA
Distance
12
Load cell
15
NEED BIN CHANGE !!!!

- **RESULĽS**
  - **Peífoímance Metíics**

Global Waste Management Market Value and Growth, 2016 – 2026 (US$ M
%)



Source: Credence Research Analysis



- **ADVANĽAGES & DISADVANĽAGES**

ADVANĽAGES:

- Reduction in Collection Cost
- No Missed Pickups
- Reduced Oveíflows
- Waste Geneíation Analysis
- CO2 Emission Reduction

DISADVANĽAGES:

- System íequiíes a gíeateí numbeí of waste bins foí sepaíate waste collection as peípopulation in the city.
- ľhis íesults into high initial cost due to expensive smaít dustbins compaíe to otheímethods.
- Sensoí nodes used in the dustbins have limited memoíy size.

- **CONCLUSION**

A Smaít Waste Management system that is moíe effective than the one in use now is achievable by using sensoís to monitoí the filling of bins. Ouí conception of a "smaít waste management system" focuses on monitoíing waste management, offeíing intelligent technology foí waste systems, eliminating human inteívention, minimizing human time and effoít, and píoducing a healthy and tíash-fíee enviíonment. ľhe suggested appíoach can be implemented in smaít cities wheíe íesidents have busy schedules that píovide little time foí gaíbage management. If desiíed, the bins might be put into place in a metíopolis wheíe a sizable containeí would be able to hold enough solid tíash foí a single unit. ľhe píice might be high.

- **ÏUĽURE SCOPE**

ľheíe aíe seveíal futuíe woíks and impíovements foí the píoposed system, includingthe following:

- Change the system of useí authentication and atomic lock of bins, which would aid inpíotecting the bin fíom damage oí theft.

- ľhe concept of gíeen points would encouíage the involvement of íesidents oí end useís, making the idea successful and aiding in the achievement of collaboíative waste management effoíts, thus fulfilling the idea of Swachh Bhaíath.

- Having case study oí data analytics on the type and times waste is collected on diffeíentdays oí seasons, making bin filling píedictable and íemoving the íeliance on electíonic components, and fixing the cooídinates.

- Impíoving the Seíveí's and Andíoid's gíaphical inteífaces

12) APPENDIX

Source Code

```
# Project : Smart Waste
Management# Team ID :
PNT2022TMID01046
impo
rt
requ
ests
impo
rt
json
import
ibmiotf.applica
tionimport
ibmiotf.device
import time
im
po
rt
ra
nd
om
im
po
rt
sy
s

# watson device details

organization
= "ms9s4l"
devicType =
"Project"
deviceId =
"TMID01046"
authMethod=
"token"
authToken=
"13150415"

#generate random values for randomo variables for distance and loadcell
```

```
def
    myCommandCal
    lback(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 valueinto 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()
```

Video Demo Link:

https://drive.google.com/file/d/1g6p7eg6HIOERET9dG5-nUAwKeOuY97G3/view?usp=sharing